Computer Engineering, BSE

Computer Engineering combines the best of electrical engineering and computer science to design and build the systems that power our digital world. From smartphones and smart homes to self-driving cars and artificial intelligence, computer engineers create the hardware and software that make modern technology possible.

Students in the Computer Engineering program learn how computers work from the ground up, i.e., from circuits and microprocessors to high performance computer architecture, software systems, and machine learning. They gain hands-on experience designing electronic systems, programming embedded devices, and developing intelligent systems that sense, think, and respond to their environment.

Our curriculum bridges hardware and software, giving students the skills to design everything from low-level computer chips to high-level computing applications. Coursework includes digital design, computer architecture, programming, software design, data structures, algorithms, embedded systems, internet of things, cloud computing, cybersecurity, and artificial intelligence.

Graduates of the program are well prepared for careers in industries such as computing, software design, hardware design, communications, robotics, developing smart devices, healthcare technology, artificial intelligence, and more. They also have a strong foundation for graduate study in fields like computer engineering, electrical engineering, software engineering, or computer science.

In short, computer engineering is where innovation meets implementation. Computer Engineers turn ideas into the smart technologies that shape our future.

The major provides technical depth and breadth as well as flexibility and the opportunity for students to customize their programs according to their own goals. Students choose one of several focus areas according to the type of job or research they plan to pursue. More than 20 focus areas are available; see Focus Areas on the Department of Electrical and Computer Engineering website. Students also have the opportunity to work with their academic advisor to build a focus area plan that adheres to their goals and objectives. Focus areas allow students to personalize their curriculum and prepare them for the jobs or research they intend to pursue.

In their senior year, students complete a two-semester capstone design sequence culminating in a significant, original project.

Programs designed to lead to professional licensure are subject to federal regulations regarding informational disclosures. Please see Professional Licensure Disclosures by Program for further information.

Educational Objectives

Graduates of the computer engineering program will:

- demonstrate initiative and perseverance to successfully apply the knowledge and skills gained in the CE program in their chosen technical, business, or academic careers;
- exhibit ethical leadership and vision in contributing to the technical and policy decisions of industry, government, and research enterprises;
- thrive in diverse, global, and multidisciplinary environments;
- excel at constructive communication and collaborative engagement with other engineers and professionals; and
- actively engage in lifelong-learning and mentoring activities that enhance their professional and personal development.

Requirements

The Bachelor of Science in Engineering (BSE) with a major in computer engineering requires a minimum of 129 s.h. of credit. At the time of graduation, students must have a cumulative grade-point average of at least 2.00 in all college work used to complete degree requirements and in all UI coursework in order to be awarded the BSE.

The computer engineering major shares a core of electrical and computer engineering courses and provides focus and depth for students preparing for graduate study or a career in computer hardware or software engineering. Students begin taking focus area elective courses in their third year.

All BSE students are required to take the same collegiate curriculum. For information about these collegiate requirements, see the Bachelor of Science in Engineering, BSE in the catalog. 6 s.h. of a student's major courses fulfill the basic science or college-level math collegiate requirement. Students completing the major in computer engineering fulfill the collegiate statistics requirement by completing STAT:2020 Probability and Statistics for the Engineering and Physical Sciences.

The BSE with a major in computer engineering requires the following coursework.

Requirements	Hours
Collegiate Curriculum	49
Basic Science and College-Level Math, from Major Requirements or Focus Area	6
Major Requirements	47
Focus Area	27

Major Requirements

Major requirements include a set of courses shared in common with the electrical engineering major (29 s.h.), required courses (17 s.h.), one departmental seminar (1 s.h.), and two capstone design courses (6 s.h.).

Common Courses

Course #	Title	Hours
All of these:		
ECE:2400	Linear Systems I	3
ECE:2410	Principles of Electronic Instrumentation	4
ECE:3320	Introduction to Digital Design	3
ECE:3360	Embedded Systems	3
ECE:3700	Electromagnetic Theory	3
ENGR:2120	Electrical Circuits	3
ENGR:2730	Computers in Engineering	3
MATH:3550	Engineering Vector Calculus	3
PHYS:1612	Introductory Physics II	4

Required Courses

Course #	Title	Hours
All of these:		
ECE:3330	Introduction to Software Design	3
ECE:3350	Computer Architecture and Organization	3
CS:2210	Discrete Structures	4
CS:2230	Computer Science II: Data Structures	4
CS:3330	Algorithms	3

Departmental Seminar

The major in computer engineering includes ECE:3000 Electrical and Computer Engineering Professional Seminar (1 s.h.), typically taken in the third year.

Capstone Design Courses

In the final year of study, students complete a two-semester capstone design sequence culminating in the development and implementation of a significant, original project. The capstone design experience emphasizes teamwork, professionalism, open-ended problem solving, and the ability to work within real-world constraints and engineering standards.

Course #	Title	Hours
Both of these:		
ECE:4880	Electrical and Computer Engineering Senior Design 1	3
ECE:4890	Electrical and Computer Engineering Senior Design 2	3

Focus Area

Students must select focus area courses according to guidelines established by the Department of Electrical and Computer Engineering. A number of established focus areas are available, and students also may work with their academic advisor to create a customized plan tailored to their goals and objectives. Focus areas allow students to personalize their curriculum and to prepare them for the jobs or research they intend to pursue.

Focus areas in the computer engineