

**Purdue University
College of Engineering**

**2012–2013
Undergraduate Academic
Catalog**

Purdue University College of Engineering

Undergraduate Academic Catalog

The 2012-13 Undergraduate Academic Catalogs provide users with information about degree programs offered at the Purdue University West Lafayette campus.

In Fall Semester 2011-12, students were enrolled in 269 undergraduate majors in 10 overarching academic colleges and schools. Some of those students were at the same time taking graduate-level classes and/or pursuing professional degrees.

The information contained in these catalogs is subject to change as a result of action by federal and/or state governments, the trustees of Purdue University and the administration of Purdue University. Questions about the detailed content should be directed to the appropriate University college/school, department or office.

Nondiscrimination Policy Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University views, evaluates, and treats all persons in any University related activity or circumstance in which they may be involved, solely as individuals on the basis of their own personal abilities, qualifications, and other relevant characteristics.

Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Purdue's Equal Opportunity, Equal Access and Affirmative Action policy which provides specific contractual rights and remedies. Additionally, the University promotes the full realization of equal employment opportunity for women, minorities, persons with disabilities and veterans through its affirmative action program.

Any question of interpretation regarding this Nondiscrimination Policy Statement shall be referred to the Vice President for Ethics and Compliance (www.purdue.edu/ethics) for final determination.

College of Engineering

The College of Engineering is internationally known for the quality and scope of its programs. Students launch their careers with a common first-year program (First-Year Engineering) in the School of Engineering Education. After completing the first-year program, they choose from undergraduate curricula in:

- Aeronautics and Astronautics
- Agricultural Engineering
- Biological Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Construction Engineering and Management
- Electrical Engineering
- Industrial Engineering
- Interdisciplinary Engineering
- Materials Engineering
- Mechanical Engineering
- Nuclear Engineering

Every school within engineering offers graduate degree programs. See www.engineering.purdue.edu.

History and Organization

Engineering instruction has been offered at Purdue University since the institution opened its doors to students. As a land-grant university, Purdue was founded primarily to teach the agricultural and mechanical arts.

One student was registered in civil engineering in the fall of 1876, and the first engineering degree (C.E.) was awarded in 1878. Since then, the development of the College of Engineering at Purdue has reflected the dynamic growth of the profession of engineering and its increasing specialization. It is now one of the most distinguished engineering colleges in the country, with 7,087 undergraduate students and 2,738 graduate students. The School of Engineering Education is the entry point for all new students, who receive initial advising and academic counseling with staff in First-Year Engineering. Qualified students are admitted to the professional engineering programs after satisfactory completion of the pre-engineering program requirements.

Engineering Instruction

Undergraduate instruction in aeronautics and astronautics, agricultural engineering, biological engineering, biomedical engineering, chemical engineering, civil engineering, computer engineering, electrical and computer engineering, industrial engineering, materials engineering, mechanical engineering and nuclear engineering leads to the degree of Bachelor of Science (B.S.) in one of those designated areas. The individual schools of engineering that administer these areas of instruction are responsible for the final three years of the particular curriculum and determine whether students enrolled in each of the schools have acceptably fulfilled the degree requirements.

The degree of Bachelor of Science in Engineering (B.S.E) or the degree of Bachelor of Science (B.S.) may be awarded to a student who acceptably carries out an interdisciplinary program that cuts across several of the traditional school lines. These programs are administered by the Interdisciplinary Engineering Program in the School of Engineering Education. The program administered by the Division of Construction Engineering and Management culminates in a degree of Bachelor of Science in Construction Engineering.

All Purdue University Schools of Engineering undergraduate educational programs are accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Engineering as a Profession

Engineering is a professional field that has a large impact on people and influences society. Perhaps no other profession is more truly concerned with safeguarding and improving life, health, property and public welfare. The goals of the engineering profession, which are maintenance of high ethical standards and quality performance, are integral to all academic programs in the College of Engineering. The mission of the College of Engineering is to advance engineering learning, discovery and engagement in fulfillment of the land-grant promise and the evolving responsibility of a global university. Purdue engineers will be prepared for leadership roles in responding to the global, technological, economic and societal challenges of the 21st century. They will be ready to make a difference at home and around the globe by:

- A. Adding value and innovation to engineering projects and collaborations
- B. Identifying and addressing significant problems and opportunities
- C. Learning and broadening professionally and as global citizens throughout life
- D. Engaging with critical stakeholders, high performance teams and knowledge network
- E. Celebrating diversity and respecting differences in ideas, people and cultures
- F. Leading from a global perspective and commitment to a sustainable future

Graduates of engineering programs are expected to acquire and demonstrate the Knowledge, Ability and Quality attributes of the Purdue Engineer of 2020:

Abilities

- Leadership
- Teamwork
- Communication
- Decision-making
- Recognize and manage change
- Work effectively in diverse and multicultural environments
- Work effectively in the global engineering profession
- Synthesize engineering, business and societal perspectives

Engineering Foundational Skills

- Science and math
- Engineering fundamentals
- Analytical skills
- Open-ended design and problem-solving skills
- Multidisciplinarity within and beyond engineering
- Integration of analytical, problem-solving and design skills

Qualities

- Innovative
- Strong work ethic
- Ethically responsible in a global, social, intellectual and technological context
- Adaptable in a changing environment
- Entrepreneurial and intrapreneurial
- Curious and persistent continuous learners

Students are encouraged to become student members of their professional societies and to be involved with the student chapters of those societies.

EPICS Program

EPICS, or Engineering Projects in Community Service, is an engineering-centered, multi-disciplinary academic program that offers courses using service learning to teach design. EPICS students learn design by creating real projects for community partners within the local area. The program was founded by Leah H. Jamieson and Edward J. Coyle at Purdue in 1995.

Teams of EPICS students partner with local not-for-profit community organizations (community partners) to design solutions that will address compelling needs in the local community. Projects are intended to solve real problems and are developed based on needs identified by both the students and community partners. A hallmark of EPICS is that the partnerships are long-term, lasting for a number of years, and many projects may last for a semester or several semesters. Students can take EPICS for as many semesters as they wish, and most choose to take the course for credit for more than one semester. This allows projects to be extended beyond traditional semester boundaries and allows more complex solutions to be developed.

The EPICS courses (EPICS 10100-41200) can be used in many departments as credit toward graduation and in many cases can be substituted for departmental requirements, such as technical electives or capstone requirements, as well as for meeting University requirements, such as the entrepreneurship certificate.

EPICS courses operate like small engineering design firms with students in leadership roles such as team leaders who run course meetings, project leaders who create and manage project timelines and schedules, and financial officers who manage budgets. The EPICS curriculum is designed to support the development of projects that make a real impact in the community and provide the professional preparation students need to become leaders in the 21st century.

The EPICS courses are open to all academic levels from first-year students through seniors. First-semester students are given the added benefit of participating in the EPICS Learning Community. A typical section of EPICS consists of a mix of first-year students, sophomores, juniors and seniors and provides opportunities for mentoring among students within the sections. EPICS draws student enrollment from more than 50 majors from engineering and other colleges.

The best way to learn more about EPICS is to read about the different teams and the types of projects they are working on. Visit the [EPICS](https://engineering.purdue.edu/EPICS) website (<https://engineering.purdue.edu/EPICS>) for additional information.

Professional Practice Program: Cooperative Education and Internships

The College of Engineering offers numerous work experience programs that allow students to gain a practical understanding of their chosen field. While completing the requirements for their engineering degrees, participating students will experience the challenge, working conditions and rewards of the engineering profession. Students considering graduate study can gain experience with instrumentation, experimental techniques and project management that are valuable assets in graduate studies and research. Additionally, students can earn a significant salary that they can apply toward a portion of their college costs by participating in these programs.

Purdue offers work experience programs that are based on both the internship and cooperative education (co-op) models. Internship programs are shorter, project-based experiences designed to provide a brief introduction to an employer and a sense of the culture within a particular segment of the engineering world. Internship experiences have less than one year total on-the-job time, and there is no commitment from the employer for continuation. Internship programs typically utilize the summer terms only. Co-op experiences are longer, more structured programs. Co-op students complete more than one year of on-the-job training, and they remain with a single employer throughout their program. Co-op students get a broader view of a host organization through rotations in a variety of departments. Co-op programs typically utilize year-round alternating sessions of work and academic study at domestic and international sites.

All Purdue professional practice programs are optional, by-invitation-only programs. Different programs have different requirements, but as a general rule, the longer the cumulative work experience, the higher the graduation index required for participation. The details of the various program options are available from the Professional Practice Program or the individual schools within the College of Engineering. Upon completion of a professional practice program, the student will receive, in addition to his or her bachelor's degree, a certificate of completion for the particular program. There is a nominal work experience fee collected by the Office of the Bursar during the off-campus work terms, and all professional practice experiences are transcript-recorded by the Office of the Registrar. The Purdue University Professional Practice Program is nationally recognized for innovation and academic excellence, and it is the largest in the Big Ten Conference. To find out more, visit the website at www.purdue.edu/propractice.

GEARE Program

The Global Engineering Alliance for Research and Education (GEARE) program is a unique and award-winning program that originated in the School of Mechanical Engineering at Purdue. Since 2009, the Professional Practice Program (OPP) has assumed all GEARE operations and opened up the program to all College of Engineering students. GEARE is designed to supplement the education of engineers so they are prepared to function immediately in the global workplace. Students in the program participate in an orientation program, 12 credit hours of foreign languages, one domestic internship, one subsequent international internship (preferably at the same company), one semester of study abroad with fully transferable engineering course credits, and a one-semester to two-semester design team project with design teams that include students from international partner universities working on an industry-inspired project.

Interested students are encouraged to refer to the [OPP website](https://engineering.purdue.edu/ProPractice) (<https://engineering.purdue.edu/ProPractice>).

Global Engineering Program (GEP)

The Global Engineering Program (GEP) at Purdue University offers an integrated vision of engineering through leadership in global learning, discovery and engagement. GEP is focused on building a sustainable global presence, founded upon Purdue College of Engineering's recognized excellence in cutting-edge research, the goal of providing every student with global learning opportunities and offering the Purdue community at large new opportunities for interaction with the international community. GEP recognizes that preeminence in global engineering derives through engagement of the international community, through programs that ensure presence and leadership where it is needed the most. GEP strives to work with all schools and programs within the College of Engineering and with appropriate schools and programs across campus, to facilitate the development of comprehensive global opportunities for faculty, students and interested community.

GEP is committed to improving the competency and livelihood of the engineering, academic and business communities in Indiana, the U.S. and the world. GEP seeks out and develops opportunities to strengthen the college's signature as a global engineering hub for strategic research in targeted geographic areas, particularly in those research areas that address and meet global engineering grand challenges of the 21st century and beyond. These global partnerships enable GEP to offer enhanced educational initiatives and research opportunities that will empower the Purdue Engineering community for global impact as scientists, students and leaders in business and industry. Recently, strategic research opportunities were identified or redefined throughout Africa, in Latin America, China and India — all regions facing growing humanitarian and environmental grand challenges, emerging economic development and infrastructure expansion. The global learning portfolio includes opportunities for research and learning experiences, entrepreneurial development, participation in international conferences and more.

Within Indiana and the United States, domestic partnerships that will enable strong teams and new business relationships are a priority for GEP and the college. GEP's commitment to engagement is reflected in its activities in developing opportunities across Europe, Asia, Latin America and the Middle East. As the program moves forward, the tools for evaluating potential and outcomes of all activities also are under development and will be a valuable aid in evaluating the impact of the global experiences of students and faculty as Engineering works to realize the Engineer 2020 initiative.

Further information about Purdue's global engineering opportunities can be found at: www.engineering.purdue.edu/gep or by contacting gep@purdue.edu.

Women in Engineering Program

Purdue University has one of the largest enrollments of women engineering students in the United States and has actively promoted this diversity since the founding of the Women in Engineering Program (WIEP) in 1969. The Women in Engineering Program offers activities and programs to provide students with resources and opportunities to interact with successful alumnae and build friendships and networks that will enhance their student life experience and knowledge of the engineering profession. Important components of the WIEP include:

- Pre-college programs
- A living community in two residence halls
- A seminar for first-year students
- Several types of mentoring programs
- A tutoring service
- A merit award program for beginning and continuing students

Purdue also has one of the oldest and largest student sections of the Society of Women Engineers (SWE). Started in 1954, Purdue SWE now averages more than 400 members each year. SWE programming includes professional development activities, social activities, community service activities, pre-college activities and leadership development activities. Although SWE and WIEP are separate organizations, they

work in partnership on several programs and events. For additional information, visit the [Women in Engineering Program](https://engineering.purdue.edu/WIEP) website (<https://engineering.purdue.edu/WIEP>) and the [Purdue Society of Women Engineers](http://swe.purdue.org/) website (<http://swe.purdue.org/>).

Minority Engineering Program

Since its inception in the early 1970s, the Minority Engineering Program (MEP) office at Purdue University has developed and successfully implemented various recruitment and retention initiatives geared toward increasing the number of engineering graduates from historically underrepresented groups.

Open to all, this program focuses on students who have not traditionally pursued engineering and science. The harvest of embracing diversity and developing the technical expertise housed within the life experience and rich heritage of our nation is dynamic leadership with tremendous global impact.

Four key organizations share in the MEP commitment to diversity: The National Society of Black Engineers, (NSBE) founded at Purdue in 1975; The Society of Hispanic Professional Engineers (SHPE); The American Indian Science and Engineering Society (AISES); and a new student organization launched in 2009, the Society of Mexican American Engineers and Scientists (MAES).

Purdue outreach activities include pre-college programs designed to engage 6th through 10th grades in engineering activities during summer engineering workshops. Recruitment activities include various pre-college programs aimed at attracting 11th-grade and 12th-grade students by exposing them to campus life in three-day to five-week programs. Retention activities consist of bridge programs developed to assist undergraduate engineering students in transitioning from high school to First-Year Engineering and from First-Year Engineering to their professional engineering school; incentive and merit awards for undergraduate engineering students; academic and personal advising; a tutorial center staffed by both graduate and undergraduate students; a freshman orientation course that emphasizes problem solving, leadership, teamwork and interpersonal skills.

Purdue University's Minority Engineering Program has achieved recognition as a benchmark for many other universities.

Visit the [Minority Engineering Program](https://engineering.purdue.edu/MEP) website (<https://engineering.purdue.edu/MEP>) for additional information.

Research

A vibrant research program in many frontier topics enhances the richness and vitality of the Purdue Engineering undergraduate experience. The multidisciplinary nature of research brings rich examples and projects from diverse fields into the engineering class, laboratory and homework. Students learn about not only the known engineering solutions but also are introduced to the unknown that may become a part of engineering.

The interplay between research and education contributes significantly to the growth of lifelong learners. Undergraduate students have the opportunity to participate in research in special classes, academic year and summer fellowships including the popular Summer Undergraduate Research Fellowships Program (SURF), internships and co-op opportunities and research laboratory assistant positions. While all classes include some element of discovery, most senior design classes and electives such as Engineering Projects in Community Service (EPICS) provide research experiences that are truly extraordinary.

Purdue Engineering research is supported by many federal agencies, state agencies, private corporations, foundations and alumni gifts.

The Office of the Associate Dean for Research helps to provide timely information on [research opportunities](https://engineering.purdue.edu/Engr/Research) (<https://engineering.purdue.edu/Engr/Research>). Purdue Engineering research is carried out in the individual schools, in multidisciplinary centers (including two recent National Science Foundation-funded Engineering Research Centers), laboratories and in [Discovery Park](http://www.purdue.edu/discoverypark/) (www.purdue.edu/discoverypark/).

Research activities within the College of Engineering include innovation; design; materials; control; optimization; management; operation; systems engineering and logistics of aircraft and spacecraft; electronics and electronic materials; automotive systems; fuel cells and hydrogen; agricultural products and renewable energy sources; photovoltaics; advanced composites such as self-assembling and self-healing materials; high-speed and low-power circuits and electronics; new types of semiconductor materials; optics and photonics; sensing; communications; computer vision; robotics and automation; computer hardware, middleware and software; secure wireless communications and secure Internet; chemical and process catalysis; drug discovery and delivery; transportation and highways; environmental engineering; safe structures and earthquake protection; nuclear energy and medical uses of radioactive materials and fusion; heat and mass transfer; fluid mechanics including micro-fluidics; tissue and cellular engineering and biological sensing; science, technology, engineering and math (STEM) education.

Many research activities within the schools are conducted in multidisciplinary centers and laboratories as well as in Discovery Park.

The National Science Foundation- (NSF) funded network for computational nanotechnology (NCN) promotes multidisciplinary research that forms an important part of the Birck Nanotechnology Center. The Engineering Research Center for Structured Organic Compounds is improving the quality and delivery of granular materials such as pharmaceuticals, and the Engineering Research Center for Compact Hydraulics is reducing energy consumption by hydraulic devices. The Department of Homeland Security (DHS) Center of Excellence for Visual Analytics for Command, Control and Interoperability promotes research on visualization sciences to enhance national security. The High-Mach Propulsion University Technology Center (UTC), funded by Rolls Royce, is investigating jet engine technology for high-speed aircraft that may fly as fast as seven times the speed of sound. A U.S. Department of Transportation-funded Regional Transportation Center is improving safety, durability and convenience of our highway system. The Network for Earthquake Engineering Simulation addresses earthquake risk using simulation tools and experimentation testing.

Multidisciplinary centers and laboratories provide very exciting opportunities for students with diverse sets of interests and passions. The range of interest opportunities spans environmental remediation, renewable energy and resource engineering, wireless sensing and applications, catalyst design and informatics, transportation and transportation safety, advanced laser-based manufacturing, composite materials, acoustics, interactive buildings, prognostics and diagnostics, product life cycle management, information engineering, financial engineering, nuclear reactions, high Mach number propulsion, aeromechanics and propulsion, high-heat flux electronics cooling, boiling and two-phase flows, and hydrogen and fuel cells.

Many of the interdisciplinary activities are conducted in collaboration with the Purdue colleges/schools of Agriculture, Education, Health and Human Sciences, Liberal Arts, Management, Science, Technology and Veterinary Medicine.

Many of these collaborations are occurring in new buildings and facilities of Discovery Park on the Purdue campus. These collaborations bring very exciting opportunities and continued expansion of the engineering disciplines into new and unknown territories that touch on the limits of size, speed, force and distance.

Engineering education extends from machines and their physical reality to thought, cognition and perception. Engineers are not limited to just inorganic and organic lifeless materials, but must now bring their ideas and thoughts to the living. The impact of this interaction is not just on the biological sciences but

is flowing back into realms traditionally considered to be purely physical. Products that mimic biology for enhanced performance such as self-healing materials are already here. Nanotechnology, biotechnology, information sciences, and ultimately thought, cognition and emotion are becoming the realm of engineers. These are exciting times to be an undergraduate engineer and participate in some of these research frontiers.

Graduation Requirements

Scholastic Index Requirements

In general, the scholastic standing and probation standards of all regular students enrolled in engineering programs are the same as those for the University as a whole.

Pass/Not-Pass Option

In order to provide students with the opportunity to broaden their educational foundations with minimal concern for grades earned, an alternate grading system, the pass/not-pass option, is permitted for a limited portion of the student's required graduation hours. The detailed limitations on this option can be different for each degree-granting unit, but the following general rules are some that currently apply:

1. Subject to the regulations of this college, a student can elect this option in any course that does not already appear on his or her academic record and in which he or she is otherwise eligible to enroll for credit with a letter grade. A student cannot elect this option for more than 20 percent of the total credit hours required for his or her graduation.
2. The Office of the Registrar's class roster includes students who have elected this option.
3. A student enrolled in a course under this option has the same obligations as those enrolled in the course for credit with a letter grade. When the instructor reports final grades in the course, he or she will report that any such student who has earned a grade of "A," "B" or "C," including plus or minus grades, has passed the course and that any other such student has not passed. The registrar will make an appropriate notation on the student's academic record in place of a letter grade but will not use the course in computing grade indexes.
4. In engineering, the pass/not-pass option is not available for required courses in the First-Year Engineering Program, except for ENGR 10000.
5. This option is not available to students on probation.
6. This option is available for a maximum of two courses in any one semester, one course during a summer module.
7. Consistent with the policy of the College of Engineering, a student receiving the grade of "pass" in a course taken under the pass/not pass option cannot take the same course for a letter grade

These are general or minimum guidelines for those electing this option, but the individual schools and departments of engineering can impose additional restrictions.

General Education Program in Engineering

Humanities and social sciences courses encompass the breadth of human experience and culture, both past and present, including individual behavior, social and political structures, aesthetic values, modes and dynamics of communication, philosophical and ethical thought and cognitive processes. Such courses are an integral part of all engineering curricula, which complements technical and professional content by enabling engineering students to appreciate the world in which they live and work and to contribute as both educated members of society and aware, ethical professionals. Humanities and social sciences courses also provide a framework for rational inquiry, critical evaluation, judgment and decisions when dealing with issues that are nonquantifiable, ambiguous or controversial. Of equal importance, they offer opportunities

for engineering students to develop interests and insights that guide, enrich and expand their perceptions of the world in which they live.

To these ends, all B.S. students in the College of Engineering are required to complete a general education program of 18 credit hours in approved humanities and social sciences electives. Students are strongly encouraged to develop a coherent general education plan and distribute their general education credits throughout their academic program. The collection of courses used to fulfill this requirement must meet all the following conditions.

1. Courses must be drawn from those offered by the departments of Agricultural Economics; Anthropology; Communication; Economics; English; History; Interdisciplinary Studies; Philosophy; Political Sciences; Psychological Sciences; Sociology; Speech, Language, and Hearing Sciences; or by the School of Languages and Cultures or the Patti and Rusty Rueff School of Visual and Performing Arts. Any course offered by these programs is allowable, provided it is open to students in the offering program and is not focused primarily on professional training, natural science or mathematics.
2. In order to ensure sufficient exposure to topics dealing with global, societal and contemporary issues, at least nine credit hours must be drawn from courses offered by the departments of Agricultural Economics, Anthropology, Communication, Economics, Family and Consumer Sciences Education, History, Interdisciplinary Studies, Philosophy, Political Science, Psychological Sciences, Sociology or the School of Languages and Cultures.
3. At least 6 of the credit hours must be taken in the same program, and a maximum of 12 credit hours may be taken in any one program
4. At least 6 of the credit hours must come from courses at the 30000 level or above, or from courses with a required prerequisite in the same program.
5. If a foreign language course is used to satisfy part of the requirements, the student must take at least 6 credit hours of the same language. Credit is not allowed for language courses in the student's native tongue(s), although literature, culture, drama and related courses are allowed.
6. Credit by examination or granted credit (e.g., advanced placement credit), conditioned solely at the discretion of the awarding program, can be used to satisfy any part of the requirement.
7. No course may be counted more than once toward the requirement, even if the offering program allows it to be repeated for credit.
8. Individual schools may impose requirements in addition to those previously stated but may not require a specific course as part of the general education program.

Abbreviations

Some of the following abbreviations of subject fields are used in the Plans of Study section of this catalog. Alphabetization is according to abbreviation.

AAE — Aeronautical and Astronautical Engineering

AAS — African American Studies

ABE — Agricultural and Biological Engineering

AD — Art and Design

AFT — Aerospace Studies

AGEC — Agricultural Economics

AGR — Agriculture

AGRY — Agronomy

AMST — American Studies

ANSC — Animal Sciences

ANTH — Anthropology

ARAB — Arabic
ASAM — Asian American Studies
ASL — American Sign Language
ASM — Agricultural Systems Management
ASTR — Astronomy
AT — Aviation Technology
BAND — Bands
BCHM — Biochemistry
BCM — Building Construction Management Technology
BGR — Boiler Gold Rush
BIOL — Biological Sciences
BME — Biomedical Engineering
BMS — Basic Medical Sciences
BTNY — Botany and Plant Pathology
CDFS — Child Development and Family Studies
CE — Civil Engineering
CEM — Construction Engineering and Management
CFS — Consumer and Family Sciences
CGT — Computer Graphics Technology
CHE — Chemical Engineering
CHM — Chemistry
CLCS — Classics
CLPH — Clinical Pharmacy
CMPL — Comparative Literature
CNIT — Computer and Information Technology
COM — Communication
CPB — Comparative Pathobiology
CS — Computer Sciences
CSR — Consumer Sciences and Retailing
DANC — Dance
EAS — Earth and Atmospheric Sciences
ECE — Electrical and Computer Engineering
ECET — Electrical and Computer Engineering Technology
ECON — Economics
EDCI — Education-Curriculum and Instruction
EDFA — Education-Foundations and Administration
EDPS — Educational and Psychological Studies
EDST — Educational Leadership and Cultural Foundations
EEE — Environmental and Ecological Engineering
ENE — Engineering Education
ENGL — English
ENGR — First-Year Engineering
ENTM — Entomology

ENTR — Entrepreneurship
EPCS — Engineering Projects in Community Service
FLL — Foreign Languages and Literatures
FN — Foods and Nutrition
FNR — Forestry and Natural Resources
FR — French
FS — Food Science
FVS — Film and Video Studies
GEOG — Geography
GEOL — Geology
GEP — Global Engineering Program
GER — German
GREK — Greek
GS — General Studies
HDFS — Human Development and Family Studies
HEBR — Hebrew
HHS — Health and Human Sciences
HIST — History
HK — Health and Kinesiology
HONR — Honors
HORT — Horticulture
HPER — Health, Physical Education and Recreation
HSCI — Health Sciences
HTM — Hospitality and Tourism Management
IDE — Interdisciplinary Engineering
IDIS — Interdisciplinary Studies
IE — Industrial Engineering
IET — Industrial Engineering Technology
IPPH — Industrial and Physical Pharmacy
IT — Industrial Technology
ITAL — Italian
JPNS — Japanese
JWST — Jewish Studies
LA — Landscape Architecture
LALS — Latina American and Latino Studies
LCME — Lafayette Center for Medical Education
LING — Linguistics
LS — Land Surveying
MA — Mathematics
MARS — Medieval and Renaissance Studies
MCMP — Medicinal Chemistry and Molecular Pharmacology
ME — Mechanical Engineering
MET — Mechanical Engineering Technology

MGMT — Management
MSL — Military Science and Leadership
MUS — Music History and Theory
NRES — Natural Resources and Environmental Science
NS — Naval Science
NUCL — Nuclear Engineering
NUPH — Nuclear Pharmacy
NUR — Nursing
NUTR — Nutrition Science
OBHR — Organizational Behavior and Human Resources
OLS — Organizational Leadership and Supervision
PES — Physical Education Skills
PHAD — Pharmacy Administration
PHIL — Philosophy
PHPR — Pharmacy Practice
PHRM — Pharmacy
PHSL — Physiology
PHYS — Physics
POL — Political Science
PPE — Professional Practice-Engineering
PPT — Professional Practice-Technology
PSY — Psychology
PTGS — Portuguese
RECR — Recreation Leadership
REL — Religious Studies
RUSS — Russian
SA — Study Abroad
SCI — General Science
SLHS — Speech, Language and Hearing Science
SOC — Sociology
SPAN — Spanish
STAR — Summer Transition, Advising and Registration
STAT — Statistics
SWRK — Social Work
TECH — Technology
THTR — Theatre
USP — Undergraduate Studies Program
VCD — Visual Communication and Design
VCS — Veterinary Clinical Sciences
VM — Veterinary Medicine
WOST — Women's Studies
YDAE — Youth Development and Agricultural Education

Plans of Study

The engineering curricula and graduation requirements of each of the engineering schools as presented in this catalog are those that were in effect in October 2012. Curricula, however, do evolve, reflecting the changing needs of the engineering profession. The student is, therefore, encouraged to obtain the latest curriculum information from his or her academic advisor.

It is important for the student to recognize that the general flexibility of academic curricula is provided in order to make possible allowances for individual differences in background and academic goals. It is the student's responsibility to consult with his or her academic advisor about using this flexibility to design a program to fit particular needs.

The traditional length of a college degree program is four academic years. For this reason, the catalog presents all engineering curricula as four-year programs. Well-qualified students with excellent high school preparation can complete the program in the four-year period or even less. However, other students may require four and one-half or even five years to complete all requirements. Such students also prove to be successful professional engineers, and the University regards their advancement through the nine or ten semesters as satisfactory academic progress toward an engineering degree. Insufficient high school backgrounds usually are most noticeable during the first and second year of a student's program in engineering. By the time the student reaches the junior year level of work, the course sequence that he or she has used usually meshes so well that high school insufficiencies present no scheduling difficulties such as may have occurred during the first part of his or her engineering program.

Within the Engineering "Plans of Study," figures within parentheses, e.g., (3), are credit hours, unless designated otherwise.

First-Year Engineering Program

All beginning engineering students are admitted to the First-Year Engineering Program, housed in the School of Engineering Education. Qualified students are then admitted to professional schools of engineering after satisfactory completion of the First-Year Engineering Program requirements. The First-Year Engineering Program provides a common core of courses in calculus, chemistry, physics, engineering design and English composition. Students must also complete a first-year general education elective and either a second semester of general chemistry, biology or computer programming. The objectives of the First-Year Engineering Program are to:

- Prepare students for entry into the engineering schools.
- Enable students to develop the necessary skills and abilities to succeed in the chosen discipline.
- Assist students in becoming acclimated to the Purdue University environment.

Advisors are available year-round to assist and advise students, parents and University faculty and staff about the curricula, programs and schools within the College of Engineering. Special programs include EPICS Program, Engineering Honors Program, Women in Engineering, Minority Engineering Program and Global Engineering Program.

Credit by Examination

Qualified students are able to obtain credit for many First-Year Engineering Program requirements by demonstrating mastery of the subject on Advanced Placement, A-Level, College Level Examination Program, International Baccalaureate or Purdue University Advanced Credit examinations. Academic advisors can assist students in determining the scores required to obtain credit and the appropriate course placement.

Learning Community Choices for First-Year Engineering Students

The Engineering Learning Communities (LC) support students' transition to Purdue's First-Year Engineering Program. Cohorts of up to 30 LC students take two to four linked courses and complete a service-learning project during their first semester. This project provides the opportunity for students to work on an engineering project for a real customer, usually a local community organization. This can stretch their views of what engineering is and what engineers do. Outside of class, activities and trips are organized. The other classes that LC students take are not linked, giving them the opportunity to meet people outside of the learning community.

First-Year Engineering students have several learning communities from which to choose: The "All-American" Marching Band First-Year Engineering Learning Community; Engineering Projects in Community Service (EPICS) Learning Community; Global Engineering Cultures and Practice Learning Community; Engineering for the Planet Learning Community; Engineering Honors Learning Community; Introducing Diversity through Engagement and Service (IDEAS) Learning Community; Network Learning Community; Women in Engineering Residential Program Learning Community; China Immersion Learning Community; Entrepreneurship and Innovation Learning Community; Future Naval Officers of Purdue Learning Community; Law and Literature, Past and Present Learning Community; Purdue Student Veterans Learning Community; Around the World (In 1 Semester and 5 Religions) Learning Community; and Lyceum.

First-Year Engineering Program Curriculum

In order to fulfill all the requirements for the First-Year Engineering Program, each student must take or obtain credit for the following nine courses: Calculus I and II, General Chemistry I, Physics I, Introducing Engineering Design, Science Selective (chosen from General Chemistry II, Biology or Computer Programming), English Composition and a First-Year General Education Elective. (Fundamentals of Speech Communication is recommended for most students.) Although not part of the FYE Program curriculum, students interested in majoring in aeronautics and astronautics engineering, civil engineering, construction engineering management or mechanical engineering are encouraged to take the appropriate computer graphics course.

Required Courses for the FYE Program (29-33 credit hours)

Calculus I

- (5) **MA 16100** (Plane Analytic Geometry and Calculus I) **or**
- (4) **MA 16500** (Analytic Geometry and Calculus I)

Calculus II

- (5) **MA 16200** (Plane Analytic Geometry and Calculus II) **or**
- (4) **MA 16600** (Analytic Geometry and Calculus II) **or**
- (5) **MA 17300** (Calculus and Analytic Geometry II)

General Chemistry I

- (4) **CHM 11500** (General Chemistry)

Physics I

- (4) **PHYS 17200** (Modern Mechanics)

Introducing Engineering Design

- (2) **ENGR 13100** (Transforming Ideas to Innovation I) **or**
- (3) **ENGR 19500H, Part I** (First-Year Engineering Projects)*

Engineering Design II

- (2) **ENGR 13200** (Transforming Ideas to Innovation II) **or**
- (3) **ENGR 19500H, Part II** (First-Year Engineering Projects)*

English Composition

- (4) **ENGL 10600** (First-Year Composition) **or**
- (3) **ENGL 10800** (Accelerated First-Year Composition)

First-Year General Education Elective

- (3) **COM 11400** (Fundamentals of Speech Communication) is strongly recommended
- 3-4 credit hours required for this elective

Science Selective ... options include the following courses

- (4) **BIOL 11000** (Fundamentals of Biology I)
- (4) **BIOL 11100** (Fundamentals of Biology II)
- (2) **BIOL 12100** (Biology I: Diversity, Ecology and Behavior) **and** **BIOL 19500** (Special Assignments) to equal at least 3 credits
- (3) **BIOL 13100** (Biology II: Development, Structure and Function of Organisms)
- (4) **CHM 11600** (General Chemistry)
- (4) **CHM 13600** (General Chemistry Honors)
- (3) **CS 15900** (Programming Applications for Engineers)

Other Common Optional Courses

- (1) **ENGR 10300** (Introduction to Careers in Engineering)
- (1) **ENGR 10400** (Introduction to Engineering and Purdue)
- (1) **ENGR 18000** (Minorities in Engineering Seminar)
- (1) **ENGR 19400** (Women in Engineering Seminar)
- (1) **ENGR 19000** (Introduction to Materials Engineering)
- (2) **CGT 16300** (Computer Graphics for Manufacturing), on AAE/ME plans of study
- (2) **CGT 16400** (Graphics for Civil Engineering and Construction), on CE/CEM plans of study
- (3-4) Additional General Education Elective that appears on professional schools' plans of study
- (3-4) Additional Math/Science/Engineering course that appears on professional schools' plans of study
- (2) Band
- (2-5) ROTC

* An option for First-Year Engineering Honors students.

Plans of Study for the First-Year Engineering Program***(Minimum — 29 credit hours)**

The First-Year Engineering Program is typically completed in two semesters, although students may remain in the First-Year Engineering Program for a maximum of four semesters. Students who have completed the necessary prerequisites may begin coursework for their professional engineering school Plans of Study while simultaneously completing any remaining First-Year Engineering Program classes. Grades of "C-" or better are required in Calculus I (MA 16500 or equivalent) and engineering problem solving (ENGR 13100, 13200 or ENGR 19500H Part I and II. Students continuing on to General Chemistry II need to complete General Chemistry I with a grade of "C-" or better. Students who begin their studies of

mathematics in Precalculus (MA 15900 or MA 15800) need a grade of “C-” or better and 75% or higher in ALEKS to progress to Calculus I.

First Semester

- (4) **CHM 11500** (General Chemistry)

- (4) **ENGL 10600** (First-Year Composition) **or**
- (3) **ENGL 10800** (Accelerated First-Year Composition)

- (2) **ENGR 13100** (Transforming Ideas to Innovation I) **or**
- (3) **ENGR 19500H, Part I** (First-Year Engineering Projects)

- (5) **MA 16100** (Analytic Geometry and Calculus I) **or**
- (4) **MA 16500** (Analytic Geometry and Calculus I)

Second Semester

- (4) **CHM 11600** (General Chemistry) **or**
- (3) **CS 15900** (Programming Applications for Engineers) **or**
- (4) **BIOL 11000** (Fundamentals of Biology I) **or**
- (4) **BIOL 11100** (Fundamentals of Biology II) **or**
- (3) **BIOL 13100** (Biology II: Development, Structure and Function of Organisms)

- (2) **ENGR 13200** (Transforming Ideas to Innovation II) **or**
- (3) **ENGR 19500H, Part II** (First-Year Engineering Projects)

- (5) **MA 16200** (Analytic Geometry and Calculus II) **or**
- (4) **MA 16600** (Analytic Geometry and Calculus II) **or**
- (5) **MA 17300** (Calculus and Analytic Geometry II)

- (4) **PHYS 17200** (Modern Mechanics)

- (3) First-Year General Education Elective, such as **COM 11400** (Fundamentals of Speech Communication)

** This is a typical sequence of courses for the first year. Adjustments are permitted based on a student's high school preparation, college credit and honors status. Common course substitutions are listed in the Required Courses for the First-Year Engineering Program section above.*

Admission to the College of Engineering

Students are typically admitted to the professional schools within the College of Engineering at the end of the fall and spring semesters. Students must have completed all the requirements of the First-Year Engineering Program in order to be admitted to any of the professional schools. A uniform measure of quality, the Engineering Admissions Index (EAI), is used to ensure that a base level of competency has been achieved by each student in the core FYE Program courses prior to admission to a professional school.

Students who do not have an EAI and GPA of 2.0 at the completion of their FYE Program courses will not be admitted to a professional engineering school.

Engineering Admissions Index

The Engineering Admissions Index (EAI) is the grade point average (GPA) of required First-Year Engineering Program classes, with the exception of the first-year general education elective and the engineering seminar courses (ENGR 10300, 10400, 18000, 19400; NUCL 11000; MSE 19000). The EAI is calculated only from required FYE Program courses taken at Purdue University West Lafayette and at Purdue Regional campuses. Courses taken at another college or university and courses for which a student has received credit by examination are not included in the EAI or the GPA.

The following formula is used to calculate both the EAI and the GPA. The sigma (Σ) denotes “the sum of”: $\Sigma(xy)/\Sigma y$, where x = the grade and y = the number of credit hours of the course.

The EAI can be computed online by using the [EAI calculator](https://engineering.purdue.edu/ENE/Academics/FirstYear/eai) (<https://engineering.purdue.edu/ENE/Academics/FirstYear/eai>).

Admission to Engineering Schools from First-Year Engineering

Students who have completed First-Year Engineering requirements at Purdue and are pursuing admission to Engineering schools should be aware of the following information. Students who have a GPA and an EAI greater than or equal to 3.2 will be admitted to the school of their choice in the College of Engineering, except in situations where the number of students exceed the critical capacity of the school. In such a situation, the students will be admitted based on GPA and EAI up to the critical capacity of the school. All other students with a GPA and EAI greater than or equal to 2.0 and less than 3.2 will be admitted up to the capacity of the school based on GPA and EAI, and other relevant factors. Students with a GPA and an EAI less than 2.0 will not be admitted into the schools in the College of Engineering.

Interdisciplinary Engineering Studies and Multidisciplinary Engineering

The primary responsibility of Interdisciplinary Engineering Studies (IDES) and Multidisciplinary Engineering (MDE), which are administratively part of the School of Engineering Education, are to provide a coordinated and controlled educational opportunity for select students whose interests and talents fall at an interface either between engineering disciplines, or between engineering and other disciplines. Both prescribed and open curricula are available, which allow IDES and MDE to accommodate highly flexible interdisciplinary programs. These programs are broad, innovative and challenging and enable graduates to seek better solutions to a variety of complex socio-economic-technical humanitarian problems.

MDE offers the Bachelor of Science in Engineering (B.S.E), and IDES offers the Bachelor of Science (B.S.). Virtually the same concentrations of majors are offered for both degrees. The B.S.E degree will be awarded to students who complete the Multidisciplinary Engineering program designed to meet accreditation standards. The B.S. degree offered by IDES is an engineering-related degree with fewer engineering courses and thus more flexibility to take courses that prepare students for professional schools or nontraditional careers. The Multidisciplinary Engineering (B.S.E) program is accredited by the Engineering Accreditation Commission of ABET, www.abet.org. The Multidisciplinary Engineering program's [mission, goals, objectives and outcomes](https://engineering.purdue.edu/ENE/Academics/Undergrad/mission) (<https://engineering.purdue.edu/ENE/Academics/Undergrad/mission>) are designed to prepare graduates to practice engineering.

Concentrations

Every engineering student at Purdue University follows a common first year. Those who decide to enter IDES/MDE usually do so toward the end of the second or third semester. Students choose concentrations of the most interest to them and plan their academic programs accordingly; in most instances, the range of available courses enables a student to proceed toward any technically based educational objective. IDES

and MDE offer many opportunities for an education that is broad and liberal but also technical for students who want to participate in planning their own personalized programs. IDES offers an excellent pre-medicine or pre-law background. A few examples of typical areas are listed here, but many other possibilities and combinations are available.

- Acoustical engineering
- Engineering management
- General engineering
- International engineering studies
- Pre-professional (law, medicine, etc.) engineering
- Self-designed plan
- Theater engineering studies
- Visual design engineering

Educational Purpose

The purposes of the IDES and MDE programs are to provide students:

- The opportunity to plan their own programs.
- Flexible alternatives to study engineering plus another field in-depth.
- Opportunities to study engineering disciplines not formally available at Purdue University.
- The opportunity to use engineering as a background to prepare for careers that satisfy their unique interests.

IDES and MDE graduates follow diverse career paths. Many obtain entry-level engineering positions; others enroll at professional schools to study law, medicine and other professions; some go to graduate school in a variety of areas; and a few become entrepreneurs.

IDES and MDE welcome Change of Degree Objective (CODO) students. Students in engineering who meet IDES/MDE CODO requirements can usually graduate without requiring additional time if they CODO before or during the first semester of their junior year. Students in other colleges may require extra time because they must complete the First-Year Engineering requirements before they CODO into IDES/MDE.

Plans of Study

All students submit a plan of study to IDES/MDE for approval during the first semester of enrollment in the division.

CODO and transfer students must submit plans of study to IDES/MDE before they transfer into the program. All transfer students must receive formal approval of their plan of study by the School of Engineering Education at least one full semester before the semester or summer session in which they intend to graduate.

Registration for Fundamentals of Engineering Examination

Multidisciplinary Engineering seniors who wish to become a registered professional engineer should take the Fundamentals of Engineering examination at the West Lafayette campus during the final semester before graduation.

Counseling Information

Students, prospective students or high school counselors who want information about IDES/MDE should contact Interdisciplinary Engineering/Multidisciplinary Engineering, 765-494-7422.

Graduation Requirements for Bachelor of Science in Engineering (B.S.E)

- Satisfaction of various University-wide graduation requirements: academic, scholastic, residence, fee payments, etc.
- Completion of an appropriate plan of study prepared by the student and approved by the faculty of the Department of Engineering Education and the director of Undergraduate Degree Programs or designated representative(s).
- The B.S.E requires meaningful integration of the required engineering core and area requirements. A minimum of 45 credit hours of engineering coursework beyond the First-Year Engineering Program is required. An approved plan of study must be developed during the student's first semester in MDE.

Academic Requirements for Bachelor of Science in Engineering (B.S.E)

Credit Hours Required for Graduation: 120

See the [Interdisciplinary Engineering](https://engineering.purdue.edu/ENE/Academics/Undergrad) website (<https://engineering.purdue.edu/ENE/Academics/Undergrad>) or email ide@ecn.purdue.edu for details.

Graduation Requirements for Bachelor of Science (B.S.)

- Satisfaction of various University-wide graduation requirements: academic, scholastic, residence, fee payments, etc.
- Completion of an appropriate Plan of Study prepared by the student and approved by the faculty of the School of Engineering Education and the director of Undergraduate Programs or designated representative(s).

The Plan of Study will provide for meaningful integration of both the core and area requirements.

Academic Requirements for Bachelor of Science (B.S.)

Credit Hours Required for Graduation: 120

See the [Interdisciplinary Engineering](https://engineering.purdue.edu/ENE/Academics/Undergrad) website (<https://engineering.purdue.edu/ENE/Academics/Undergrad>) or email ide@ecn.purdue.edu for details.

Aeronautics and Astronautics

The School of Aeronautics and Astronautics offers bachelor's, master's and doctoral degrees in aeronautical and astronautical engineering. Aeronautics covers all aspects of atmospheric flight, and astronautics is concerned with flight in space. The field of aeronautical and astronautical engineering, often collectively called "aerospace," deals with the challenging problems encountered in the design and operation of air and space vehicles.

Mission Statement

To serve the State of Indiana and our Nation by providing degree-granting programs — recognized as innovative learning experiences — that prepare students to be exceptional, recognized contributors to aeronautical and astronautical engineering in industry, government laboratories and universities.

To develop and maintain quality graduate research programs in technical areas relevant to Aeronautics and Astronautics and to foster a collegial and challenging intellectual environment necessary to conduct enabling and breakthrough research for aerospace systems.

Program Educational Objectives

The objective of the undergraduate aeronautical and astronautical engineering program is to prepare students for careers in aerospace engineering and related disciplines.

We consider this objective to be achieved if:

- All graduates are meaningfully employed in industry or government or are pursuing graduate studies within one year of graduation,
- Most of our graduates take jobs in the aerospace industry or pursue graduate work in aerospace engineering,
- After five years, most graduates are working in engineering,
- After five years, most graduates have advanced their careers by, for example, promotion or pursuit of an advanced degree,

and, most importantly,

- All of our alumni feel that their education at Purdue was valuable preparation for their careers, whatever their field of endeavor.

Program Outcomes

Through the course of their studies, students shall gain:

- an ability to apply knowledge of mathematics, science and engineering,
- an ability to design and conduct experiments, as well as to analyze and interpret data,
- an ability to design an aerospace system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multidisciplinary teams,
- an ability to identify, formulate and solve aerospace engineering problems,
- an understanding of professional and ethical responsibility,
- an ability to communicate effectively,
- an understanding of the impact of engineering solutions in a global, economic, environmental and societal context,
- a recognition of the need for, and an ability to engage in, life-long learning,
- a knowledge of contemporary issues in aerospace engineering,
- an ability to use the techniques, skills and modern engineering tools necessary for aerospace engineering practice.

Basic Program	Credit Hours
Mathematics	
Calculus: MA 16500, 16600, 26100	12
Linear Algebra: MA 26500	3
Differential Equations: MA 26600, 30400	6
Sciences	
Chemistry: CHM 11500	4
Physics: PHYS 17200, 24100	7
Communications, Humanities and Social Sciences	
English Composition	3
Communications	3
<i>Note: Students must take at least 3 credits of coursework focused on written and/or spoken communications at the 30000 level or higher.</i>	
General Education Electives	18
Computer Skills	
Programming: CS 15900, ENGR 13200	5
Graphics: CGT 16300	2
Professional Development	
Undergraduate Seminar: AAE 20000, 30000, 40000	1
ENGR 13100	2
<i>Note: AAE 20000 will be taken once in the sophomore year, AAE 30000 once in the junior year and AAE 40000 once in the senior year.</i>	
Aeronautics and Astronautics Program	
Structures and Materials: AAE 20400, 20401, 35200	7
Aerodynamics: AAE 33300, 33301, 33400	7
Lab Elective: AAE 35201 or 33401	1
<i>Note: The selected lab should be taken with the corresponding course, if possible.</i>	
Propulsion	
Thermodynamics: ME 20000	3
Jet Propulsion AAE 37200 or Rocket Propulsion AAE 43900	3
<i>Note: Students planning to specialize in aeronautics should take AAE 37200; those aimed at astronautics should take AAE 43900.</i>	
Dynamics and Control	
Statics and Dynamics: AAE 20300, 34000	6
Controls: AAE 30100, 36400, 36401	7
Vehicle Dynamics: AAE 42100 or 44000	3
<i>Note: Students planning to specialize in aeronautics should take AAE 42100; those aimed at astronautics should take AAE 44000. AAE 36401 is to be taken following AAE 36400.</i>	
Design	
Introduction: AAE 25100	3
Spacecraft AAE 45000 or Aircraft AAE 45100	3
<i>Note: Students planning to specialize in aeronautics should take AAE</i>	

42100; those aimed at astronautics should take AAE 45000.

Major Electives 9

Minor Electives 6

Note: Major and minor electives are topically related specializations within aerospace engineering. They must be approved by the academic advisor.

Technical Electives 6

Note: Technical electives may be chosen from a broad range of science, engineering or technology courses, subject to the approval of the academic advisor.

Note: Students must take at least 3 credits of coursework focused on economics, business or entrepreneurship — subject to approval by the academic advisor. This may be covered either in the general education or technical electives and, therefore, need not increase the credits to graduate.

Summary

The sophomore year sets the foundation of basic engineering, including statics, dynamics, elementary structures, electrical circuits and a broad introduction to the design of both aircraft and spacecraft.

In the junior year, students learn about aerodynamics, propulsion, structures, dynamics and control systems. Some courses in the third year are available in both aeronautical and astronautical versions, and students choose the area of primary interest.

In the senior year, students choose, in consultation with their academic advisor, two areas of concentration called “major” and “minor” areas. Elective classes can be selected in any of the following fields: fluid mechanics, aerodynamics, propulsion, structures and materials, control systems, dynamics, design, and orbit and flight mechanics.

All students must complete a team-based senior design project, which integrates the technical disciplines and leads to a preliminary design of an aerospace system. Students may elect either aircraft or spacecraft versions of the senior design project.

More information about the school can be found at [the School of Aeronautics and Astronautics](https://engineering.purdue.edu/AAE) website (<https://engineering.purdue.edu/AAE>).

Honors Program

A B.S.AAE with honors degree is available to qualified students. Students should consult with their academic advisor for details.

Study Abroad

Purdue University’s Program for Study Abroad Office currently offers more than 200 programs in over 45 countries around the world. The School of Aeronautics and Astronautics has student exchange agreements with Bristol University, U.K.; Royal Melbourne Institute of Technology in Melbourne, Australia; University of New South Wales in Sydney, Australia; Technical University of Braunschweig in Germany; Ecole Supérieure des Techniques Aeronautiques et de Construction Automobile (ESTACA) in Paris, France; and Osaka University in Japan.

Bachelor of Science Curriculum in Aeronautics and Astronautics

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Credit Hours Required for Graduation: 130

The basic B.S.AAE degree program has a minimum of 130 credit hours, including the First-Year Engineering requirements. The required courses and the major and minor area courses cannot be taken on a pass/not-pass basis. Students must have a 2.0 GPA in the major, as well as overall, to graduate with a B.S.AAE degree. Divided into topical areas, the required curriculum is as follows:

Suggested Plan of Study for Aeronautical and Astronautical Engineering: Aeronautics Concentration

Credit Hours Required for Graduation: 130

Freshman Year: see "First Year Engineering Program."

In addition, **CGT 16300** (Introduction to Graphics for Manufacturing) for 2 credit hours is required in the aeronautical and astronautical engineering curriculum. Students planning to enter AAE are encouraged to take computer programming as the science selective.

Sophomore Year

Third Semester

- (0) **AAE 20000** (Undergraduate Sophomore Seminar)
- (3) **AAE 20300** (Aeromechanics I)
- (4) **MA 26100** (Multivariate Calculus)
- (3) **MA 26500** (Linear Algebra)
- (3) **PHYS 24100** (Electricity and Optics) **or** **AAE 25100** (Introduction to Aerospace Design)
- (3) General education elective
- (16)

Fourth Semester

- (3) **AAE 20400** (Aeromechanics II)
- (1) **AAE 20401** (Aeromechanics II Laboratory)
- (3) **MA 26600** (Ordinary Differential Equations)
- (3) **ME 20000** (Thermodynamics I)
- (3) **PHYS 24100** (Electricity and Optics) **or** **AAE 25100** (Introduction to Aerospace Design)
- (3) General education elective
- (16)

Junior Year

Fifth Semester

- (0) **AAE 30000** (Undergraduate Junior Seminar) (3)
- (3) **AAE 30100** (Signals Analysis in Aerospace) (1)
- (3) **AAE 33300** (Fluid Mechanics) (3)
- (1) **AAE 33301** (Fluid Mechanics Laboratory) (3)
- (3) **AAE 35200** (Structural Analysis I) (3)
- (3) **MA 30400** (Differential Equations and Analysis of Nonlinear Systems for Engineering and the Sciences) (3)
- (3) General education elective (16)

Sixth Semester

- (3) **AAE 33400** (Aerodynamics) (3)
- AAE 33401** (Aerodynamics Laboratory) **or** **AAE 35201** (Structural Analysis I Laboratory) (1)
- (3) **AAE 34000** (Dynamics and Vibrations) (3)
- (3) **AAE 36400** (Control Systems Analysis) (3)
- (3) **AAE 37200** (Jet Propulsion Power Plants) (3)
- (3) General education elective (16)

Senior Year

Seventh Semester

- (1) **AAE 36401** (Control Systems Laboratory) (3)
- (1) **AAE 40000** (Undergraduate Senior Seminar) (9)
- (3) **AAE 42100** (Flight Dynamics and Control) (3)
- (6) Major or minor area electives (3)
- (3) Technical elective (3)
- (3) General education elective (17)

Eighth Semester

- (3) **AAE 45100** (Aircraft Design) (3)
- Major or minor area electives (9)
- Technical elective (3)
- General education elective (3)
- (18)

Suggested Plan of Study for Aeronautical and Astronautical Engineering: Astronautics Concentration

Credit Hours Required for Graduation: 130

Freshman Year, see First-Year Engineering Program

In addition, **CGT 16300** (Introduction to Graphics for Manufacturing) for 2 credit hours is required in the aeronautical and astronautical engineering curriculum. Students planning to enter AAE are encouraged to take computer programming as the science selective.

Sophomore Year

Third Semester

- (0) **AAE 20000** (Undergraduate Sophomore Seminar)
- (3) **AAE 20300** (Aeromechanics I)
- (4) **MA 26100** (Multivariate Calculus)
- (3) **MA 26500** (Linear Algebra)
- (3) **PHYS 24100** (Electricity and Optics) **or** **AAE 25100** (Introduction to Aerospace Design)
- (3) General education elective
- (16)

Fourth Semester

- (3) **AAE 20400** (Aeromechanics II)
- (1) **AAE 20401** (Aeromechanics II Laboratory)
- (3) **MA 26600** (Ordinary Differential Equations)
- (3) **ME 20000** (Thermodynamics I)
- (3) **PHYS 24100** (Electricity and Optics) **or** **AAE 25100** (Introduction to Aerospace Design)
- (3) General education elective
- (16)

Junior Year

Fifth Semester

- (0) **AAE 30000** (Undergraduate Junior Seminar)
- (3) **AAE 30100** (Signals Analysis in Aerospace)
- (3) **AAE 33300** (Fluid Mechanics)
- (1) **AAE 33301** (Fluid Mechanics Laboratory)
- (3) **AAE 35200** (Structural Analysis I)
- MA 30400** (Differential Equations and Analysis of Nonlinear Systems for Engineering and the Sciences)
- (3) General education elective
- (16)

Sixth Semester

- (3) **AAE 33400** (Aerodynamics)
- AAE 33401** (Aerodynamics Laboratory) **or** **AAE 35201** (Structural Analysis I Laboratory)
- (1)
- (3) **AAE 34000** (Dynamics and Vibrations)
- (3) **AAE 36400** (Control Systems Analysis)
- (3) Technical elective
- (3) General education elective
- (16)

Senior Year

Seventh Semester

- (1) **AAE 36401** (Control Systems Laboratory)
- (1) **AAE 40000** (Undergraduate Senior Seminar)
- (3) **AAE 43900** (Rocket Propulsion)
- (6) Major or minor area electives
- (3) Technical elective
- (3) General education elective
- (17)

Eighth Semester

- (3) **AAE 44000** (Spacecraft Attitude Dynamics)
- (3) **AAE 45000** (Spacecraft Design)
- (9) Major or minor area electives
- (3) General education elective
- (18)

Options in Aeronautical and Astronautical Engineering

The school offers curriculum options for major and minor areas of study in programs leading to the degrees of B.S.AAE, M.S.AAE and Ph.D. The techniques developed in these courses are by no means limited to aerospace applications, even though the emphasis is in that area. These options include:

Aerodynamics. This option emphasizes the study of fluid motion around a body moving through atmospheric air at speeds that range from subsonic to hypersonic. Theoretical, computational and experimental methods are developed to determine forces, moments and heat transfer that can be applied to the design of aircraft, missiles and space vehicles. The basic theory and techniques also find application in other areas such as high-speed ground transportation, hydrofoils, mechanics of blood flow and noise generation.

Design. The design option involves the study of methods and techniques necessary for the design of aerospace systems and their components. The courses in this option provide opportunities to gain exposure to design methods and to gain experience through design projects. The topics addressed include requirements definition, functional decomposition, concept synthesis, application of design-oriented analysis methods and optimization. Because aerospace systems are highly interdisciplinary, a systems perspective is encouraged to ensure that students are aware of how design decisions impact numerous features of the aerospace system.

Dynamics and Control. This option involves the study of techniques for aerospace vehicle guidance; systems analysis and control; analysis of flight vehicle trajectories, orbits and dynamic motion; mission planning; and system optimization methods. This area deals more with the vehicle as a whole and how the subsystems and related technologies are integrated into the optimal design of a vehicle so that the mission requirements are met.

Propulsion. This option involves the study of the basic operation and design of aerospace propulsion devices, including both air-breathing engines and rocket powerplants. The gas dynamics of internal flows, thermodynamics and combustion processes associated with these devices are discussed in detail. Engine components such as inlets, pumps and/or compressors, combustion chambers, turbines and nozzles are investigated. Various air-breathing engines such as turbojets, turbofans, ramjets, turboprops and scramjets are treated. Rocket propulsion systems — including solid rocket motors; liquid rocket engines; hybrid rockets; and nuclear, electric and advanced nonchemical systems — also are covered.

Structures and Materials. This option emphasizes the study of structural analysis, structural dynamics, structural design and behavior of aerospace materials. This includes courses that deal with the principles of mechanics and the theoretical, computational and experimental techniques necessary to ensure the structural integrity of aerospace vehicles. Response to, and failure of, both materials and structures subjected to static and dynamic loads and thermal and corrosive environments are investigated theoretically and observed experimentally.

Agricultural and Biological Engineering

Energy, food, water and the environment are vital for the well-being of both current and future generations. Agricultural and Biological Engineering (ABE) programs prepare students for careers that address these and other vital concerns. ABE offers two distinct degree programs: Agricultural Engineering and Biological Engineering. The Agricultural Engineering program trains professional engineers for rewarding careers in the Machine Systems Engineering specialization or the Environmental and Natural Resources Engineering specialization. The Biological Engineering program emphasizes the processing and chemistry of biological materials, the development of food, pharmaceuticals, and industrial products or cellular and biomolecular engineering. Both curricula include a combination of courses in biology, life sciences and engineering that

provides the essential skills needed to design and/or manage biologically based production or processing systems, and machines.

Agricultural engineers with a focus on environmental and natural resources engineering work in industries and organizations focused on effective environmental and natural resource management, sources of clean energy and maintaining water and air quality.

Agricultural engineers with a focus on machine systems engineering develop machines and processes to support the environmentally friendly production and efficient use of energy, food and water while promoting health and safety.

Biological engineers work in industries that produce food or pharmaceuticals or use biological or biochemical processes to develop and manufacture new products.

Students in the department have flexibility in planning their professional training to meet particular degree objectives. Additional information, including the department's mission statement is available at www.purdue.edu/abe.

Educational Objectives

Agricultural Engineering Program Educational Objectives

The educational objectives of the Agricultural Engineering program is to produce graduates who:

- Effectively practice agricultural and biological engineering in the areas of machine systems and environmental and natural resources.
- Have demonstrated proficiency in fundamental engineering skills and technical knowledge as well as professional and personal skills appropriate for their profession.
- Are prepared for future challenges in agricultural engineering through the application and discovery of knowledge.
- Learn and grow as individuals, contribute to society and attain maximum potential through lifelong learning.

Biological Engineering Program Educational Objectives

The educational objectives of the Biological Engineering program are to produce graduates who:

- Effectively practice biological engineering in the areas of machine systems and environmental and natural resources.
- Have demonstrated proficiency in fundamental engineering skills and technical knowledge as well as professional and personal skills appropriate for their profession.
- Are prepared for future challenges and opportunities in the areas of food, pharmaceutical and biochemical engineering through the discovery and application of knowledge.
- Learn and grow as individuals, contribute to the profession and society and attain maximum potential through lifelong learning.

To achieve the program educational objectives, the department will:

- Recruit, support and retain competent faculty and staff.

- Provide facilities and equipment to create an atmosphere conducive to learning and discovery and to the application of knowledge.

Student Outcomes

Student outcomes refer to the important capabilities and skills that a student should possess as a graduate of one of the engineering undergraduate programs in the department. Outcomes for both agricultural engineering (AE) and biological engineering (BE) are divided into two groups: “basic engineering skills” and “professional and personal skills.”

Basic Engineering Skills

Graduates of this program will demonstrate:

- An ability to apply knowledge of mathematics, science and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
- An ability to identify, formulate and solve engineering problems.
- An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Professional and Personal Skills

Graduates of these programs will demonstrate:

- An ability to function on multidisciplinary teams.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.
- A recognition of the need for, and an ability to engage in, lifelong learning.
- A knowledge of contemporary issues.

Career Opportunities

Graduates of these programs will be prepared to develop products and systems ranging from intelligent machines, to techniques for conserving land and water resources and improving their quality, to the creation of healthy foods or new bio-based materials. The highly interdisciplinary focus enables students to apply basic engineering principles to the design of new and renewable products or processes.

Employment opportunities for Agricultural Engineering graduates include product engineering, design and test engineering for machinery and manufacturing industries, engineering for consulting firms and government agencies responsible for environmental conservation and quality, facilities design, safety engineering, engineering management, private consulting, teaching in colleges and universities, and research in industry and government

Biological Engineering graduates are employed in food and/or biologically related industries where their activities include research and development of new foods or biological and pharmaceutical products; development and operation of manufacturing, packaging and distribution systems for pharmaceutical, food

and bio-based products; design and installation of production processes; and/or plant engineering; distribution and marketing; quality evaluation and control; sanitation and waste disposal; and by-product utilization. There also is a great need for biological and food process engineers as educators, production and processing managers and food industry executives.

The plans of study lead to either the degree of Bachelor of Science in Agricultural Engineering (B.S.AE) or Bachelor of Science in Biological Engineering (B.S.BE). They are administered by the College of Engineering and the College of Agriculture. Beginning students can apply for admission to the College of Engineering and complete the First-Year Engineering Program. An alternative for students with an interest in agricultural or biological engineering is to apply to the Pre-Agricultural and Biological Engineering program in the College of Agriculture.

Dual-degree programs also are available in Biological Engineering/Biochemistry or Biological Engineering/Pharmaceutical Sciences. These programs require an additional year of study and lead to two degrees. The department also offers graduate study leading to the degrees of Master of Science (M.S.) or Doctor of Philosophy (Ph.D.). A five-year dual B.S./M.S. degree is offered in each of the areas for which students can apply at the end of their sophomore year.

Professional Practice Program with Industry or Governmental Organizations

The professional practice programs enable qualified students to obtain experiences related to their specific engineering discipline with selected employers while completing the requirements of their undergraduate degree. Students can participate in a five-session co-op, a three-session co-op or an internship program. International internships also are available through the Global Partners in Apprenticeship Learning (G-PAL) Program within the Professional Practice Program. OPP also offers the GEARE program, which combines domestic and international work experiences, a design project component and an opportunity to study abroad.

For more information, visit the [Professional Practice Program](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

GEARE Program

The Global Engineering Alliance for Research and Education (GEARE) program is a unique and award-winning program that originated in the School of Mechanical Engineering at Purdue. Since 2009, the Professional Practice Program (OPP) has assumed all GEARE operations and opened up the program to all College of Engineering students and some students in the College of Technology. GEARE is designed to supplement the education of engineers so they are prepared to function immediately in the global workplace. Students in the program participate in an orientation program, 12 credit hours of foreign languages, one domestic internship, one subsequent international internship (preferably at the same company), one semester of study abroad with fully transferable engineering course credits, and a one-semester to two-semester design team project with design teams that include students from international partner universities working on an industry-inspired project.

Interested students are encouraged to refer to the [OPP](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

Honors Program

An honors program is available for outstanding students who desire the flexibility to pursue their interests in more depth. Under the guidance of a professional staff member, an honors student can devise his or her own plan of study, which, except for school requirements, may be altered extensively from the regular curricula. Particular attention will be given to self-study opportunities, design and research projects and

work experience that would reinforce the overall goals of the student. For more detailed information, students should go to the Student Academic Center in Room 201 of the Agricultural and Biological Engineering Building.

Study Abroad and International Studies Minor

If the United States is to compete effectively in a global economy, engineers must understand not only the international economic system but also the cultures, languages and the scientific and engineering capabilities of other nations. The Study Abroad Office provides Purdue students with opportunities to take classes overseas. Those who desire more extensive training can participate in the International Studies Minor Program.

There are more than 200 programs, varying in length from one week to one academic year, available to Purdue students through the Study Abroad Office. These programs allow students to earn academic credit that can be used to fulfill their general education requirements and/or academic course requirements in their major or minor areas of study.

Students who participate in the International Studies Minor Program incorporate a special international component into their undergraduate programs of study. Except for the overseas experiential component of the program, students usually are able to use the elective structure within their major program of study to earn the minor. The Office of International Programs in Agriculture (IPIA) can provide special counsel to ABE students regarding program operations, including the identification and coordination of out-of-country experiences.

More detailed information about international opportunities is available through [Purdue's Global Engineering Program](https://engineering.purdue.edu/GEP) (<https://engineering.purdue.edu/GEP>) and the [Office of International Programs in Agriculture](https://ag.purdue.edu/ipia/Pages/default.aspx) (<https://ag.purdue.edu/ipia/Pages/default.aspx>).

Degree Requirements for Agricultural Engineering

Accredited by the Accreditation Commission of ABET, www.abet.org.

Credit Hours Required for Graduation: 131

Courses	Credit Hours
Mathematics and Basic Sciences	
Calculus: MA 16500, 16600, 26100, 26200	16
Chemistry: CHM 11500, 11600	8
Physics: PHYS 17200, 24100	7
Biological Sciences	8
Agricultural Sciences	
AGRY 25500	3
Elective	3
Computing	
CS 15900	3
<i>Students specializing in Machine Systems have the option of taking CS 15900 and an additional hour of a free elective instead of CHM 11600.</i>	
Professional Development	
ABE 29000, 49000	3
Communication	
English Composition: ENGL 10600	4

Speech: COM 11400	3
Humanities and Social Sciences General Education	18
<i>Courses must be chosen in accordance with the approved general education list and with the help of a faculty advisor. Of the 18 credit hours, 3 must be an additional communication elective and 3 must be economics. Six credit hours must be taken to fulfill the College of Agriculture international understanding requirement; these credits may be taken as humanities/social sciences, free elective or agriculture elective — depending on the chosen courses.</i>	
Core Engineering Courses	
Computations: ABE 20500	3
Basic Mechanics of Materials: NUCL 27300, ME 27000 and 27400	9
Thermodynamics: ABE 21000	3
Physical Properties: ABE 30500	3
Soil and Water Conservation: ABE 32500	4
Basic Fluid Mechanics/Hydraulics: ME 30900, or CE 34000 and 34300	4
Machine Design: ABE 33000	3
Electronics: ECE 20100	3
Hydraulics for Mobile Equipment: ABE 43500	3
Numerical Methods/Modeling: ABE 45000	3
Capstone Design: ABE 48400, 49500	4
Technical Electives	6
Free Electives	7

Suggested Plan of Study for Agricultural Engineering

Credit Hours Required for Graduation: 131

Freshman Year, see [First-Year Engineering Program](http://www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)
(www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)

ABE 12000 (Introduction to Agricultural and Biological Engineering) for one credit hour is recommended for students interested in agricultural and biological engineering, but it is not required for admission to the program. **ABE 29000** (Sophomore Seminar) for 1 credit hour also is recommended in the third semester.

Sophomore Year

Third Semester

- (3) **ABE 20500** (Engineering Computations for Biological Systems)
- (1) **ABE 29000** (Sophomore Seminar)
- (4) **MA 26100** (Multivariate Calculus)
- (3) **ME 27000** (Basic Mechanics I)
- (3) **PHYS 24100** (Electricity and Optics)
- (4) Biological sciences elective

Fourth Semester

- (3) **ABE 21000** (Biological Applications of Material and Energy Balances)
- (4) **MA 26200** (Linear Algebra and Differential Equations)
- (3) **ME 27400** (Basic Mechanics II)
- (3) **NUCL 27300** (Mechanics of Materials)
- (3) General education elective*

(18)

(16)

Junior Year

Fifth Semester

- (3) **ABE 30500** (Physical Properties of Biological Materials)
- (4) **ABE 32500** (Soil and Water Resource Engineering)
- (3) **AGRY 25500** (Soil Science)
- (3) **CE 34000** (Hydraulics) **and** (1) **CE 34300** (Elementary Hydraulics Laboratory) **or** (4) **ME 30900** (Fluid Mechanics)
- (3) General education elective*
- (17)

Sixth Semester

- (3) **ABE 33000** (Design of Machine Components)
- (3) **ECE 20100** (Linear Circuit Analysis I)
- (4) Biological sciences elective
- (3) General education elective*
- (3) Elective
- (16)

Senior Year

Seventh Semester

- (3) **ABE 43500** (Hydraulic Control Systems for Mobile Equipment)
- (3) **ABE 45000** (Finite Element Method in Design and Optimization)
- (1) **ABE 49000** (Professional Practice in Agricultural and Biological Engineering)
- (3) Agriculture elective
- (3) Engineering technical elective
- (3) General education elective*
- (16)

Eighth Semester

- (3) **ABE 49500** (Agricultural Engineering Design)
- (3) Engineering technical elective
- (6) General education electives*
- (3) Elective
- (15)

**Eighteen credit hours of general education electives must be chosen in accordance with the general education document (available in the Student Academic Center, Room 201, Agricultural and Biological Engineering Building). Of the 18 credit hours, 3 must be economics such as ECON 25100 or 25200 and 3 must be an additional communication elective.*

Degree Requirements for Biological Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Credit Hours Required for Graduation: 135

Courses	Credit Hours
Mathematics and Basic Sciences	
Calculus: MA 16500, 16600, 26100, 26500, 26600	18
Chemistry: CHM 11500, 11600, 25700	12
Physics: PHYS 17200, 24100	7
Biological and Food Sciences	
Biological Sciences: BIOL 22100, 23000, IT 22600	9
BCHM 22100 or FN 20500	3
Biological or Food Science electives	7
Engineering Tools and Skills	
ENGR 13100, 13200, CHE 32000	7
Professional Development	
ABE 29000, 49000	2
Communication	
English Composition: ENGL 10600	4
Speech: COM 11400	3
Humanities and Social Sciences General Education	18
<i>Courses must be chosen in accordance with the approved general education list and with the help of a faculty advisor. Of the 18 credit hours, 6 must meet College of Agriculture international understanding requirements, 3 must be an additional communication elective and 3 must be economics. Designated humanities or social sciences courses may be used to fulfill the international understanding requirements.</i>	
Core Engineering Courses	
Thermodynamics: ABE 20100, 20200, 30100, 30300	13
Heat, Mass and Momentum Transfer: CHE 37700, 37800	8
Kinetics and Reaction Engineering: ABE 37000	3
Sensors and Process Control: ABE 46000	3
Transport Processes: ABE 45400	4
Unit Operations: ABE 55500	4
Plant Design and Economics: ABE 55600	4
Process Engineering: ABE 58000	3
Technical Electives	3

Suggested Plan of Study for Biological Engineering

Credit Hours Required for Graduation: 135

Freshman Year, see [First-Year Engineering Program](http://www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)

(www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)

It is recommended that students take a general education elective in the freshman year.

Sophomore Year

Third Semester

- (4) **ABE 20100** (Thermodynamics in Biological Systems I)
- (1) **ABE 29000** (Sophomore Seminar)
- (3) **BIOL 23000** (Biology of the Living Cell)
- (4) **CHM 25700** (Organic Chemistry)
- (2) **IT 22600** (Biotechnology Laboratory I)
- (4) **MA 26100** (Multivariate Calculus)
- (18)

Fourth Semester

- (3) **ABE 20200** (Thermodynamics in Biological Systems II)
- (3) **BCHM 22100** (Analytical Biochemistry) or **FN 20500** (Food Science)
- (3) **CHE 32000** (Statistical Meeting)
- (3) **MA 26500** (Linear Algebra)
- (3) **MA 26600** (Ordinary Differential Equations)
- (3) General education elective*
- (18)

Junior Year

Fifth Semester

- (3) **ABE 30100** (Modeling and Computation Tools in Biology and Engineering)
- (3) **ABE 30300** (Applications of Physical Chemistry to Biological Processes)
- (4) **CHE 37700** (Momentum Transfer)
- (3) **PHYS 24100** (Electricity and Optics)
- (3) General education elective*
- (17)

Sixth Semester

- (3) **ABE 37000** (Biological/Microbial Kinetics and Reaction Engineering)
- (4) **ABE 45400** (Transport Processes in Biological and Food Process Systems)
- (4) **BIOL 22100** (Introduction to Microbiology)
- (4) **CHE 37800** (Heat and Mass Transfer)
- (3) Engineering elective
- (18)

Senior Year

Fifth Semester

- (1) **ABE 49000** (Professional Practice in Agricultural and Biological Engineering)
- (4) **ABE 55500** (Biological and Food Processing Operations)
- (4) Biological or food science elective†
- (3) Engineering elective†
- (6) General education elective
- (18)

Sixth Semester

- (3) **ABE 46000** (Sensors and Process Control)
- (4) **ABE 55600** (Food Plant Design and Economics)
- (3) **ABE 58000** (Process Engineering of Renewable Resources)
- (3) Biological or food science elective†
- (3) General education elective*
- (16)

**Eighteen credit hours of general education electives must be chosen in accordance with the general education document (available in the Student Academic Center, Room 201, Agricultural and Biological Engineering Building). Of the 18 credit hours, 3 must be economics, such as ECON 25100 or 25200 and 3 must be an additional communication elective.*

† See the list of approved restricted electives that appears in the ABE Student Handbook.

Biomedical Engineering

Biomedical engineering combines engineering expertise with medical needs for the enhancement of human health care. It is a branch of engineering in which knowledge and skills are developed and applied to understand and solve problems in biology and medicine.

Having established a new undergraduate program in Biomedical Engineering in 2004, students can now earn a Bachelor of Science in Biomedical Engineering (B.S.BME) degree from the Weldon School of Biomedical Engineering. The first class of undergraduates received degrees in May 2007. A fully established graduate program in biomedical engineering has been in place since 1998, granting degrees of Master of Science in Biomedical Engineering (M.S.BME) and Doctor of Philosophy (Ph.D.).

Opportunities for B.S.BME graduates will continue to increase. Positions available in the medical products industry include the design, development and manufacturing of a wide array of medical devices, computer models to monitor and diagnose disease, biosensors to measure and the design of biocompatible materials for tissue replacement.

Students who complete the undergraduate program with high scholastic achievement and who are interested in careers in research are encouraged to pursue an advanced degree in biomedical engineering. Students with stronger interest in the clinical aspect of biomedical engineering should consider application to the joint program between the Weldon School of Biomedical Engineering and the Indiana University School of Medicine, which leads to a combined degree (M.D./Ph.D.).

Students admitted to Purdue for Fall 2012 and all students matriculating from First-Year Engineering (FYE) to the professional schools beginning in May 2012 and thereafter will use the following criteria to determine eligibility for admission to the Weldon School of Biomedical Engineering:

- Completion of all FYE requirements (CHM 11600 must be completed prior to the start of the sophomore fall semester in BME).
- An EAI and GPA ≥ 3.20 .

If these criteria are met, a student will be guaranteed admission into the Weldon School of Biomedical Engineering up to the critical capacity.

Students not selected are encouraged to pursue admission to one of the other professional engineering schools through which well-established specialty areas within the field of biomedical engineering continue to be offered. These programs include agricultural and biological engineering, electrical and computer engineering, mechanical engineering and chemical engineering.

The BME undergraduate curriculum, which begins in the sophomore year, includes an array of courses that teach engineering science, analysis and design in the context of biological and biomedical problems. Courses incorporate instruction in biomolecules, biomechanics, physiological mechanisms and analysis, biological transport, cell biology, biostatistics and bioinstrumentation. In addition, elective courses in BME and other engineering disciplines, life science, general education and two professional seminars are required before graduation.

Undergraduate internship, co-op and study abroad programs provide an opportunity for biomedical engineering students to participate in a practical, supervised engineering experience with domestic industry partners or in an international setting. Sponsoring companies may choose to place students in a variety of roles, including research, product development, manufacturing, regulatory affairs and marketing.

A senior design project provides the capstone engineering design experience, which ties together all the previous semesters of coursework on design and analysis into one integrated group project that takes the students from conception through construction and testing to a final presentation. Further information about the undergraduate program in biomedical engineering, including a Plans of Study listing required courses and recommended electives, is available through the [Weldon School of Biomedical Engineering](http://www.weldon.purdue.edu/BME/Academics) website (<https://engineering.purdue.edu/BME/Academics>).

Minimum Degree Requirements for Biomedical Engineering (B.S.BME)

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Credit Hours Required for Graduation: 130*

Courses	Credit Hours
First-Year Engineering	30
All required First-Year Engineering courses must be completed with a “C-” or above for entry into the BME undergraduate program. No more than 8 credit hours of freshman calculus can be applied toward the BME degree.	
Core Biomedical Engineering Courses	24
BME 20100, 20400, 20500, 20600, 25600, 29000, 30100, 30400, 30500, 30600, 39000	
BME Breadth Requirement	43
Core Life Sciences: BIOL 23000 and two additional Life Science courses	9*
Core Engineering: ECE 30100; IE 33000 (or STAT 51100); ME 20000, 27000; MSE 23000	15
BME Technical Engineering Electives	15*†
Five additional BME or other Engineering courses <i>At most 6 credits at the 30000 level; must include at least one 3-credit 40000-level BME course and at least one 3-credit course chosen from the Quantitative Breadth List.</i>	
Senior Design Capstone Requirements: BME 48800, 48900, 49000	4
Advanced Physics and Math: PHYS 24100; MA 26100; and MA 26600 or 26200	10
General Education Electives	18*
<i>Course selections must meet the General Education Program requirements. Includes an Ethics elective to be chosen from the Ethics list.</i>	
Unrestricted Electives	5
<i>Additional coursework to fulfill the total number of credits required for graduation.</i>	

* Selected from a list of courses approved by the Biomedical Engineering faculty and maintained by the Undergraduate Advising Office.

† Student must complete a 40000-level BME elective with at least a “B-” before taking a BME 50000-level course as a technical elective.

GPA Requirement: A minimum Graduation Index of at least 2.0 is required to qualify for graduation with a B.S.BME degree. A minimum BME major GPA of at least 2.0 is also required to qualify for graduation with a B.S.BME. Courses included in the BME major GPA are: BME 20100, 20400, 20500, 20600, 25600, 29000, 30100, 30400, 30500, 30600, 39000, 48800, 48900, 49000; ME 20000, 27000; MSE 23000; ECE 30100; IE 33000 (or STAT 51100).

Suggested Plan of Study for Biomedical Engineering

Credit Hours Required for Graduation 130

Freshman Year, see [First-Year Engineering Program](http://www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)
(www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)

CHM 11600 must be completed prior to the start of your sophomore year in BME. **CS 15900** is recommended as a first-year course but is required before the junior year.

Sophomore Year

Third Semester

- (3) **BIOL 23000** (Biology of the Living Cell)
- (3) **BME 20100** (Biomolecules: Structure, Function and Engineering Applications)
- (1) **BME 20500** (Biomolecular and Cellular Systems Laboratory)
- (1) **BME 29000** (Frontiers in Biomedical Engineering)
- (4) **MA 26100** (Multivariate Calculus)
- (3) **ME 27000** (Basic Mechanics I)
- (3) **PHYS 24100** (Electricity and Optics)
- (18)

Fourth Semester

- (3) **BME 20400** (Biomechanics of Hard and Soft Tissues)
- (1) **BME 20600** (Biomechanics and Biomaterials Laboratory)
- (3) **BME 25600** (Physiological Modeling in Human Health)
- (3-4) **MA 26200** (Linear Algebra and Differential Equations)/**MA 26600** (Ordinary Differential Equations)*
- (3) **ME 20000** (Thermodynamics I)
- (3) **MSE 23000** (Structure and Properties of Materials Engineering)
- (16-17)

Junior Year

Fifth Semester

- (3) **BME 30100** (Bioelectricity)
- (3) **BME 30400** (Biomedical Transport Fundamentals)
- (3) **BME 30500** (Bioinstrumentation Laboratory)
- (3) BME technical elective
- (3) General education or ethics elective†

Sixth Semester

- (2) **BME 30600** (Biotransport Laboratory)
- (1) **BME 39000** (Professional Development and Design in Biomedical Engineering)
- (3) **ECE 30100** (Signals and Systems)
- (3) **IE 33000** (Probability and Statistics in Engineering II)
- (3) BME technical elective
- (3) General education or ethics elective†

(15)

(15)

Senior Year

Seventh Semester

- (1) **BME 48800** (Preliminary Senior Project Design)
- (1) **BME 49000** (Professional Elements of Design)
- (6) BME technical electives‡
- (3) Life science elective
- (3) General education elective
- (2) Unrestricted elective **or BME 48900** (Senior Design Project Laboratory)§
- (16)

Eighth Semester

- (2) **BME 48900** (Senior Design Project Laboratory)§
- (3) BME technical elective
- (3) Life science elective
- (6) General education electives
- (3) Unrestricted elective
- (17)

* *MA 26200 is highly recommended but not required.*

† *PHIL 28000 or 27000 is required in order to complete the Ethics elective. The course is included as part of the College of Engineering General Education requirement.*

‡ *Choose from a list of Quantitative Breadth courses.*

§ *Senior Project Design Laboratory can be taken in either the spring or fall semester.*

Chemical Engineering

The School of Chemical Engineering offers courses of study leading to the degree of Bachelor of Science in Chemical Engineering (B.S.ChE) and the advanced degrees of Master of Science in Chemical Engineering (M.S.ChE) and Doctor of Philosophy (Ph.D).

At the B.S. level, the objective is to prepare engineering professionals with a strong functional command of chemical engineering fundamentals; experimental, mathematical, computational and communication skills; and awareness of the scope of the profession, which will enable them to become the engineering leaders of the future.

Chemical engineers rely on their knowledge of mathematics and science — particularly chemistry — to overcome technical problems in industry and society. With strong problem-solving skills and a fundamental background in mathematics, physics, chemistry and biology, chemical engineers can seize opportunities to translate industrial problems into competitive advantages.

Chemical engineers use their technical training every day, but they also must have well-developed communication and teamwork skills to work with many different teams of engineers, scientists, managers, financiers, doctors, lawyers and government officials. Chemical engineers have many interests and skills that are shared by electrical engineers, civil engineers, biomedical engineers, aeronautical engineers and mechanical engineers. Along with these varied skills, they have a strong understanding of chemistry, and increasingly, biology. As a result, students in chemical engineering excel in coursework within and outside of the ChE major that prepares them to be world leaders in technology areas such as energy, the environment, biotechnology and medicine, personal care products, food and high-performance materials.

Chemical engineers are involved in manufacturing high-value-added products, which translates into salaries that are usually the highest of any engineering major.

To prepare graduates to succeed in graduate or professional school as well as in industry, the chemical engineering curriculum at Purdue emphasizes a healthy blend of theoretical and applied coursework. A typical course schedule contains basic courses in mathematics, chemistry, physics and biology, accompanied by specialized courses to give students an advanced understanding of the principles of chemical engineering. It is important to remember that Purdue graduates are in demand by a wide range of companies without having to take specialized coursework to prepare for a given industry sector. As a student, this means many opportunities will be available to you based on your basic B.S. degree in Chemical Engineering from Purdue.

Additional information is available on the School of Chemical Engineering [website](https://engineering.purdue.edu/ChE/index.html) (<https://engineering.purdue.edu/ChE/index.html>).

Professional Practice Program and Industry Experience

The School of Chemical Engineering strongly encourages students to gain as much work experience as possible during their undergraduate program. The school offers a formal, academic Co-Operative Education Program through the Office of Professional Practice. This is a five-year program in which students gain real work experience in coordination with their academic studies. Students alternate semesters between on-campus studies and work in the field (including summers). Callouts for the program are held early in the spring semester of the first year. Students who meet the GPA requirements after fall will receive an invitation to the callout. If accepted, students begin their work experience either the summer following the first-year program or the fall semester of the sophomore year. Visit our detailed [co-op plans of study](https://engineering.purdue.edu/ChE/Academics/Undergrad/Co-Op/CoOpPlanofStudy) (<https://engineering.purdue.edu/ChE/Academics/Undergrad/Co-Op/CoOpPlanofStudy>).

Students who do not participate in the Co-Op Program should pursue internships to gain work experience.

Preparation for the Graduate Program

Students with a high scholastic index who are interested in the more creative and technical phases of engineering, such as research, development, design and teaching, are advised to follow a program leading to the degree of M.S.ChE or Ph.D. It is recommended that such students take at least a year of foreign language in their nontechnical elective program. Their technical electives should be chosen from advanced courses in mathematics or statistics, chemical engineering, biology, chemistry or physics.

Students interested in pursuing graduate studies are strongly encouraged to complete research as well as an undergraduate thesis via the College of Engineering Honors Program or the Undergraduate Thesis Concentration.

Honors Program

An optional honors program is available for students who demonstrate exceptional academic ability. Students may be admitted to the College of Engineering Honors Program as an incoming freshman based on admission criteria, or may join the program once criteria is met at any time during their undergraduate career. Eligibility is determined by the College of Engineering Honors Program Office. Criteria for the program requires all students to complete 24 honors “points” and maintain the appropriate GPA as determined by the Honors Program Office, though each professional school determines detailed requirements within the 24 points.

The faculty of the School of Chemical Engineering believe that the purposes of an honors option include encouragement of students' interest in graduate study and research/academic careers as well as special recognition of students attaining high levels of academic achievement. The Chemical Engineering program requires two thesis research courses resulting in the submission of a thesis as well as the completion of a transport phenomena course. These requirements account for 9 of the 24 honors points. More information can be found through the College of Engineering Honors Program Office or the Chemical Engineering Undergraduate Office.

Plan of Study for Chemical Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Chemistry Sequence. The freshman chemistry requirement for chemical engineering students is 8 credits of general chemical and qualitative analysis. These may be earned by taking one of the following sequences: CHM 11500/11600 (8 credits) or CHM 12300/12400 (8 credits). The preference within the School of Chemical Engineering is that students take the CHM 12300/12400 sequence, but CHM 11500/11600 also will be accepted.

Credit Hours Required for Graduation: 130

Freshman Year: see [First-Year Engineering Program](http://www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)
(www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)

Sophomore Year

Third Semester

- (0) **CHE 20000** (Chemical Engineering Seminar)
- (4) **CHE 20500** (Chemical Engineering Calculations)*
- (3) **CHM 26100** (Organic Chemistry I)
- (1) **CHM 26300** (Organic Chemistry Laboratory I)
- (4) **MA 26100** (Multivariate Calculus)
- (3) **PHYS 24100** (Electricity and Optics)
- (3) General education elective
- (18)

Fourth Semester

- (4) **CHE 21100** (Chemical Engineering Thermodynamics)
- (3) **CHE 32000** (Statistical Modeling)
- (3) **CHM 26200** (Organic Chemistry II)
- (1) **CHM 26400** (Organic Chemistry Laboratory II)
- (4) **MA 26200** (Linear Algebra and Differential Equations)
- (3) General education elective
- (18)

Junior Year

Fifth Semester

- (3) **BIOL 23000** (Biology of the Living Cell)
- (3) **CHM 30600** (Staged Separations)
- (3) **CHE 37000** (Physical Chemistry)
- (4) **CHE 37700** (Momentum Transfer)
- (3) **MA 30300** (Differential Equations)

Sixth Semester

- (0) **CHE 30000** (Chemical Engineering Seminar)
- (4) **CHE 34800** (Chemical Reaction Engineering)
- (4) **CHE 37800** (Heat and Mass Transfer)
- (3) Engineering elective
- (3) Technical elective

	for Engineering)	
(16)		(3) General education elective
		(17)

Senior Year

Seventh Semester

- (1) **CHE 40000** (Chemical Engineering Seminar)
- (4) **CHE 43500** (Chemical Engineering Laboratory)
- (3) **CHE 45600** (Process Dynamics and Control)
- (3) Chemical engineering elective
- (3) General education elective
- (14)

Eighth Semester

- (4) **CHE 45000** (Design and Analysis of Processing Systems)
- (3) Chemical engineering elective
- (3) Engineering elective
- (6) General education electives
- (16)

* A "C" or better must be earned in CHE 20500 to continue to enroll in chemical engineering classes.

Chemistry/Chemical Engineering Dual-Degree Program

The Department of Chemistry and the School of Chemical Engineering offer a joint five-year program for students. This curriculum leads to both the degree of B.S. in Chemistry and the B.S.ChE. Graduates of this program will be certified as fulfilling the recommended requirements of the American Chemical Society. The curriculum in chemical engineering is accredited by the Engineer's Council for Professional Development. Students wishing to participate in this program should apply accordingly and must be in the First-Year Engineering Program to complete the required ENGR 13100 and 13200 courses.

Additional information about the Chemical Engineering degree program can be found on the School of [Chemical Engineering website](https://engineering.purdue.edu/ChE/index.html) (<https://engineering.purdue.edu/ChE/index.html>).

Plan of Study for Chemistry/Chemical Engineering Dual Degree

Students must complete all [First-Year Engineering requirements](http://www.purdue.edu/catalogs/engineering/firstyear.html#curriculum) (www.purdue.edu/catalogs/engineering/firstyear.html#curriculum) prior to admission to the School of Chemical Engineering.

Sophomore Year

Third Semester

- (4) **CHE 20500** (Chemical Engineering Calculations)[†]
- (3) **CHM 26100** (Organic Chemistry I)
- (2) **CHM 26500** (Organic Chemistry Laboratory I)
- (4) **MA 26100** (Multivariate Calculus)
- (4) **PHYS 27200** (Electricity and Optics)
- (17)

Fourth Semester

- (4) **CHE 21100** (Introductory Chemical Engineering Thermodynamics)
- (3) **CHM 26200** (Organic Chemistry II)
- (2) **CHM 26600** (Organic Chemistry Laboratory II)
- (3) **COM 21700** (Science Writing and Presentation)
- (4) **MA 26200** (Linear Algebra and Differential Equations)
- (16)

Junior Year

Fifth Semester

- (4) **CHE 37700** (Momentum Transfer)
- (3) **CHM 53300** (Introductory Biochemistry)
- (3) **MA 30300** (Differential Equations for Engineering)
- (3) Foreign Language 10100
- (3) Great Issues class
- (16)

Sixth Semester

- (3) **CHE 32000** (Statistical Modeling)
- (3) **CHM 37400** (Physical Chemistry II)
- (2) **CHM 37600** (Physical Chemistry Laboratory)
- (3) Foreign Language 10200
- (3) Engineering elective
- (14)

Senior Year

Seventh Semester

- (3) **CHE 30600** (Design of Staged Separation Processes)
- (4) **CHE 34800** (Chemical Reaction Engineering)
- (4) **CHM 32100** (Analytical Chemistry I)
- (3) Foreign Language 20100
- (14)

Eighth Semester

- (4) **CHE 37800** (Heat and Mass Transfer)
- (4) **CHM 24100** (Introduction to Inorganic Chemistry)
- (1) **CHM 51300** (Literature)
- (3) Chemical engineering elective
- (3) General education elective
- (15)

Fifth Year

Ninth Semester

- (1) **CHE 40000** (Chemical Engineering Seminar)
- (4) **CHE 43500** (Chemical Engineering Laboratory I)
- (3) **CHE 45600** (Process Dynamics and Control)
- (4) **CHM 42400** (Analytical Chemistry II)
- (3) General education elective
- (15)

Tenth Semester

- (4) **CHE 45000** (Design and Analysis of Processing Systems)
- (4) **CHM 34200** (Inorganic Chemistry I)
- (1) **CHM 49400** (Chemistry Seminar)
- (3) Engineering elective
- (3) General education elective
- (15)

** If MA 16100 and/or 16200 is taken, the course or courses will be accepted as only 4 credit hours each toward meeting the graduation requirements for Chemical Engineering.*

† Student must earn a "C" or better in CHE 20500 to continue to enroll in chemical engineering courses.

Civil Engineering

Civil engineering is a remarkably broad field of study. Students can elect to prepare for professional careers in planning, design or construction in a variety of areas: architectural engineering, construction

engineering, environmental engineering, geomatics (surveying) engineering, geotechnical engineering, hydraulic and hydrologic engineering, civil engineering materials, structural engineering, and transportation and infrastructure systems engineering.

The curriculum accommodates this breadth by providing a fundamental set of required courses complemented by sufficient flexibility to allow students to concentrate portions of their studies in some meaningful combination of the special areas that are of particular interest to them. Students develop plans of study that meet their career objectives with the help of interested faculty advisors.

The goals of the civil engineering program are to provide students who qualify for the program with:

- An outstanding engineering education from a nationally and internationally recognized institution.
- A program of study that accommodates the individual's interests and career goals.
- Teaching and advising by talented faculty who are accessible and available for interaction with students.
- The ability to solve practical engineering problems and communicate the solutions effectively.
- The opportunity to join the vast family of Purdue civil engineering graduates who are leaders in the practice of civil engineering worldwide.
- A solid foundation for those students who wish to pursue graduate studies.
- The ability to engage in lifelong learning.

The educational experience in civil engineering provides students with a solid foundation of technical knowledge; an appreciation of the social, economic and political implications of civil engineering projects; the ability to make decisions based on these implications as well as on technical, ethical and humanistic considerations; and finally, the capacity to effectively communicate not only these decisions but ideas in general.

This four-year program leads to a Bachelor of Science in Civil Engineering (B.S.CE) degree. A graduate program leading to master's and doctoral degrees is open to outstanding students who wish to undertake advanced study. It is also quite common for civil engineering graduates to pursue further study in other professions such as business or law.

The civil engineering profession encompasses a wide range of projects: buildings and bridges; tunnels, dams and levees; harbors, waterways and irrigation facilities; water supply systems; contaminant flows, waste treatment facilities and air and geoenvironmental remediation; airports, highways, railroads and intelligent transportation systems; pipelines and power lines — the infrastructure of the world. These often-monumental projects, coupled with the changing needs of our civilization and the need for sustainable development, provide unlimited challenges and opportunities. In meeting these challenges, civil engineers use a variety of advanced technologies, including high-performance computing, geographic information systems, imaging and automation.

Employment opportunities for civil engineering graduates interested in traditional civil engineering projects include engineering consulting firms; construction firms; industrial firms; federal, state and municipal agencies; and the military. Additionally, however, civil engineering graduates often become involved in organizations with activities that are far removed from traditional civil engineering endeavors, such as the aerospace industry, research laboratories, the automotive industry, software developers and management consultants.

While studying for the bachelor's degree in civil engineering, a student may elect to obtain a minor in any of a number of disciplines within the University. For example, a minor in management typically requires one additional semester of study beyond that required for the B.S.CE degree.

Scholarships

The School of Civil Engineering sponsors a broad array of need-based and merit-based scholarships. There are many benefits to being awarded a Civil Engineering named scholarship — one being an increased opportunity to network with the civil engineering community. Eligible candidates — incoming sophomores through senior civil engineering students — are invited in early spring to submit a single online application. Scholarship dollars will be applied to fees for the following fall and spring terms. This scholarship is in addition to the University's Trustees and Presidential scholarships in Civil Engineering.

Throughout the year, the school also receives information about scholarships provided to civil engineering students by outside organizations. A list of these opportunities is maintained under the "Scholarships" link on the CE website. Various professional civil engineering organizations, companies and affiliations offer these scholarships. A separate application is required for each scholarship. The process and deadline to apply varies by individual scholarship. Applications can be obtained via the sponsoring organization's website unless otherwise indicated.

Study Abroad

Purdue University's Program for Study Abroad Office currently offers to Purdue students more than 200 programs in over 45 countries around the world. They vary in length from one week to one academic year. These programs allow students to earn academic credit that can be used to fulfill their general education requirements and/or academic course requirements in their major or minor area of study.

The School of Civil Engineering offers a global experience through short-term summer courses. Examples of such trips include the United Kingdom and Australia. More detailed information about international opportunities is available through Purdue's [Global Engineering Program](https://engineering.purdue.edu/GEP) (<https://engineering.purdue.edu/GEP>) as well as through Purdue's [Study Abroad Office](https://www.studyabroad.purdue.edu/) (<https://www.studyabroad.purdue.edu/>). Students who have an interest in study abroad should contact the Undergraduate Office in the School of Civil Engineering.

Professional Practice Program with Industry or Governmental Organizations

The professional practice programs enable qualified students to obtain experiences related to their specific engineering discipline with selected employers while completing the requirements of their undergraduate degree. Students can participate in a five-session co-op, a three-session co-op or an internship program. International internships also are available through the Global Partners in Apprenticeship Learning (G-PAL) Program within the Professional Practice Program. OPP also offers the GEARE program, which combines domestic and international work experiences, a design project component and an opportunity to study abroad.

For more information visit the [Professional Practice Program](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

GEARE Program

The Global Engineering Alliance for Research and Education (GEARE) program is a unique and award-winning program that originated in the School of Mechanical Engineering at Purdue. Since 2009, the Professional Practice Program (OPP) has assumed all GEARE operations and opened up the program to all College of Engineering students and some students in the College of Technology. GEARE is designed to supplement the education of engineers so they are prepared to function immediately in the global workplace. Students in the program participate in an orientation program, including language and culture, one domestic internship, one subsequent international internship at the same company, one semester of study abroad with fully transferable engineering course credits, and a one- to two-semester design team

project with design teams that include students from international partner universities working on an industry-inspired project.

Interested students are encouraged to refer to the [OPP](https://engineering.purdue.edu/Engr) website (<https://engineering.purdue.edu/Engr>).

Honors Program

An honors program is available for qualified undergraduate students. Among the purposes of this program are special recognition of students attaining high levels of academic achievement and encouragement of student interest in graduate study and research/academic careers. An individual's honors program of study will be designed in cooperation with the faculty to provide more depth, breadth, self-study and/or research experience than the regular program of study. Successful completion of the honors program will be recognized at graduation.

Detailed information about the honors program can be found on the [School of Civil Engineering](https://engineering.purdue.edu/CE/Academics/Undergraduate/Honors) website (<https://engineering.purdue.edu/CE/Academics/Undergraduate/Honors>). Students who have an interest in the honors program should contact the Undergraduate Office in the School of Civil Engineering.

Land Surveying Minor

The Land Surveying (LS) minor is available to any student at Purdue who has met the corequisites and/or prerequisites for courses in the LS course sequence. The LS minor consists of 10 courses (31 credits) plus a summer internship.

When the minor is combined with the B.S.CE degree program, the minor will likely add two to five courses to the student's program of study. Working with an LS advisor during the junior and senior undergraduate years will minimize the impact on the student's time to graduation.

Once a student has proposed a sequence of courses for the LS minor, this will be submitted to a curriculum committee, which will approve the sequence. When the student has successfully completed the sequence of courses and has earned at least a 2.0 grade point average over the entire sequence, that student will be granted a minor in LS.

Core Course Policy

Students in the School of Civil Engineering must satisfy a core course policy to graduate. A core course is defined as any course required for graduation with a Bachelor of Science in Civil Engineering degree that is not required by the First-Year Engineering (FYE) program. The policy is as follows:

- A student must earn a grade of "C-" or better in all core courses.
- A student must earn a grade of "C-" or better in a core course in order to use the course as a prerequisite.
- A student shall be dismissed from the School of Civil Engineering after three attempts to complete a core course where each attempt resulted in a grade of "D+," "D," "D-," "E," "F" or "WF." A grade of "W" does not count toward the three attempts. Re-entry will be solely at the discretion of the Civil Engineering Undergraduate Committee and will be reviewed on a case-by-case basis. The Undergraduate Committee has the prerogative to set the requirements, if any, for re-entry.

Technical electives and general education electives are not subject to this policy. Also, the science selective from the FYE program is not subject to this policy.

English Requirement

To meet graduation requirements, students in the School of Civil Engineering must receive a grade of “C-” or better in a first course in English composition.

GPA Requirement

A graduation index of 2.0 or better is required for graduation with a B.S.CE degree. In addition, a minimum grade point average (GPA) of 2.0 is required in all CE courses (all sophomore-level and higher) to qualify for graduation.

Please note:

- The pass/not-pass option may not be used for any courses required for graduation. All required courses must have a letter grade.
- Deviations from the stated curriculum must be approved by the Undergraduate Curriculum Committee of the School of Civil Engineering.

Preparation for Graduate Study

The School of Civil Engineering also offers graduate work leading to the degrees of Master of Science (M.S.) for students with non-engineering degrees; Master of Science in Engineering (M.S.E) for students with non-civil engineering degrees; Master of Science in Civil Engineering (M.S.CE) for students with B.S.CE degrees; and the Doctor of Philosophy degree (PhD.)

Graduate study is an option for outstanding students who wish to undertake advanced study. The regular undergraduate curriculum (or the honors program) provides a strong foundation for graduate study. Students who complete either of the programs with appropriate academic records are encouraged to pursue graduate work. It is also quite common for civil engineering graduates to pursue further study in other professions, such as business or law.

For answers to questions about graduate study, visit the Civil Engineering Graduate Office in the Civil Engineering Building, Room 1141, call 765-494-2166 or visit www.engineering.purdue.edu/CE/Academics/Graduate.

Minimum Degree Requirements for Civil Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Credit Hours Required for Graduation: 132

Courses	Credit Hours
Mathematics and Physical Sciences	
Calculus: MA 16500, 16600, 26100, 26500, 26600	18
Statistics: STAT 51100	3
Chemistry: CHM 11500	4
Physics: PHYS 17200, 24100	7
Science Selective: CHM 11600 or CS 15900	3

Engineering Design

ENGR 13100, 13200, CGT 16400	6
First-Year (or other) Electives	0-2

Communication and General Education

English Composition: ENGL 10600 or 10800	3-4
Speech: COM 11400	3
Basic Science Requirement	3
Humanities and Social Sciences: Selected BIOL and EAS courses	18

Courses must be chosen in accordance with the School of Civil Engineering's general education policies and with the help of a faculty advisor.

Core Engineering Courses

Geomatics: CE 20300	4
Basic Mechanics/Materials: CE 23100, 27000, 29700, 29800, 33100, 34000, 34300	20
Contemporary Issues in CE: CE 29201	1
Thermodynamics: ME 20000	3
Systems Design: CE 39800	3
Final Design Project: CE 49800.	3

This course must be taken during the student's final semester.

Technical Electives 30

Courses are selected in accordance with the School of Civil Engineering's Technical Elective policy using the help of a faculty advisor to accommodate the student's professional goals and to provide the student with sufficient design background. At least 21 of these credits must be CE-designated courses.

Plan of Study for Civil Engineering**Credit Hours Required for Graduation: 132**

Freshman Year, see "First Year Engineering Program."

Communications. COM 11400 is a required course in the civil engineering curriculum and should be taken in the freshman year. A general education elective* should be taken in the freshman year.

Science Selective. CHM 11600 is the recommended course and should be taken in the freshman year.

Sophomore Year

Third Semester

- (4) **CE 20300** (Principles and Practices of Geomatics)
- (1) **CE 29201** (Contemporary Issues in CE)
- (3) **CE 29700** (Basic Mechanics I: Statics)
- (2) **CGT 16400** (Graphics for Civil Engineering and Construction)
- (4) **MA 26100** (Multivariate Calculus)
- (3) **PHYS 24100** (Electricity and Optics)
- (17)

Fourth Semester

- (3) **CE 23100** (Engineering Materials I)
- (4) **CE 27000** (Introductory Structural Mechanics)
- (3) **CE 29800** (Basic Mechanics II: Dynamics)
- (3) **MA 26500** (Linear Algebra)
- (3) General education elective*
- (16)

Junior Year

Fifth Semester

- (3) **CE 33100** (Engineering Materials II)
- (3) **CE 34000** (Hydraulics)
- (1) **CE 34300** (Elementary Hydraulics Laboratory)
- (3) **MA 26600** (Ordinary Differential Equations)
- (3) General education elective*
- (3) Elective†
- (16)

Sixth Semester

- (3) **CE 39800** (Introduction to Civil Engineering Systems Design)
- (3) Basic Science Requirement (from selected BIOL and EAS courses)
- (3) **STAT 51100** (Statistical Methods)
- (3) General education elective*
- (6) Electives†
- (18)

Senior Year

Seventh Semester

- (3) **ME 20000** (Thermodynamics I)
- (3) General education elective*
- (12) Electives†
- (18)

Eighth Semester

- (3) **CE 49800** (Civil Engineering Design Project)
- (3) General education elective*
- (9) Electives†
- (15)

* Eighteen credit hours of general education electives are chosen in accordance with the general education requirements of the College of Engineering and the following departmental requirements:

1. The program must contain at least 6 credit hours in the humanities.
2. The program must contain at least 6 credit hours in social sciences. It is strongly recommended that ECON 25100 be included in the program in social sciences.
3. All general education courses must be taken for a grade.

† Thirty credit hours of electives are chosen in accordance with the following requirements:

1. *The elective course program shall be consistent with career objectives. For instance, one can elect to concentrate on a major in a specialized area with an integrated sequence of courses or can choose a general program in civil engineering by taking courses in several areas.*
2. *At least 12 credit hours must be chosen from an approved list of introductory civil engineering courses to provide breadth of study.*
3. *At least 9 credit hours must be chosen from an approved list of design-intensive civil engineering courses.*
4. *At least 21 credit hours must be CE designated courses that must include two integrated sequences with a minimum of 6 credit hours in each.*
5. *The remaining credit hours required must be selected in support of the career objectives of the student. See an advisor for current policies.*

Construction Engineering and Management

The Division of Construction Engineering and Management (CEM) offers a degree program that prepares the graduate for practice as an engineering professional in the diverse construction industry. Coursework covers the basic physical sciences, engineering sciences, engineering principles of design, construction planning, business and management, humanities and social sciences in a curriculum tailored to address globally relevant issues as well as to meet the requirements for an accredited Bachelor of Science in Construction Engineering (B.S.CNE) degree.

Construction engineers provide engineering management services that include the planning and direction of projects to construct facilities and infrastructure that serve the needs of society and business. Employing the classic construction resources elements of materials, machines, workforce, money and information — and with respect for the natural environment and the needs of the end user — the construction professional ensures that construction of designed facilities is completed in a safe manner within schedule and budgetary constraints and according to quality standards. The optimal planning and control of construction processes is the construction engineer's unique expertise.

Requirements in the construction engineering and management industry for professional engineers and managers are increasing. Increased competitiveness, advancing use of technology, global competition and the growing complexity of management challenges have created new opportunities for well-prepared graduates. The educational objectives of the B.S.CNE degree program are to graduate students who are prepared:

- To obtain leadership positions within their industry organizations.
- To contribute to the advancement of the profession through participation in education, mentoring and research.
- To pursue professional advancement through registration, certification, etc.
- To continue their education through lifelong learning opportunities, graduate studies and/ or self study.
- To engage in global/societal advancement through use of their professional talents to serve the communities in which they reside and by engaging in the dialogue surrounding the societal impact of engineering decisions.

The Purdue Construction Engineering program stresses study and experience in engineering as well as the management and human relations aspects of the profession. Graduates from the Purdue program, which was established in 1976, have moved into positions of significant responsibility in a variety of construction endeavors throughout the country.

Internship Program with Industry

A unique feature of this program is the requirement for three 12-week internship periods, during which the student works as a paid employee of a construction contractor or related construction organization. Through these internships, graduates gain valuable practical experience and learning to complement their classroom work and enhance their qualifications to enter professional practice in construction.

The internship director of the Division of Construction Engineering and Management facilitates the internship and monitors the intern's progress through a succession of field assignments, typically progressing from field operations and construction office operation to project management work.

The student is selected for the program through an application and an interview, generally during the second semester of his or her first year. Selection depends upon the applicant's proven academic ability, aptitude for the construction field, potential for successful performance in intern assignments and the availability of sponsor firms.

Preparation for Graduate Education

The construction engineering curriculum prepares undergraduates for graduate-level study in construction and civil engineering. Students with interests in advanced education and research in this and related fields pursue M.S.CE, M.S.E. and Ph.D. degrees at Purdue and other leading universities.

Minimum Grade Requirements

A minimum 2.5 EAI (GPA based on required First-Year Engineering courses) is required for admission to the construction engineering degree program. Furthermore, students in the program must obtain a grade of "C" or better in a first course in English composition and a grade of "C-" or better in all courses required beyond the First-Year Engineering curriculum.

Plan of Study for Construction Engineering and Management

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Credit Hours Required for Graduation: 134

Freshman Year, see "First-Year Engineering Program."

Summer Session

(0) **CEM 19100** (Construction Internship I)

Sophomore Year

Third Semester

- (4) **CE 20300** (Principles and Practices of Geomatics)
- (3) **CE 29700** (Basic Mechanics I: Statics)
- (3) **CEM 20100** (Life Cycle Engineering and Management of Constructed Facilities)
- (2) **CGT 16400** (Graphics for Civil Engineers and Construction)
- (4) **MA 26100** (Multivariate Calculus)

Fourth Semester

- (3) **CE 23100** (Engineering Materials I and Laboratory)
- (4) **CE 27000** (Introductory Structural Mechanics)
- (1) **CEM 29000** (Construction Engineering Seminar)
- (3) **MA 26500** (Linear Algebra)
- (3) **MGMT 20000** (Introductory Accounting)

(3) General education elective
(19)

(3) **PHYS 24100** (Electricity and Optics)
(17)

Summer Session

(0) **CEM 29100** (Construction Internship II)

Junior Year

Fifth Semester

- (3) **CE 29800** (Basic Mechanics II: Dynamics)
- (3) **CE 39800** (Introduction to Construction Engineering Systems Design)
- (3) **CEM 30100** (Project Control and Life Cycle Execution of Constructed Facilities)
- (1) **CEM 49700** (Materials Laboratory)
- (3) **MA 26600** (Ordinary Differential Equations)
- (1) **STAT 51100** (Statistical Methods)
- (16)

Sixth Semester

- (3) **CE 34000** (Hydraulics)
- (1) **CE 34300** (Elementary Hydraulics Laboratory)
- (3) **CE 37100** (Structural Analysis I)
- (3) **CE 38300** (Geotechnical Engineering I)
- (3) **CEM 30200** (Practical Applications for Construction Engineering)
- (3) **ME 20000** (Thermodynamics I)
- (3) General education elective
- (19)

Summer Session

(0) **CEM 39100** (Construction Internship III)

Senior Year

Seventh Semester

- (4) **CE 47300** (Reinforced Concrete Design)
- (3) **CEM 32400** (Human Resource Management in Construction)
- (3) **CEM 42500** (Construction Practice Project)
- (3) **MGMT 45500** (Legal Background for Business)
- (6) General education electives
- (19)

Eighth Semester

- (3) **CE 52100** (Construction Business Management)
- (6) Technical electives
- (6) General education electives
- (15)

* *Eighteen credit hours of general education electives are chosen in accordance with the general education requirements of the College of Engineering.*

† *Technical electives vary depending on the specialty area of interest and career objectives. A list of acceptable technical electives is available from the Division of Construction Engineering and Management.*

Electrical and Computer Engineering

Electrical and computer engineering encompasses all areas of research, development, design and operation of electrical and electronic systems and their components, including software. There are two degree programs offered by the school: the Bachelor of Science in Electrical Engineering (B.S.EE) and the

Bachelor of Science in Computer Engineering (B.S.CmpE). Engineers in both programs must have a strong background in mathematics and physics, a broad base in the humanities and social sciences and a command of the English language to provide the breadth essential for optimum professional growth.

Graduates from the School of Electrical and Computer Engineering are sought by all major industries. Graduates hold many important and challenging positions in the aerospace, chemical, nuclear, automotive, medical, metallurgical, textile, railway, petroleum and other basically non-electrical industries as well as in computers, electronics, communications, power and other electrical industries.

Mission of the School

The Purdue School of Electrical and Computer Engineering enriches society and advances engineering in three crucial ways: by educating electrical and computer engineering students from Indiana, the country and the world so that they have the knowledge, ability and skills to innovate, excel and lead in their professions; by contributing to the benefit of humanity through the discovery of fundamental knowledge, the solution of current technological problems and the development of new applications; and finally, by sharing knowledge and expertise through meaningful engagement within and outside the Purdue community.

Program Educational Objectives

The objective of the B.S.EE and B.S.CmpE degree programs is to prepare graduates who will be successful in their chosen career paths. Specifically, graduates of these programs will be capable of achieving:

Success in post-undergraduate studies as measured by:

- Career satisfaction.
- Promotions/raises.
- Professional visibility (e.g., publications, presentations, patents, inventions, awards, etc.).
- Entrepreneurial activities.
- International activities (e.g., participation in international conferences, collaborative research, employment abroad, etc.).

and/or

Success in post-undergraduate studies as measured by:

- Satisfaction with the decision to further their education.
- Advanced degrees earned.
- Professional visibility (e.g., publications, presentations, patents, inventions, awards, etc.).
- International activities (e.g., participation in international conferences, collaborative research, employment abroad, etc.).

Student Outcomes

Graduates of the School of Electrical and Computer Engineering must have demonstrated:

- An ability to apply knowledge of mathematics, science and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component or process to meet desired needs within realistic

- constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
- An ability to function on multidisciplinary teams.
- An ability to identify, formulate and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.
- A recognition of the need for, and an ability to engage in, lifelong learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Professional Practice Programs

The professional practice programs enable qualified students to obtain experiences related to their specific engineering discipline with selected employers while completing the requirements of their undergraduate degree. Students can participate in a five-session co-op, three-session co-op, or internship program. International internships also are available through the Global Partners in Apprenticeship Learning (G-PAL) Program within the Professional Practice Program (OPP). OPP also offers the GEARE program, which combines domestic and international work experiences, a design project component and an opportunity to study abroad.

For more information, please visit the [Professional Practice](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

GEARE Program

The Global Engineering Alliance for Research and Education (GEARE) program is a unique and award-winning program that originated in the School of Mechanical Engineering at Purdue. Since 2009, the Professional Practice Program (OPP) has assumed all GEARE operations and opened up the program to all College of Engineering students. GEARE is designed to supplement the education of engineers so they are prepared to function immediately in the global workplace. Students in the program participate in an orientation program, including language and culture, one domestic internship, one subsequent international internship at the same company, one semester of study abroad with fully transferable engineering course credits, and a one-semester to two-semester design team project with design teams that include students from international partner universities working on an industry-inspired project.

Interested students are encouraged to refer to the [OPP](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

Honors Program

Basic Program Information

The ECE/College of Engineering Honors Program seeks to recognize students who exhibit academic excellence and encourages them to pursue an enriched academic experience. The program is designed for students who enjoy an intellectual challenge. It helps to build community with other high-potential students, provides an opportunity to interact closely with distinguished faculty, leads to increased skills and research opportunities and culminates with the distinction of graduating with honors.

General Information

- Entry into the program is “self-selecting” and is open to sophomores.
- A GPA ≥ 3.6 is required for entry and to remain in good standing.
- A minimum of 24 honors points is needed to complete the program and graduate with honors.
- At least 15 honors points must be accumulated in ECE upper-division activities.
- The program requires a research component involving at least 2 credits (yielding 2 honors points) of ECE 49600 or a permitted alternative research activity.
- Attendance is required at two 1-credit Honors Seminars offered, respectively, through the College of Engineering in the sophomore and junior years. (If not offered, students may substitute other honors points with the approval of the ECE Honors Program coordinator.)

ECE Upper-Division Activities

The minimum of 15 honors points that must be accumulated in ECE upper-division activities can be achieved as follows:

- Credit in honors courses offered by ECE.
- Honors contract credits in 30000-level and 40000-level ECE courses (not available during any summer session).
- Credit in ECE 50000-level courses and approved non-ECE 50000-level courses.
- Credit hours (6 maximum) of ECE 49600 after completion of the sophomore core courses.

Research Component

The required minimum of 2 honors points associated with a research component can be achieved after completion of the sophomore core courses as follows:

- At least 2 credit hours of ECE 49600.
- NSF Research Experience for Undergraduates (RED) with an ECE professor.
- Coordinator-approved Summer Undergraduate Research Fellowship (SURF) with an ECE professor.

The research component is to include a public presentation of results (i.e., an oral paper presentation or poster presentation). Possible venues for the public presentation include the Undergraduate Research and Poster Symposium (URPS), a planned “Scholars Day” to be hosted by the College of Engineering, and technical conferences.

Non-ECE Honors Points

Activities yielding the additional honors points needed to reach the overall 24-point minimum include the following:

- Honors points from the First-Year Engineering Honors Program.
- 2 honors points as previously noted for attendance at the 1-credit Honors Seminars offered in the sophomore and junior years through the College of Engineering.
- Any 20000-level and above honors course on campus.
- Up to 3 honors points obtained for involvement in program-broadening experiences, such as Study Abroad and formal Co-op and Internship sessions.
- Taking honors “Strategic Initiative” courses (as defined by the College of Engineering).

Study Abroad

Many study abroad opportunities have been approved for undergraduate students in the School of Electrical and Computer Engineering. See www.studyabroad.purdue.edu for more information. The ECE advising staff works closely with students studying abroad to ensure a rewarding experience that conforms to a student's plan of study.

Minimum Degree Requirements for Bachelor of Science in Electrical Engineering (B.S.EE)

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

The Bachelor of Science in Electrical Engineering degree requires a total of 124 credit hours and a minimum Graduation Index of 2.0. Students must qualify for admission into the School of Electrical and Computer Engineering by completion of [the First-Year Engineering Program \(www.purdue.edu/catalogs/engineering/firstyear.html#curriculum\)](http://www.purdue.edu/catalogs/engineering/firstyear.html#curriculum).

Courses	Credit Hours
ECE Requirements	47
EE Core Curriculum: ECE 20100, 20200, 20700, 20800, 25500, 27000, 30100, 30200, 31100	24
ECE Seminars: ECE 20000, 40000	1
Advanced EE Selectives: Choose 3 of the following: ECE 30500, 32100, 36200, 38200, 43800, 44000. Choose 4 if both ECE 43800 and 44000 are selected. ECE 36200, 43800 and 44000 also contribute to satisfaction of the ECE Upper-Level Laboratory Requirement described below.	9-11
Senior Design Requirement: ECE 40200, 47700 (taken in one semester) or at least 3 credit hours of EPCS 41100/41200 (taken over two consecutive semesters). A prerequisite for all senior design courses is completion of the EE Core Curriculum. Some Senior Design Courses may have additional prerequisites. When used to satisfy the Senior Design Requirement, these courses cannot also be used to satisfy the ECE Laboratory Requirement below.	3-4
ECE Electives:	7-10
Additional ECE courses to bring total ECE credit hours to at least 47, including at least three Upper-Level Laboratory courses.	
<i>Major Area GPA: A GPA of 2.0 or higher in the ECE courses taken to satisfy the ECE Requirements is required to qualify for graduation with the B.S.EE degree.</i>	
General Engineering	7
Introduction to Engineering: ENGR 13100, 13200	4
Engineering Breadth Requirement: Choose one course from the approved list	3
Mathematics	18-19
Choose one of the math options below. If MA 16100 and/or 16200 are taken in place of MA 16500 and/or 16600, only 4 of the 5 credit hours for each course may be applied to degree requirements.	
Option 1: MA 16500, 16600, 26100, 26500, 26600	18
Option 2: MA 16500, 16600, 26100, 26200, and one of MA 30300, 30400, 35100, 36200, 38500, 42500, 51000 or CS 31400	19

Science 18-19

CS 15900, CHM 11500/12300, PHYS 17200 and 27200 and one of BIOL 311000, 11100, CHM 11600/12400, PHYS 31000, 32200, 34200

Liberal Arts 24-25

Communication Skills: ENGL 10600 or 10800, COM 11400 6-7

General Education Requirements: See General Education Program 18

Complementary Electives 8-11

The student must take additional courses to bring the total to at least 124 credit hours. These courses should be selected to enhance the student's academic program and may include ECE courses beyond those required to complete the ECE Requirements, additional mathematics, science, engineering and liberal arts courses, or other approved electives such as management (MGMT) and entrepreneurship (ENTR).

Plan of Study for B. S. in Electrical Engineering (B.S.EE)

Credit Hours Required for Graduation: 124

Freshman Year, see [First-Year Engineering Program](http://www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)
(www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)

First Semester

- (4) **CHM 11500** (General Chemistry)
- (4) **ENGL 10600** (First-Year Composition)
- (2) **ENGR 13100** (Transforming Ideas to Innovation I)
- (4) **MA 16500** (Analytic Geometry and Calculus I)
- (14)

Second Semester

- (3) **COM 11400** (Fundamentals of Speech Communication)
- (3) **CS 15900** (Programming Applications for Engineers)
- (2) **ENGR 13200** (Transforming Ideas to Innovation II)
- (4) **MA 16600** (Analytic Geometry and Calculus II)
- (4) **PHYS 17200** (Modern Mechanics)
- (16)

Sophomore Year

Third Semester

- (0) **ECE 20000** (Electrical and Computer Engineering Seminar)
- (3) **ECE 20100** (Linear Circuit Analysis I)
- (1) **ECE 20700** (Electronic Measurement Techniques)
- (4) **MA 26100** (Multivariate Calculus)
- (4) **PHYS 27200** (Electric and Magnetic Interactions)

Fourth Semester

- (3) **ECE 20200** (Linear Circuit Analysis II)
- (1) **ECE 20800** (Electronic Devices and Design Laboratory)
- (3) **ECE 25500** (Introduction to Electronic Analysis and Design)
- (4) **ECE 27000** (Introduction to Digital System Design)
- (3) **MA 26600** (Ordinary Differential Equations)

- (3) General education elective
- (15)

- (3) General education elective
- (17)

Junior Year

Fifth Semester

- (3) **ECE 30100** (Signals and Systems)
- (3) **MA 26500** (Linear Algebra)
- (3) Advanced EE selective
- (1) ECE elective
- (4) Science selective
- (3) General education elective

Sixth Semester

- (3) **ECE 30200** (Probabilistic Methods in Electrical and Computer Engineering)
- (3) **ECE 31100** (Electric and Magnetic Fields)
- (3) Advanced EE selective
- (1) ECE elective (laboratory)
- (3) Complementary elective
- (3) General education elective

Senior Year

Seventh Semester

- (1) **ECE 40000** (Electrical and Computer Engineering Undergraduate Seminar)
- (3) **ECE 40200** (Electrical Engineering Design Projects)
- (4) ECE elective (with laboratory)
- (3) Complementary elective
- (3) General education elective

Eighth Semester

- (4) Advanced EE selective (with laboratory)
- (3) ECE elective
- (3) Engineering breadth requirement
- (3) Complementary elective
- (3) General education elective

Minimum Degree Requirements for Bachelor of Science in Computer Engineering (B.S.CmpE)

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

The Bachelor of Science in Computer Engineering degree requires a total of 125 credit hours and a minimum graduation index of 2.0. Students must qualify for admission into the School of Electrical and Computer Engineering by completion of the First-Year Engineering Program (www.purdue.edu/catalogs/engineering/firstyear.html#curriculum).

Credit Hours Required for Graduation: 125

Courses	Credit Hours
ECE Requirements	49
CmpE Core Curriculum: ECE 20100, 20200, 20700, 20800, 25500, 26400, 27000, 30100, 30200, 33700, 36200, 36400, 36800	34
ECE Seminars: ECE 20000 and 40000	1
Advanced CmpE Requirement: ECE 43700 and either 46800 or 46900	8

Senior Design Requirement: ECE 40200, 47700 (taken in one semester) 3-4 or at least 3 credit hours of EPCS 41100/41200 (taken over 2 consecutive semesters). A prerequisite for all senior design courses is completion of the EE Core Curriculum. Some senior design courses may have additional prerequisites.

CmpE Electives: Additional approved computer engineering electives to bring total ECE credit hours to at least 49.

Major Area GPA: A GPA of 2.0 or higher in ECE courses taken to satisfy the ECE Requirement is required to qualify for graduation with the B.S.CmpE degree.

General Engineering	7
Introduction to Engineering: ENGR 103100 and 13200	4
Engineering Breadth Requirement: Choose one course from the approved list	3
Mathematics	21-22
Choose one of the math options below. If MA 16100 and/or 16200 are taken in place of MA 16500 and/or MA 16600, only 4 of the 5 credit hours for each course may be applied to degree requirements.	
Option 1: MA 16500, 16600, 26100, 26500, 26600, ECE 36900	21
Option 2: MA 16500, 16600, 26100, 2620; ECE 36900 and one of MA 30300, 30400, 35100, 36200, 38500, 42500, 51000, or CS 31400	22
Science	18-19
CS 15900, CHM 11500/12300, PHYS 17200, PHYS 27200 and one of BIOL 11000, 11100, CHM 11600/12400, PHYS 31000, 32200, 34200	
Liberal Arts	24-25
Communication Skills: ENGL 10600 or 10800, COM 11400	6-7
General Education Requirements: See General Education Program	18
Complementary Electives	4-6

Additional courses to bring the total to at least 125 credit hours. These courses should be selected to complement the student's academic program. These courses may include EC courses beyond those required to complete the ECE Requirements, additional mathematics, science, engineering and liberal arts courses, or other approved electives, such as management (MGMT) and entrepreneurship (ENTR).

Plan of Study for Bachelor of Science in Computer Engineering (B.S.CmpE)

Credit Hours Required for Graduation: 125

Freshman Year, see "First-Year Engineering Program."

First Semester	Second Semester
(4) CHM 11500 (General Chemistry)	(3) COM 11400 (Fundamentals of Speech Communication)
(4) ENGL 10600 (First-Year Composition)	(3) CS 15900 (Programming Applications for Engineers)
(2) ENGR 13100 (Transferring Ideas to Innovation I)	(2) ENGR 13200 (Transferring Ideas to Innovation II)

- | | |
|--|---|
| (4) MA 16500 (Analytic Geometry and Calculus I) | (4) MA 16600 (Analytic Geometry and Calculus II) |
| (4) PHYS 17200 (Modern Mechanics) | (4) Science selective |
| (18) | (16) |

Sophomore Year

Third Semester

- (0) **ECE 20000** (Electrical and Computer Engineering Seminar)
- (3) **ECE 20100** (Linear Circuit Analysis I)
- (1) **ECE 20700** (Electronic Measurement Techniques)
- (3) **ECE 26400** (Advanced C Programming)
- (4) **MA 26100** (Multivariate Calculus)
- (4) **PHYS 27200** (Electricity and Optics)
- (15)

Fourth Semester

- (3) **ECE 20200** (Linear Circuit Analysis II)
- (4) **ECE 27000** (Introduction to Digital System Design)
- (1) **ECE 36400** (Software Engineering Tools Laboratory)
- (3) **ECE 36800** (Data Structures)
- (3) **MA 26600** (Ordinary Differential Equations)
- (3) General education elective
- (17)

Junior Year

Fifth Semester

- (1) **ECE 20800** (Electronic Devices and Design Laboratory)
- (3) **ECE 25500** (Introduction to Electronic Analysis and Design)
- (3) **ECE 30100** (Signals and Systems)
- (4) **ECE 36200** (Microprocessor Systems and Interfacing)
- (3) General education elective
- (14)

Sixth Semester

- (3) **ECE 30200** (Probabilistic Methods in Electrical and Computer Engineering)
- (2) **ECE 33700** (ASIC Design Laboratory)
- (3) **ECE 36900** (Discrete Mathematics for Computer Engineering)
- (2) Computer engineering elective
- (3) Engineering breadth requirement
- (3) General education elective
- (16)

Senior Year

Seventh Semester

- (4) **ECE 43700** (Computer Design and Prototyping) **or** **ECE 46800** (Introduction to Compilers and Translation Engineering)
- (4) **ECE 47700** (Digital Systems Senior Project)
- (3) **MA 26500** (Linear Algebra)
- (3) General education elective
- (14)

Eighth Semester

- (1) **ECE 40000** (Electrical and Computer Engineering Undergraduate Seminar)
- (4) **ECE 43700** (Digital Systems Senior Project) **or** **ECE 46900** (Operating Systems Engineering)
- (4) Complementary elective
- (6) General education electives
- (15)

Industrial Engineering

Industrial engineers design, analyze and manage complex human-integrated systems such as manufacturing systems, supply-chain networks and services systems. These systems typically consist of a combination of people, information, material and equipment. Industrial engineers determine how to optimize the system for maximum efficiency, effectiveness, throughput, safety or some other objective of interest to the stakeholders of the system. To achieve these objectives, an industrial engineer draws upon knowledge of mathematics, the physical and engineering sciences and the management and behavioral sciences to function as a problem-solver, innovator, designer, coordinator and system integrator. Industrial engineers are employed in and apply their skills in an extremely wide range of organizations, including manufacturing industries, service industries and governmental agencies.

The complexity of these organizations and the emphasis on increased effectiveness, efficiency and productivity have led to a growing need for industrial engineering analysis and design and an increased demand for industrial engineering graduates. This increased demand recognizes the modern industrial engineer's versatility and responsiveness to the challenges of a rapidly changing society. Industrial engineering is already one of the nation's largest and most rapidly growing engineering professions.

The industrial engineering program prepares graduates for careers in all phases of industrial engineering and enables them to perform both technical and managerial functions that require scientific and engineering backgrounds. By combining the study of science, mathematics, engineering fundamentals, design and management principles, an industrial engineering education provides a unique background and a sound basis for lifelong career development in engineering practice, research or management.

The School of Industrial Engineering offers educational programs leading to the degree of Bachelor of Science in Industrial Engineering (B.S.IE). The two undergraduate programs of study — the regular industrial engineering curriculum and the honors curriculum — provide students with a broad scientific and engineering base and contain a sequence of courses in mathematics, physics, chemistry and the engineering sciences. These courses are accompanied by courses in manufacturing processes, facilities design, engineering statistics, engineering cost analysis, work analysis and design, operations research, process control, production system design, computer utilization, information systems, systems analysis and industrial engineering design.

Students are encouraged to develop a coherent plan for their general and technical elective courses. These courses can be used to gain a specific skill-set, a familiarization with a particular application domain such as manufacturing, healthcare, information visualization or financial engineering, or to meet a student's special interest. The school provides guidance on how to develop such plan of study.

Educational Objectives

The industrial engineering program is designed to achieve the following detailed objectives that are consistent with the mission of Purdue University and the College of Engineering:

- **Graduates should be prepared to take the lead in recognizing engineering problems in their organizations and designing solutions.** Prominent in this area are skills in developing (possibly several) useful analytical formulations to gain insights into ill-structured problems and characterize the best solution obtainable within the limits of the available time, data and economic resources. However, developing an elegant solution is not sufficient; the engineer also should have a clear idea of issues related to the implementability of the proposed solution, make modifications required for acceptance of a proposal and be capable of guiding a project through the implementation process.

- **Graduates should be capable of identifying the best contemporary tools for the problem, applying them and interpreting their results to gain insight into industrial engineering problems and propose effective solutions.** Graduates should be sufficiently well-trained in basic science and engineering to be able to read technical literature and become familiar with different tools that are available (computer software and modeling approaches/formalisms such as mathematical programming, simulation, etc.) to the point that they can identify when each tool is appropriate to use with a clear understanding of underlying assumptions and limitations; collect and analyze the data required for the selected approach, including understanding of the effects of missing and inaccurate data, and where appropriate, conducting experiments; interpret the results of the analysis in the context of the problem at hand; and use the analysis as an effective base for assessing the implementability of the proposed solution.
- **Graduates should be capable of operating effectively in today's dynamic, heterogeneous organizations.** The accelerating rate of technological change is leading to organizations becoming global, culturally diverse and increasingly dynamic and goal-oriented in organizational structure. Often the basic organizational unit is the cross-functional team deployed to achieve a specific, tactical objective in a short period of time. This increasing lack of permanence in organization places new stresses on engineers' ability to rapidly achieve an effective level of professional collaboration with people of diverse skill sets and cultural backgrounds. Performance in this environment requires the ability to communicate effectively with technical and non-technical people at very different levels of the organization, the ability to rapidly establish working relationships and become familiar with new application domains, and the assumption of several different roles with the same people over time — perhaps even at the same time in different contexts. Effective problem definition, task breakdown and delegation are particularly important.
- **Graduates should have the basic skills required to maintain their professional knowledge over the duration of their career.** Graduates should be able to take responsibility for their own learning, including identifying weak areas in their background and seeking out resources to remedy them. The ability to do this in a time-effective manner is essential in today's fast-paced engineering organizations. This results in many graduates pursuing a variety of advanced or professional degrees subsequent to their completion of the undergraduate industrial engineering program. Hence, students should graduate with a solid base of skills and knowledge upon which these further studies can build. Examples are knowledge of computer skills for problem solving, and basic literacy in science and engineering.
- **Graduates should be prepared to contribute as ethical and responsible members of society.** Engineering graduates should be as well prepared as any other citizens to contribute as members of society. Still, the increasing importance of technology to our economic well-being and its pervasive presence in all aspects of our daily lives places a special burden on the engineering community to be cognizant of the social impacts of their actions. Furthermore, engineering practitioners are increasingly being called upon to address problems with broad social and ethical consequences. Students should be familiar with these issues and be prepared to address them with integrity and empathy for all stockholders involved.

Professional Practice Program with Industry or Governmental Organizations

The professional practice programs enable qualified students to obtain experiences related to their specific engineering discipline with selected employers while completing the requirements of their undergraduate degree. Students can participate in a five-session co-op, a three-session co-op or an internship program. International internships also are available through the Global Partners in Apprenticeship Learning (G-PAL) Program within the Professional Practice Program. OPP also offers the GEARE program, which combines domestic and international work experiences, a design project component and an opportunity to study abroad.

For more information on the Professional Practice Program, please visit www.engineering.purdue.edu/ProPractice.

GEARE Program

The Global Engineering Alliance for Research and Education (GEARE) program is a unique and award-winning program that originated in the School of Mechanical Engineering at Purdue. Since 2009, the Professional Practice Program (OPP) has assumed all GEARE operations and opened up the program to all College of Engineering students. GEARE is designed to supplement the education of engineers so they are prepared to function immediately in the global workplace. Students in the program participate in an orientation program, including language and culture, one domestic internship, one subsequent international internship at the same company, one semester of study abroad with fully transferable engineering course credits and a one- to two-semester design team project with design teams that include students from international partner universities working on an industry-inspired project.

Interested students are encouraged to refer to the [OPP](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

Honors Program

A special honors program is available for students who have demonstrated exceptional academic ability and want to conduct meaningful independent research or solve a unique design project. To enter and remain in the honors program, a student must maintain at least a 3.0 graduation index.

The program is usually initiated at the start of the second semester of the junior year by registering for IE 30000 (Honors Program Seminar). The course is designed to assist students with the identification of a suitable research or design project topic under the direction of an industrial engineering faculty member. After satisfactory completion of two consecutive semesters of IE 49900 for 3 credit hours per semester, submission of an acceptable written report, obtaining the recommendation of the course instructor and being approved by the school head, participation in the honors program is noted on the student's post-graduation transcript. The 6 credit hours of IE 49900 can be used as part of the 9 hours of unspecified technical electives during the senior year.

Minors

The School of Industrial Engineering recognizes minors granted by other academic units such as electrical engineering, mechanical engineering, liberal arts, management, modern languages and various branches of science. Sample plans of study for minors are on file in the Industrial Engineering Undergraduate Office.

Students interested in earning a minor that will be recorded on their transcript must file an approved plan of study by the beginning of the senior year. The plan of study must be approved by the academic unit granting the minor and by the School of Industrial Engineering. Courses selected for the minor cannot substantially duplicate material in the student's industrial engineering plan of study. Some courses may be used in both plans of study; for example, a course could be a general education elective in the industrial engineering plan of study and a required course for a minor in a given area.

Minors typically require 15 to 18 credit hours of work from a restricted list of courses.

Pass/Not-Pass Option

The pass/not-pass option is allowed only in the general education program. Technical electives must be taken for a grade. This option provides an opportunity for students to broaden their educational experience by taking advanced courses with minimal concern for grades earned due to the lack of necessary prerequisite material. Introductory courses should be taken for a grade. Physical education service courses, unless required for ROTC, should be taken with the pass/not-pass option. The general rules stated under the graduation requirements for engineering are in effect for all industrial engineering students.

Preparation for Graduate Study

The School of Industrial Engineering also offers graduate work leading to the degrees of Master of Science (M.S.), Master of Science in Industrial Engineering (M.S.IE) and Doctor of Philosophy (Ph.D.). The regular undergraduate curriculum and the honors program provide strong foundations for graduate study, and students who complete either of the programs with appropriate academic records are encouraged to pursue graduate work.

Curriculum in Industrial Engineering

Industrial engineering is a diversified discipline, with students preparing for careers in a variety of areas within the general field. The curriculum provides flexibility in course selection so students can specialize in a given major option. Academic advisors in each area provide assistance in selection of appropriate elective courses.

Minimum Degree Requirements for Industrial Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Credit Hours Required for Graduation: 123

Courses	Credit Hours
First-Year Engineering Program	29
Mathematics and Physics MA 26100, 26500, 26600; PHYS 24100	13
General Education Electives	18
Required Engineering Courses ECE 20100; IE 23000, 33000, 33200, 33500, 33600, 34300, 37000, 38300, 38600, 43100, 47400, 48600; ME 20000, 27000; NUCL 27300	48
Technical Electives	15

Plan of Study for Industrial Engineering

Credit Hours Required for Graduation: 123

Freshman Year, see [First-Year Engineering Program](http://www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)
(www.purdue.edu/catalogs/engineering/firstyear.html#curriculum)*

Sophomore Year

Third Semester

- (0) **IE 20000** (Industrial Engineering Seminar)
- (3) **IE 23000** (Probability and Statistics in Engineering I)
- (3) **IE 34300** (Engineering Economics)
- (4) **MA 26100** (Multivariate Calculus)

Fourth Semester

- (3) **IE 33000** (Probability and Statistics in Engineering II)
- (3) **MA 26500** (Linear Algebra)
- (3) **NUCL 27300** (Mechanics of Materials)
- (3) **PHYS 24100** (Electricity and Optics)

(3) **ME 27000** (Basic Mechanics I)
(3) General education elective
(16)

(3) General education elective
(15)

Junior Year

Fifth Semester

- (3) **ECE 20100** (Linear Circuit Analysis I)
- (3) **IE 33200** (Computing in Industrial Engineering)
- (3) **IE 33500** (Operations Research — Optimization)
- (3) **IE 37000** (Manufacturing Processes I)
- (3) **MA 26600** (Ordinary Differential Equations)
- (3) General education elective
- (18)

Sixth Semester

- (3) **IE 33600** (Operations Research — Stochastic Models)
- (3) **IE 38300** (Integrated Production Systems I)
- (3) **IE 38600** (Work Analysis and Design I)
- (3) **ME 20000** (Thermodynamics I)
- (3) General education elective
- (15)

Senior Year

Seventh Semester

- (3) **IE 47400** (Industrial Control Systems)
- (3) **IE 48600** (Work Analysis and Design II)
- (6) Technical electives†
- (3) General education elective
- (15)

Eighth Semester

- (3) **IE 43100** (Industrial Engineering Design)
- (9) Technical electives†
- (3) General education electives
- (15)

** IE students are required to complete CS 15900 and COM 11400, usually taken during their First-Year Engineering program.*

† The 15 credit hours of technical electives are chosen from a list of courses approved by the School of Industrial Engineering faculty and must include two out of the three following courses: IE 47000 (Manufacturing Processes II), IE 48400 (Integrated Production Systems II) or an approved 3-credit-hour industrial engineering course.

Emphasis Areas and Specializations in Industrial Engineering

The elective programs contained within the industrial engineering curriculum allow a student to gain broader understanding in an area where industrial engineering skills are commonly applied.

The School of Industrial Engineering recognizes the following emphasis areas for which suggested courses have been identified:

- Financial Engineering.
- Healthcare Engineering.
- Human Factors.
- Manufacturing.
- Operations Research.
- Production and Management Systems.

A student interested in a particular emphasis area will consult with an academic advisor to select appropriate courses of interest. Students are not required to select a particular emphasis area to complete their degree.

In addition, the School of Industrial Engineering has a specialization in software engineering. The software engineering specialization requires coursework, team projects and internship experience to complete the program. Coursework and projects allow the student to focus on elements of software engineering such as software design, quality assurance and process management, among others. Upon completion of the program, the specialization will be recorded on the student's transcript.

Materials Engineering

Materials have been central to the growth, prosperity, security and quality of life of humans since the beginning of recorded history. In everyday life, we are constantly reminded that we live in a world that is both dependent upon, and limited by, materials. Everything we see and use is made of materials derived from the earth: cars, airplanes, computers, refrigerators, microwave ovens, TVs, dishes, silverware, athletic equipment of all types and even biomedical devices such as replacement joints and limbs. Materials influence our lives each time we buy or use a new product.

No engineer can make anything without materials, so materials engineers are at the forefront of every cutting-edge engineering development. They achieve new levels of understanding of materials and the controls in materials processing to achieve the performance outcomes desired.

The intellectual core and definition of the field stem from a realization concerning the application of all materials. Whenever a material is being created, developed or produced, the properties or phenomena the material exhibits are of central concern. Experience shows that the properties and phenomena associated with a material are intimately related to its composition and structure at all levels, including which atoms are present and how the atoms are arranged in the material, and that this structure is the result of synthesis and processing. The final materials must perform a given task and must do so in an economical and societally acceptable manner. It is these elements' properties, structure and composition, synthesis— and the strong interrelationship among them — that define the field of materials science and engineering.

Materials scientists and engineers study the structure and composition of materials on scales ranging from the electronic and atomic through the microscopic to the macroscopic. They develop new materials, improve traditional materials and are key people in the manufacturing process to produce materials reliably and economically. They seek to understand phenomena and to measure materials properties of all kinds, and they predict and evaluate the performance of real materials as structural or functional elements in engineering systems. Employment opportunities span all types of industry, such as aerospace, automotive, chemical, electronic, energy and primary material-producing companies.

The first three years of study provide the basic educational core. In addition to the broad range of basic sciences and general education courses, the core provides a generic approach to the elements of the field. The core exploits the idea that the field is composed of the key elements of the field: synthesis/processing, composition/structure, properties and performance. This concept provides the foundation across the materials classes: ceramics, metals, polymers, etc. The senior year, consisting of electives primarily, allows students the opportunity to focus their program toward personal goals in the field.

In addition to the undergraduate program in materials science and engineering that leads to the Bachelor of Science in Materials Science Engineering (B.S.MSE), the school offers graduate programs for the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees.

For current information about plans of study, please visit the [Materials Engineering](https://engineering.purdue.edu/MSE/index.html) website (<https://engineering.purdue.edu/MSE/index.html>).

Undergraduate MSE Program Goals

The School of Materials Engineering at Purdue University will provide an education that optimally serves the school's constituencies: the students, the MSE faculty, other programs at Purdue, alumni, employers, graduate programs and the state of Indiana.

Program Educational Objectives

The degree program in the School of Materials Engineering will provide the educational experiences to produce graduates with the knowledge and skills to excel in materials science and engineering-related positions or to pursue graduate study. Within a few years of graduating, our students will:

1. Be successful in top graduate schools and/or in materials science and engineering or other professional positions.
2. Contribute their materials engineering expertise effectively as members of engineering teams.
3. Demonstrate professional skills, including continued professional development, participation in professional societies and organizations and engagement in leadership positions.

Program Outcomes

Graduates of the School of Materials Engineering will have:

1. An ability to apply knowledge of mathematics, science and engineering to problems in materials engineering.
2. An ability to design and conduct experiments, as well as to develop engineering judgment through the analysis and interpretation of data.
3. An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
4. An ability to function on multi-disciplinary teams to solve engineering problems.
5. An ability to identify, formulate and solve engineering problems, particularly in the context of materials selection and design.
6. An understanding of professional and ethical responsibility.
7. An ability to exhibit effective oral and written communication skills.
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.
9. A recognition of the need for, and an ability to engage in, life-long learning.
10. A knowledge of contemporary issues, particularly as they relate to materials engineering.
11. An ability to use the techniques, skills and experimental computational and data analysis tools necessary for materials engineering practice.

Professional Practice Program with Industry or Governmental Organizations

The professional practice programs enable qualified students to obtain experiences related to their specific engineering discipline with selected employers while completing the requirements of their undergraduate degree. Students can participate in a five-session co-op, a three-session co-op or an internship program.

Minimum Degree Requirements for Materials Engineering

Accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>

Credit Hours Required for Graduation: 128

Courses	Credit Hours
Mathematics and Physical Sciences	
Calculus: MA 16500, 16600, 26100, 26500, 26600	18
Chemistry: CHM 11500, 11600, 25700,	15
Physics: PHYS 15200 or 17200, 24100, 25200	8
Communication and General Education	
English Composition: COM 11400 or approved communications elective	3
General Education elective and social science elective courses to be selected with MSE faculty guidance in accordance with the general education requirements of the College of Engineering.	18
Seminars	
ENGR 10000, MSE 39000	1
First-Year Electives	2
Core Engineering Courses	
Computing: ENGR 12600	3
MSE Core: 23000, 23500, 25000, 26000, 27000, 33000, 33500, 34000, 36700, 37000, 38200, 43000, 44000, 44500	33
<i>Integrated MSE courses, including year-long, industry-sponsored senior design projects, on the structure, properties, processing and performance of engineering materials.</i>	
Technical Electives	18
A plan of study is designed with the help of a faculty advisor to meet each individual student's professional goals. At least 12 of the 18 credits must be materials-specific courses; the remaining 6 credits may be selected from an approved list of courses, including other academic disciplines.	

Plan of Study for Materials Science and Engineering (B.S.MSE)

Credit Hours Required for Graduation: 128

Freshman Year, see "First-Year Engineering Program."

Sophomore Year*

Third Semester	Fourth Semester
(4) MA 26100 (Multivariate Calculus)	(3) MA 26600 (Ordinary Differential Equations)
(3) MA 26500 (Linear Algebra)	(3) MSE 25000 (Physical Properties in Engineering Systems)
(3) MSE 23000 (Structure and Properties of Materials)	(3) MSE 26000 (Thermodynamics of Materials)
(3) MSE 23500 (Materials Properties Laboratory)	(3) MSE 27000 (Atomistic Materials Science)
(0) MSE 39000 (Materials Engineering Seminar)	(0) MSE 39000 (Materials Engineering Seminar)
(3) PHYS 24100 (Electricity and Optics)	(1) PHYS 25200 (Electricity and Optics Laboratory)

- (16) (3) General education elective†
(16)

Junior Year

Fifth Semester

- (4) **CHM 25700** (Organic Chemistry)
(3) **MSE 33500** (Materials Characterization Laboratory)
(3) **MSE 34000** (Transport Phenomena)
(3) **MSE 37000** (Electricity, Optics and Magnetic Properties of Materials)
(0) **MSE 39000** (Materials Engineering Seminar)
(3) General education elective†
(16)

Sixth Semester

- (3) **MSE 33000** (Processing and Properties of Materials)
(3) **MSE 36700** (Materials Processing Laboratory)
(3) **MSE 38200** (Mechanical Response of Materials)
(0) **MSE 39000** (Materials Engineering Seminar)
(3) Technical elective‡
(3) General education elective†
(15)

Senior Year

Seventh Semester

- (0) **MSE 39000** (Materials Engineering Seminar)
(3) **MSE 43000** (Materials Processing and Design I)
(3) **MSE 44500** (Materials Engineering Systems Analysis and Design)
(6) Technical electives‡
(3) General education elective*
(15)

Eighth Semester

- (0) **MSE 39000** (Materials Engineering Seminar)
(3) **MSE 44000** (Materials Processing and Design II)
(9) Technical electives‡
(6) General education elective*
(18)

* Students entering the School of Materials Engineering should have completed the sequence of CHM 11500 and 11600 or the sequence of CHM 12300 and 12400.

† Eighteen credit hours of general education electives are chosen in accordance with the general education requirements of the College of Engineering.

‡ Eighteen credit hours of technical electives must be selected from lists of courses approved by the faculty of the School of Materials Engineering. At least 12 of the 18 hours are to be selected from an approved list of materials courses. Up to 6 hours can be chosen from a separate list of courses, which includes other support areas.

Note: Of the courses used to satisfy the minimum graduation requirements, the pass/not-pass option may be applied only to general education elective courses.

Mechanical Engineering

Mechanical engineering comprises a wide range of activities that include researching, designing, developing, manufacturing, and managing and controlling engineering systems and their components. The

many industrial sectors to which mechanical engineers make substantial contributions include aerospace, automotive, biotechnology, chemical, computers and electronics, construction, consumer products, energy, engineering consulting, and thermal systems, among others. As such, mechanical engineering is the broadest of all of the engineering disciplines and provides the widest range of career opportunities. Graduates of the School of Mechanical Engineering have gone on to become CEOs, entrepreneurs, chief engineers, business analysts, astronauts, faculty, physicians, dentists, patent lawyers and public policy leaders.

Program Educational Objectives and Outcomes

The School of Mechanical Engineering offers coursework leading to the Bachelor of Science in Mechanical Engineering (B.S.ME).

The program educational objectives of the School of Mechanical Engineering are to matriculate graduates who conduct themselves in a responsible, professional and ethical manner (citizenship), and who upon the years following graduation, are committed to:

1. Discovery

- Actively embracing leadership roles in the practice of engineering in industry and government organizations (including both traditional and emerging technical areas).
- Conducting research and development across disciplines (via graduate study or industry) to advance technology and foster innovation in order to compete successfully in the global economy.
- Applying their engineering problem-solving skills to less-traditional career paths (e.g., law, medicine, business, education, start-up ventures, public policy, etc.).

2. Learning

- Actively participating in ongoing professional development opportunities (conferences, workshops, short courses, graduate education, etc.).
- Updating and adapting their core knowledge and abilities to compete in the ever-changing global enterprise.
- Developing new knowledge and skills to pursue new career opportunities.

3. Engagement

- Serving as ambassadors for the engineering profession, inspiring others to develop a passion for engineering.
- Exchanging and applying knowledge to create new opportunities that advance society and solve a variety of technical and social problems.
- Advancing entrepreneurial ventures and fostering activities that support sustainable economic development to enhance the quality of life of people in the state, across the country and around the world.

In order for students to achieve these objectives, the program of study should satisfy the comprehensive set of program outcomes categorized in three areas: engineering foundational skills, professional skills and emerging skills.

Engineering Foundational Skills

The program should provide students with a solid technical foundation for their careers. This foundation should include:

- Engineering fundamentals.
- Analytical skills.
- Experimental skills.
- Modern engineering tools.
- Design skills.
- Impact of engineering solutions.

Professional Skills

The program should prepare students to be effective engineers in the professional workplace. To this end, students should develop the following professional skills:

- Communication skills.
- Teamwork skills.
- Professional and ethical responsibility.
- Contemporary issues.
- Lifelong learning.

Emerging Skills

The program should assist students in fostering a number of other emerging skills that are becoming increasingly critical to the success of future engineers. These emerging skills include:

- Leadership.
- Global engineering skills.
- Innovation.
- Entrepreneurship.

To achieve these objectives and outcomes, the School of Mechanical Engineering has developed a comprehensive, integrated curriculum to provide students with a broad base on which to build an engineering career. It is founded on basic sciences, including physics, chemistry and mathematics; computer science and computer graphics; and English composition and communications.

To this foundation, a core of engineering science and design courses is added in three main curriculum stems: mechanical sciences (statics, dynamics, mechanics of materials, and structures and properties of materials), information technologies (electric circuits and electronics, instrumentation, system modeling and controls), and thermal-fluid sciences (thermodynamics, fluid mechanics and heat transfer).

Throughout the core curriculum, students gain extensive laboratory and computer experience via modern facilities in all basic areas of the discipline. In addition, the curriculum provides an integrated innovation, design and entrepreneurship experience. This experience — which begins with a sophomore-level cornerstone course and culminates with a senior-level capstone course — emphasizes innovation, problem-solving, leadership, teamwork, communication skills, practical hands-on experience with various product design processes and entrepreneurship. Students then specialize by selecting two restricted electives that provide additional depth in two of the three main stems of the curriculum. Students can further specialize with 12 credit hours of professional electives in engineering, mathematics, natural sciences, select management courses or individualized project courses (ME 49700).

Just as design experiences are integrated throughout the mechanical engineering curriculum, so too are opportunities to communicate technical information, both orally and in writing. Students experience a variety of communications opportunities in progressing through the mechanical engineering program.

As a freshman, each student is required to take both speech and composition courses. These courses lay the foundation for future oral and written communications. In the sophomore seminar course (ME 29000), students learn how to create professional documents and correspondence (e.g., resumes, letters, memos, etc.), develop personal interview skills, learn the basics of Web publishing and develop a global engineering professional profile. In ME 26300, the cornerstone design course, student teams prepare formal design reports, give oral presentations and maintain individual design notebooks. The communications experiences culminate in the capstone design course (ME 46300), in which student teams prepare presentations and reports for the sponsors of their selected design projects and compete in an innovation competition.

A major feature of the curriculum is the flexible 39-credit-hour elective program, of which 24 credit hours are taken during the senior year. This allows for a program with considerable breadth while also permitting the depth and specialization in an area of the student's professional interests.

Because of the wide scope of activities in which the mechanical engineer is engaged and because of the broad spectrum of student interests, mechanical engineering graduates may choose either to enter the profession immediately after receiving their bachelor's degree or go directly to graduate school. In either case, the curriculum provides a firm foundation for continuing education and fosters a commitment to lifelong learning, whether it is as a member of the engineering profession, through formal graduate work or through independent study.

Visit the [School of Mechanical Engineering](https://engineering.purdue.edu/ME) website (<https://engineering.purdue.edu/ME>) for more current information about the undergraduate programs.

Scholarships

The School of Mechanical Engineering sponsors a broad array of need-based and merit-based scholarships. Eligible candidates (incoming sophomores through senior mechanical engineering students) are invited in mid-spring to submit applications for consideration. To qualify, students are required to have a scholastic index of 2.8 or better on a 4.0 scale. Awards range from \$500 to \$10,000 and total more than \$1 million. This scholarship money is in addition to the University's Trustees and Presidential scholarships in Mechanical Engineering, which, when fully funded, will include more than 300 awards worth a total of more than \$2 million.

Professional Student Organizations and Activities

Student organizations provide valuable opportunities for students to enhance organizational, communication, teamwork and leadership skills. Students also are strongly encouraged to become involved in one or more extracurricular activities. Student organizations specific to mechanical engineering include the American Society of Mechanical Engineers (ASME), the Purdue Mechanical Engineering Ambassadors (PMEA), Pi Tau Sigma (the Mechanical Engineering Honor Society) and the Society of Automotive Engineers (SAE).

Professional Practice Program with Industry or Governmental Organizations

The professional practice programs enable qualified students to obtain experiences related to their specific engineering discipline with selected employers while completing the requirements of their undergraduate degree. Students can participate in a five-session co-op, a three-session co-op or an internship program.

International internships also are available through the Global Partners in Apprenticeship Learning (G-PAL) Program within the Professional Practice Program. OPP also offers the GEARE program, which combines domestic and international work experiences, a design project component and an opportunity to study abroad.

For more information, visit the [Professional Practice Program](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

GEARE Program

The Global Engineering Alliance for Research and Education (GEARE) program is a unique and award-winning program that originated in the School of Mechanical Engineering at Purdue. Since 2009, the Office of Professional Practice (OPP) has assumed all GEARE operations and opened up the program to all College of Engineering students. GEARE is designed to supplement the education of engineers so they are prepared to function immediately in the global workplace. Students in the program participate in an orientation program, including language and culture, one domestic internship, one subsequent international internship at the same company, one semester of study abroad with fully transferable engineering course credits, and a one- to two-semester design team project with design teams that include students from international partner universities working on an industry-inspired project.

Interested students are encouraged to refer to the [OPP](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

Honors Program

An honors program is available for outstanding mechanical engineering undergraduate students. The honors program is a mechanism for:

1. Participating in small enrollment, targeted courses.
2. Participating in a directed project in their area of interest.
3. Stimulating interest in graduate study and research/academic careers.
4. Developing a community of honors scholars.
5. Allowing for special recognition of high levels of academic achievement.

The ME Honors program utilizes the normal professional, general education and free elective requirements for the B.S.ME degree in a way that is consistent with its designation as an honors program. Admission to the ME Honors program is automatic for any student in good standing in the First-Year Engineering Honors program. Students not in the First-Year Engineering Honors program can apply for admission into the ME Honors program by completing an honors application and meeting the required cumulative GPA for admission.

Completion of the ME Honors program requires earning a required minimum number of honor points (credit hours) earned in one of the following manners:

- Take honors courses (including the sophomore and junior honors seminar sequence).
- Complete honors experiences (e.g., study abroad, special work experiences, etc.).
- Take honors strategic initiative courses (defined by the College of Engineering).

Successful completion of the minimum number of honors points will earn a student a certificate and his/her transcript will read, “Bachelor of Science Mechanical Engineering — Honors Program Awarded at West Lafayette.”

More details on the ME Honors program can be found on the ME website. Questions about the program should be directed to Professor Charles M. Krousgrill.

Study Abroad

Global competency skills are a major focus in the School of Mechanical Engineering. By graduation, roughly 30 percent of ME graduates have international experience (as compared to about 3 percent nationally in engineering). The School of Mechanical Engineering has developed an extensive and multi-faceted study abroad program that ranges from an extensive eight-month experience abroad to a three-week stint abroad. This staged program allows students to pick and choose the program that best fits their requirements and timing. A brief summary of these programs are provided below. Additional information can be found on the [School of Mechanical Engineering](https://engineering.purdue.edu/ME/Academics/Global/index.html) website (<https://engineering.purdue.edu/ME/Academics/Global/index.html>).

GEARE Program. The Global Engineering Alliance for Research and Education (GEARE) program is the flagship international program. The GEARE program involves an eight-month experience abroad that includes both a domestic and international internship, a semester of study abroad with fully transferable engineering course credits (all taught in English) and a one-semester to two-semester design team project with students from the international partner institution.

ETA Program. The Engineering Term Abroad (ETA) program is a one-semester study abroad at a partner institution and includes fully transferable engineering course credits (all taught in English). This enables participating students to continue with their engineering subjects and thus stay on track for graduation while still gaining international experience. Current partner institutions exist in Australia, China, England, France, Germany, India, New Zealand, Singapore, Spain and Turkey, among other locations. The ETA is our most popular international program.

RTA Program. The Research Term Abroad (RTA) program is designed to enable interested students to conduct undergraduate engineering research at a partner institution. Currently our primary partners are Hannover University and Clausthal University of Technology in Germany.

G-PAL Program. The Global Partners in Apprenticeship (G-PAL) program offers a pair of concurrent international internship positions, one for a student from the target international partner country and one for a student from the U.S. Preferably both students will be housed at the international student's home for the duration of the assignment abroad. The G-PAL students can also come from two different academic disciplines. Internships are typically three months to six months in duration.

MTA. Special Maymester Term Abroad (MTA) programs are available to select locations and provide students with a short three-week stint in a foreign country. Brief stints like this enable students to test the waters to see if they would be interested in a more protracted time abroad. As such, this program compliments other existing programs and provides a vehicle for students experience going abroad without a long-term commitment. Currently, the Maymester program involves international experiences in China.

Registration for the Fundamentals of Engineering Examination

Mechanical engineering seniors are strongly encouraged to take the first step to becoming registered professional engineers (PEs) by registering and successfully completing the Fundamentals of Engineering (FE) examination, also called the Engineer in Training (EIT) exam. Seniors register to take the FE exam at the West Lafayette campus in their final fall or spring semester before graduation. Announcements appear early in the semester. To aid seniors in their preparation for the exam, the student chapter of the American Society of Mechanical Engineers (ASME) sells EIT Review Manuals, and the student chapter of the American Society of Civil Engineers (ASCE) organizes faculty-taught review sessions on key topics

covered on the FE exam. Typically, 50 to 75 percent of graduating mechanical engineering seniors register to take the FE exam, and 98 to 100 percent pass the exam on the first attempt.

After passing the FE exam and completing four years of engineering experience after graduation, an engineer is typically eligible to take the professional engineering (PE) licensing examination. Specific information about the EIT exam is available on the [School of Mechanical Engineering](https://engineering.purdue.edu/ME) home page (<https://engineering.purdue.edu/ME>). Questions about the FE exam or the process to become a registered professional engineer should be directed to [Professor James D. Jones](mailto:jonesjd@purdue.edu) (jonesjd@purdue.edu) in the School of Mechanical Engineering.

ME Minor Program

A minor in mechanical engineering is available to any non-ME student in the College of Engineering as well as to any student in industrial management. The mechanical engineering minor involves completing 15 credits of core requirements and 7 credits from one of three elective options. To be awarded the ME minor, all 22 required credits must be completed with a grade of “C” or better. Details of the specific course requirements and approval forms can be found at the [Mechanical Engineering](https://engineering.purdue.edu/ME) website (<https://engineering.purdue.edu/ME>).

B.S.ME/M.B.A. 5-Year Program

The School of Mechanical Engineering in conjunction with the Krannert School of Management offers an integrated five-year B.S.ME/M.B.A. program to high-achieving students. Each year a significant number of engineering graduates pursue M.B.A.s at U.S. business schools. The M.B.A. is seen as a complement to the engineer’s technical education, providing an understanding of the business context within which many technical decisions are made. Many employers also have a strong preference for hiring M.B.A.s with engineering backgrounds, particularly in the manufacturing and technology sectors, in which Krannert and the College of Engineering enjoy many longstanding relationships with leading employers. The B.S.ME/M.B.A. combined degree offering will provide top B.S.ME students an efficient and cost-effective path for developing management knowledge as well as the highly valued credential of an M.B.A. degree. It will also open new job opportunities for the program graduates that expedite their progression to high-level management positions.

Basic admission requirements include:

1. Maintaining a 3.5 graduation GPA.
2. Securing at least one session of internship and/or co-op work experience prior to the senior year.
3. Securing advanced credit (preferably math) or willingness to accelerate your ME program by taking summer courses.
4. Completing an application and successfully interviewing for a position with the Krannert School of Management faculty.

More details about the [B.S.ME/M.B.A. program](https://masters.krannert.purdue.edu/programs/) (<https://masters.krannert.purdue.edu/programs/>) are available online.

Combined B.S.ME/M.S.ME Program

A combined B.S.ME/M.S.ME program is available for outstanding mechanical engineering undergraduate students. This program is anticipated to take approximately five years to complete (with the M.S.ME non-thesis option) and result in receiving both the B.S.ME and M.S.ME degrees.

The B.S.ME/M.S.ME program is a mechanism for:

1. Providing a seamless transition from the B.S.ME to the M.S.ME program.
2. Participating in a directed project in their area of interest.
3. Stimulating interest in graduate study and research/academic careers.
4. Allowing for special recognition of high levels of academic achievement.

The B.S.ME/M.S.ME program requires students to take 12 hours of graduate coursework toward their B.S.ME professional elective requirement. This same 12 hours likewise count toward the M.S.ME degree.

Interested students typically apply as an “internal ME applicant” in the second half of their junior year after completion of 81 hours of coursework in the undergraduate program with a cumulative undergraduate GPA of 3.2 or higher. If a GPA of 3.0 has been maintained and grades of “B” or better are received in the first two graduate courses (typically in the seventh semester), the student will be asked to formally apply to the Purdue Graduate School at the beginning of his or her eighth semester of the senior year.

Complete details of the combined [B.S.ME/M.S.ME](https://engineering.purdue.edu/ME/Academics/Graduate/combinedBSMS.html) program (<https://engineering.purdue.edu/ME/Academics/Graduate/combinedBSMS.html>) can be found on the Web. Questions about this information should be directed to Professor David Anderson, <mailto:dave@purdue.edu>.

Preparation for Graduate Study

The School of Mechanical Engineering also offers graduate work leading to the degrees of Master of Science (M.S.), for students with non-engineering degrees; Master of Science in Engineering (M.S.E), for students with non-mechanical engineering degrees; Master of Science in mechanical engineering (M.S.ME), for students with B.S.ME degrees; and the Doctor of Philosophy (Ph.D.).

Courses	Credit Hours
Mathematics and Sciences	
Calculus: MA 16500, 16600, 26100, 26200, 30300	19
Chemistry: CHM 11500	4
Physics: PHYS 17200, 24100	7
Science Selective	3-4
Communication, Humanities and Social Sciences	
English Composition: ENGL 10600 or 10800	3-4
Speech: COM 11400	3
Professionalism, Ethics, Global Issues, Technical Communication: ME 29000	1
General Education Electives	18
Must be chosen in accordance with the approved general education list and with the help of a faculty advisor.	
Mechanical Sciences	
Basic Mechanics: ME 27000, 27400	6
Materials: ME 32300; MSE 23000	6
Design	
Design: ME 26300, 35200, 46300	10
Thermal Fluid Sciences	
Thermodynamics: ME 20000	3
Fluid Mechanics: ME 30900	4
Heat Transfer: ME 31500	4
Information Technologies	
Electrical and Computer Engineering: ECE 20100, 20700	4
Systems, Measurements and Controls: ME 36500, 37500	6
Freshman Requirements	

ENGR 13100, 13200; CGT 16300 6

Restricted Electives

ME 30000, 45200, 47500 (2 of 3) 6

Professional Electives

Can be taken from an extensive list of physical sciences, mathematics and engineering courses 12
and select management courses as approved by an academic advisor.

Free Electives

Chosen from the general education elective or professional elective groups, or a course approved by an academic advisor. 3

GPA Requirement

A graduation index of 2.0 or better is required for graduation with a B.S.ME degree. In addition, a minimum grade point average (GPA) of 2.0 is required in the core index (all sophomore-level and higher required technical courses, including the restricted electives) and the non-core index (all required courses except the core courses) to qualify for graduation.

The regular undergraduate curriculum (and the honors undergraduate program) provides a strong foundation for graduate study, and students who complete either of the programs with appropriate academic records are encouraged to pursue graduate work. Many graduates have continued their education by pursuing advanced studies in engineering, business, law, medicine, dentistry and public policy.

For answers to your questions about graduate study, visit the Mechanical Engineering Graduate Office in the Mechanical Engineering Building, Room 1003, call 765-494-5730, email megrad@ecn.purdue.edu or visit the ME [website](https://engineering.purdue.edu/ME/Academics/Graduate/index.html) (https://engineering.purdue.edu/ME/Academics/Graduate/index.html).

Minimum Degree Requirements for Mechanical Engineering (B.S.ME)

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

Credit Hours Required for Graduation: 128

Plan of Study for Mechanical Engineering

Credit Hours Required for Graduation: 128

Freshman Year, see "First-Year Engineering Program."

Graphics. CGT 16300 is a required course in the mechanical engineering curriculum and should be taken in the freshman year.

Sophomore Year

Third Semester

- (4) **MA 26100** (Multivariate Calculus)
- (3) **ME 20000** (Thermodynamics I)
- (3) **ME 27000** (Basic Mechanics I)

Fourth Semester

- (3) **ECE 20100** (Linear Circuit Analysis I)
- (1) **ECE 20700** (Electronic Measurement Techniques)
- (4) **MA 26200** (Linear Algebra and Differential Equations)

(1) **ME 29000** (Mechanical Engineering Professional Seminar)

(3) **PHYS 24100** (Electricity and Optics)

(3) Economics elective*

(17)

(3) **ME 26300** (Introduction to Mechanical Engineering Design, Innovation and Entrepreneurship)

(3) **ME 27400** (Basic Mechanics II)

(3) World affairs and cultures elective*

(17)

Junior Year

Fifth Semester

- (3) **MA 30300** (Differential and Partial Differential Equations for Engineering and the Sciences)
- (4) **ME 30900** (Fluid Mechanics)
- (3) **ME 32300** (Mechanics of Materials)
- (3) **ME 36500** (Systems and Measurements)
- (3) General education elective*
- (16)

Sixth Semester

- (4) **ME 35200** (Machine Design I)
- (3) **ME 37500** (System Modeling and Analysis)
- (3) **MSE 23000** (Structure and Properties of Materials)
- (3) General education elective*
- (3) Professional elective*
- (16)

Senior Year

Seventh Semester

- (4) **ME 31500** (Heat and Mass Transfer)
- (3) Free elective*
- (3) General education elective*
- (3) Professional elective*
- (3) Restricted elective*
- (16)

Eighth Semester

- (3) **ME 46300** (Engineering Design)
- (3) General education elective*
- (6) Professional electives*
- (3) Restricted electives*
- (15)

* The 39 credit hours of electives must be chosen in accordance with the following conditions:

1. Eighteen credit hours of general education electives (including the economics elective and the world affairs and cultures elective) chosen in accordance with the general education document, which is available at www.purdue.edu/ME/Academics/Undergraduate/GenEds.html.
2. Six credit hours of restricted electives are to include two of the following three courses: ME 30000, 45200, 47500.
3. Twelve credit hours of professional electives in engineering, mathematics, natural sciences, ME 49700 projects or select management courses chosen in accordance with the professional elective rules, which are available at www.purdue.edu/ME/Academics/Undergraduate/METechElects.html.
4. Three credit hours of free electives can be chosen from items 1 through 3 above, or, with prior approval of the student's faculty advisor, from other areas.

Notes:

- A. The pass/not-pass option may not be used for any courses required for graduation.
- B. Deviations from the stated curriculum must be approved by the Curriculum Committee of the School of Mechanical Engineering.

Nuclear Engineering

Nuclear engineering at Purdue University encompasses many areas of research, development and application of nuclear science and technology, with a focus on nuclear energy and nuclear materials. Students receive a broad background applicable in many different nuclear-related careers and an opportunity to specialize in areas such as energy production (fission, fusion, fuel cells and hydrogen

production), nuclear materials, nuclear physics, radiation science, national security, nuclear propulsion and nuclear waste management.

The four-year undergraduate program leading to a Bachelor of Science in Nuclear Engineering (B.S.NE) degree provides a well-grounded education that will lead to opportunities in any field of engineering.

Educational Objectives

The undergraduate education in the School of Nuclear Engineering has the following goals and objectives:

• **Provide the B.S. graduate with the technical capabilities required for successful performance as a nuclear engineer.** Nuclear engineers are challenged by a wide variety of problems related to consumer and industrial power, space exploration, water supply, food supply, environment and pollution, health and transportation, among others. Therefore, the technical capabilities required of the nuclear engineer are highly varied. The School of Nuclear Engineering's program of education will provide:

- A fundamental knowledge of the traditional and evolving areas in nuclear engineering and requisite subject areas.
- The ability to mathematically model and analyze data.
- The ability to use computers as tools in solving engineering problems.
- A working knowledge of radiation measurements and statistical analysis.
- An ability to solve open-ended design problems systematically.

• **Prepare graduates to be effective engineers in the workplace.** In addition to technical skills, the modern engineer must be able to communicate effectively, perform efficiently as a member of interdisciplinary project teams and display excellent interpersonal skills in order to fulfill expectations of most industrial employers. Graduates should have the ability to:

- Effectively communicate technical information orally and in writing.
- Function efficiently as an individual, on a team and with peers.
- Address difficult, complex problems and adapt to new situations.
- Work with a diverse, interdisciplinary workforce.

• **Instill in students a sense of responsibility to their profession, their community and society at large.** The undergraduate program should go beyond the purely technical preparation to assist students in developing their sense of responsibility to the broader environments in which they must live and function. Upon completion of their program, graduates should have developed a commitment and sensitivity to these broader professional and social needs. They also should have developed:

- A commitment to professional and ethical behavior in every endeavor.
- The motivation and the ability for lifelong learning inside and outside of a formal educational setting.
- A strong work ethic.

- An appreciation of the impact of engineering solutions within a global and societal context.
- A sensitivity to world affairs and cultures.
- A commitment to public safety and understanding of nuclear processes.

In order to meet these objectives, the School of Nuclear Engineering has developed a curriculum with a broad base in the humanities and basic sciences upon which to build a nuclear engineering career. The required courses provide a strong foundation in basic sciences, including physics, mathematics, computer science and chemistry. Engineering science courses include mechanics, materials, electric circuit analysis, thermodynamics, fluid mechanics and heat and mass transfer. These form the foundation of any engineering program related to nuclear processes and applications.

Specialized courses in reactor physics and engineering build on this foundation. In addition, each student develops an area of specialty through the careful selection of 15 hours of technical electives. These areas may include such diverse nuclear specialties as reactor engineering, nuclear materials, reactor physics, controlled thermonuclear fusion, reactor safety, energy systems, security, nuclear medicine, instrumentation, controls and reactor simulation. New areas include computational methods, hydrogen generation, fuel cells and plasma-material interactions. Additionally, nuclear engineering students may select electives that prepare them for careers in medical diagnostics and treatments, nuclear waste management, plasma processing and related software development.

To prepare nuclear engineering students to meet their educational goals, they will complement their technical preparation with general education electives consisting of 18 credit hours of courses that provide an integrated and well-rounded program in the humanities and social sciences.

Graduate programs leading to the degrees of Master of Science in Nuclear Engineering (M.S.NE), Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) are offered for qualified students seeking advanced degrees. The M.S.NE normally is obtained by students with a B.S. in engineering.

Financial aid with remitted tuition for graduate students includes teaching and research assistantships as well as traineeships and fellowships.

Information about the M.S.NE and PhD programs can be found at <https://engineering.purdue.edu/NE/Academics/Graduate/index.html>.

Areas for graduate research and study include nuclear theory and analysis, fuel management, design of advanced nuclear systems, reactor thermal-hydraulics and safety, artificial intelligence, fusion plasma engineering and technology, radiation effects, energy materials, advanced reactor fuels, laser plasma physics, plasma-material interactions, irradiation-driven nanopatterning, radioactive waste, direct energy conversion, energy storage, fuel cells and nuclear hydrogen systems.

A coordinated undergraduate/graduate program leading to a higher degree is available. Under this program, undergraduate students can apply for admission to the Graduate School at the beginning of their final semester. Qualified and interested students may start planning their graduate program with their undergraduate counselors at the beginning of the junior year.

Although one objective of the nuclear engineering program is to help students develop in specialized areas, the primary goal is to prepare them for a professional career. As a result, students are encouraged to develop a broad background in engineering and science and an awareness of social, economic and environmental issues. Thus equipped, they will be capable of continued professional growth in the constantly changing technological world.

The curriculum in nuclear engineering is accredited by the Engineering Accreditation Commission of ABET, www.abet.org. Further information about the undergraduate program in nuclear engineering is available at <https://engineering.purdue.edu/NE>.

Professional Practice Program with Industry or Governmental Organizations

The professional practice programs enable qualified students to obtain experiences related to their specific engineering discipline with selected employers while completing the requirements of their undergraduate degree. Students can participate in a five-session co-op, a three-session co-op or an internship program. International internships also are available through the Global Partners in Apprenticeship Learning (G-PAL) Program within the Professional Practice Program. OPP also offers the GEARE program, which combines domestic and international work experiences, a design project component and an opportunity to study abroad.

For more information, visit the [Professional Practice Program](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

GEARE Program

The Global Engineering Alliance for Research and Education (GEARE) program is a unique and award-winning program that originated in the School of Mechanical Engineering at Purdue. Since 2009, the Professional Practice Program (OPP) has assumed all GEARE operations and opened up the program to all College of Engineering students. GEARE is designed to supplement the education of engineers so they are prepared to function immediately in the global workplace. Students in the program participate in an orientation program, including language and culture, one domestic internship, one subsequent international internship at the same company, one semester of study abroad with fully transferable engineering course credits and a one-semester to two-semester design team project with design teams that include students from international partner universities working on an industry-inspired project.

Interested students are encouraged to refer to the [OPP](https://engineering.purdue.edu/ProPractice) website (<https://engineering.purdue.edu/ProPractice>).

Minor Program

A minor in nuclear engineering is available to any student who completes a total of 12 credits, consisting of core courses NUCL 20000 and 30000 (each of 3 credits) plus an additional 6 credits in one area of specialization. Available areas of specialization include reactor physics, nuclear power systems, nuclear fusion, direct energy conversion, neural fuzzy approaches, reactor thermal-hydraulics, nuclear materials and radioactive waste management. For more information, email crandler@purdue.edu in the Nuclear Engineering Student Services Office.

Scholarships

Nuclear engineering students are eligible for a broad array of aid-based and merit-based scholarships. In addition to these, several assistantships and scholarships are available for students seeking research experience. Interested candidates (incoming freshman through senior nuclear engineering students) are invited to submit applications for consideration. For more information, email crandler@purdue.edu in the Nuclear Engineering Student Services Office.

Curriculum in Nuclear Engineering

Graduation requirements for the degree of B.S.NE are:

- Satisfaction of various University-wide graduation requirements (academic, scholastic, residence, fee payments, etc.).
- Completion of an appropriate plan of study prepared by the student and his or her academic counselor and approved by the Undergraduate Committee and the head of the School of Nuclear Engineering or a designated representative.

Minimum Degree Requirements for Nuclear Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Credit Hours Required for Graduation: 134

Courses	Credit Hours
Freshman Year, see First-Year Engineering	34*
Mathematics	11†
Physics	3‡
General Education Electives	18
Engineering Core	53§
Technical Electives	15¶

* Freshman year credit hour total is 34 because Nuclear Engineering requires CHEM 11600, which is four credits.

† *The recommended courses to satisfy the mathematics requirement involve MA 26100, 26500, 26600 (or MA 26200 in place of MA 26500, 26600) and three elective hours, for a minimum of 11 credit hours.*

‡ *This requirement involves PHYS 24100 (or equivalent).*

§ *The recommended courses to satisfy the engineering core are NUCL 20000, 20500, 27300, 29800, 30000, 30500, 31000, 32000, 32500, 35000, 35100, 35500, 39800, 40200, 44900, 45000, 49800, 51000 or 52000; ECE 20100; ME 20000, 27000 and 27400; or their equivalent. The substitution of a maximum of 6 credit hours of courses approved by the undergraduate committee will be permitted to meet special needs.*

¶ *After satisfactory completion of four semesters of advanced ROTC, 6 of these credits can be substituted for technical electives.*

All elective courses are to be selected with the aid of the student's counselor to best fulfill the objectives of the individual student's program. General education electives must be chosen from the list of courses approved by the College of Engineering (available in the Nuclear Engineering Student Services Office). A maximum of 12 credit hours may be taken in any one department, a minimum of 6 credit hours must be taken in at least one department in each of the two categories of humanities and social sciences. At least 6 of the credit hours must come from courses at the 30000 level or above, or from courses with a required prerequisite in the same department.

Technical electives are to be selected from the colleges of Science, Engineering, and Health and Human Sciences, but exceptions will be considered on their merit by the undergraduate committee.

This website includes sample plans of study in a few technical areas. Students, with the help of their advisors, may create plans of study in any relevant technical discipline.

Suggested Plan of Study for Energy Materials and Nuclear Waste

Credit Hours Required for Graduation: 134

Freshman Year, see "First-Year Engineering Program."

Sophomore Year

Third Semester

- (4) **MA 26100** (Multivariate Calculus)
- (3) **ME 20000** (Thermodynamics I)
- (3) **ME 27000** (Basic Mechanics I)
- (3) **NUCL 20000** (Introduction to Nuclear Engineering)
- (0) **NUCL 29800** (Sophomore Seminar)
- (3) General education elective
- (16)

Fourth Semester

- (3) **MA 26500** (Linear Algebra)
- (3) **ME 27400** (Basic Mechanics II)
- (2) **NUCL 20500** (Nuclear Engineering Undergraduate Laboratory I)
- (3) **NUCL 27300** (Mechanics of Materials)
- (0) **NUCL 29800** (Sophomore Seminar)
- (3) **PHYS 24100** (Electricity and Optics)
- (3) General education elective
- (17)

Junior Year

Fifth Semester

- (3) **MA 26600** (Ordinary Differential Equations)
- (3) **NUCL 30000** (Nuclear Structure and Radiation Interactions)
- (3) **NUCL 32000** (Introduction to Materials for Nuclear Applications)
- (3) **NUCL 32500** (Nuclear Materials Laboratory)
- (3) **NUCL 35000** (Nuclear Thermal-Hydraulics I)
- (0) **NUCL 39800** (Junior Seminar)
- (3) General education elective
- (18)

Sixth Semester

- (3) **NUCL 31000** (Introduction to Neutron Physics)
- (3) **NUCL 35100** (Nuclear Thermal-Hydraulics II)
- (3) **NUCL 35500** (Nuclear Thermohydraulics Laboratory)
- (0) **NUCL 39800** (Junior Seminar)
- (3) Mathematics elective‡
- (3) Technical elective
- (3) General education elective
- (18)

Senior Year

Seventh Semester

- (2) **NUCL 30500** (Nuclear Engineering Undergraduate Laboratory II)
- (3) **NUCL 40200** (Engineering of Nuclear Power Systems)
- (1) **NUCL 44900** (Senior Design Proposal)
- (0) **NUCL 49800** (Senior Seminar)
- (3) **NUCL 51000** (Nuclear Reactor Theory I) **or** **NUCL 52000** (Radiation Effects and Reactor Materials)
- (6) Technical electives*
- (3) General education elective
- (18)

Eighth Semester

- (3) **ECE 20100** (Linear Circuit Analysis I)
- (3) **NUCL 45000** (Design in Nuclear Engineering)
- (0) **NUCL 49800** (Senior Seminar)
- (6) Technical electives*
- (3) General education elective
- (15)

* Fifteen credit hours of technical electives are required and should be selected with the help of your academic advisor. Recommended electives for the energy materials option include AAE 55300; MSE 33500, 34000, 35000, 36700, 37000, 38200, 50200, 50800, 53100, 55500, 55600, 55700, 55900, 56000, 57500 and 57600; NUCL 50300, 51000 and 52000 (NUCL 50300 is required for radioactive waste management). Either NUCL 51000 or 52000 must be included in the engineering core. Other courses to meet specific objectives also can be selected.

† One materials lab course beyond NUCL 32500 is required.

‡ The mathematics elective is a 30000-level or higher course.

Suggested Plan of Study for Nuclear Fusion

Credit Hours Required for Graduation: 135

Freshman Year, see "First-Year Engineering Program."

Sophomore Year

Third Semester

- (4) **MA 26100** (Multivariate Calculus)
- (3) **ME 20000** (Thermodynamics I)
- (3) **ME 27000** (Basic Mechanics I)
- (3) **NUCL 20000** (Introduction to Nuclear Engineering)
- (0) **NUCL 29800** (Sophomore Seminar)
- (3) General education elective
- (16)

Fourth Semester

- (3) **MA 26500** (Linear Algebra)
- (3) **ME 27400** (Basic Mechanics II)
- (2) **NUCL 20500** (Nuclear Engineering Undergraduate Laboratory I)
- (3) **NUCL 27300** (Mechanics of Materials)
- (0) **NUCL 29800** (Sophomore Seminar)
- (4) **PHYS 26100** (Electricity and Optics)
- (3) General education elective
- (18)

Junior Year

Fifth Semester

- (3) **MA 26600** (Ordinary Differential Equations)
- (3) **NUCL 30000** (Nuclear Structure and Radiation Interactions)
- (3) **NUCL 32000** (Introduction to Materials for Nuclear Applications)
- (3) **NUCL 32500** (Materials Properties Laboratory)
- (3) **NUCL 35000** (Nuclear Thermal-Hydraulics I)
- (0) **NUCL 39800** (Junior Seminar)
- (3) General education elective
- (18)

Sixth Semester

- (3) **NUCL 31000** (Introduction to Neutron Physics)
- (3) **NUCL 35100** (Nuclear Thermal-Hydraulics II)
- (3) **NUCL 35500** (Nuclear Thermohydraulics Laboratory)
- (0) **NUCL 39800** (Junior Seminar)
- (3) **NUCL 46000** (Introduction to Controlled Thermonuclear Fusion)*
- (3) **PHYS 33000** (Intermediate Electricity and Magnetism)*
- (3) Mathematics elective†
- (18)

Senior Year

Seventh Semester

- (3) **MA 51100** (Boundary Value Problems of Differential Equations)*
- (2) **NUCL 30500** (Nuclear Engineering Undergraduate Laboratory II)
- (3) **NUCL 40200** (Engineering of Nuclear Power Systems)
- (1) **NUCL 44900** (Senior Design Proposal)
- (0) **NUCL 49800** (Senior Seminar)
- (3) **NUCL 51000** (Nuclear Reactor Theory I)*
- (3) **NUCL 56000** (Introduction to Fusion Technology)*
- (3) General education elective
- (18)

Eighth Semester

- (3) **ECE 20100** (Linear Circuit Analysis I)
- (3) **NUCL 45000** (Design in Nuclear Engineering)
- (0) **NUCL 49800** (Senior Seminar)
- (3) **NUCL 56300** (Direct Energy Conversion)*
- (6) General education electives
- (15)

* Fifteen credit hours of technical electives are required and should be selected with the help of your academic advisor. Recommended electives for nuclear fusion include **NUCL 46000**, **51000**, **52000**, **56000**, **56300** and **57000**; and **PHYS 33000**. Either **NUCL 51000** or **52000** must be included in the engineering core. Other courses to meet specific objectives also can be selected.

† The mathematics elective is usually **MA 51000**.

Suggested Plan of Study for Nuclear Power Engineering

Credit Hours Required for Graduation: 134

Freshman Year, see "First-Year Engineering Program."

Sophomore Year

Third Semester

- (4) **MA 26100** (Multivariate Calculus)
- (3) **ME 20000** (Thermodynamics I)
- (3) **ME 27000** (Basic Mechanics I)

- (3) **NUCL 20000** (Introduction to Nuclear Engineering)
- (0) **NUCL 29800** (Sophomore Seminar)
- (3) General education elective

- (16)

Fourth Semester

- (3) **MA 26500** (Linear Algebra)
- (3) **ME 27400** (Basic Mechanics II)
- (2) **NUCL 20500** (Nuclear Engineering Undergraduate Laboratory I)
- (3) **NUCL 27300** (Mechanics of Materials)

- (0) **NUCL 29800** (Sophomore Seminar)
- (3) **PHYS 24100** (Electricity and Optics)
- (3) General education elective

- (17)

Junior Year

Fifth Semester

- (3) **MA 26600** (Ordinary Differential Equations)
- (3) **NUCL 30000** (Nuclear Structure and Radiation Interactions)
- (3) **NUCL 32000** (Introduction to Materials for Nuclear Applications)
- (3) **NUCL 32500** (Materials Properties Laboratory)
- (3) **NUCL 35000** (Nuclear Thermal-Hydraulics I)
- (0) **NUCL 39800** (Junior Seminar)

- (3) General education elective

- (18)

Sixth Semester

- (3) **ECE 20100** (Linear Circuit Analysis I)
- (3) **NUCL 31000** (Introduction to Neutron Physics)
- (3) **NUCL 35100** (Nuclear Thermal-Hydraulics II)

- (3) **NUCL 35500** (Nuclear Thermohydraulics Laboratory)
- (0) **NUCL 39800** (Junior Seminar)
- (3) **NUCL 52000** (Radiation Effects and Reactor Materials)*
- (3) General education elective

- (18)

Senior Year

Seventh Semester

- (2) **NUCL 30500** (Nuclear Engineering Undergraduate Laboratory II)
- (3) **NUCL 40200** (Engineering of Nuclear Power Systems)
- (1) **NUCL 44900** (Senior Design Proposal)
- (0) **NUCL 49800** (Senior Seminar)
- (3) **NUCL 51000** (Nuclear Reactor Theory I)*
- (6) Technical electives*
- (3) General education elective

- (18)

Eighth Semester

- (3) **NUCL 45000** (Design in Nuclear Engineering)

- (0) **NUCL 49800** (Senior Seminar)

- (3) Mathematics elective†
- (6) Technical electives*
- (3) General education elective

- (15)

* Fifteen credit hours of technical electives are required and should be selected with the help of your academic advisor. Recommended electives for nuclear power engineering include HSCI 43800 and 52600;

IE 577; ME 43000 and 43300; and NUCL 46000, 47000, 50300, 51000, 51100, 51200, 52000, 54400, 55100, 55200, 56000, 56300, 57000 and 57500. Either NUCL 51000 or 52000 must be included in the engineering core. Other courses to meet specific objectives also can be selected.

† The mathematics elective usually is selected from MA 30400 or 36200.

Course Information

https://selfservice.mypurdue.purdue.edu/prod/bwckctlg.p_disp_dyn_ctlg?

College of Engineering Faculty

See <https://engineering.purdue.edu/Engr/People/ptDirectory>

Contact Engineering

For information about undergraduate programs in the College of Engineering, contact:

Email: tmortiz@purdue.edu

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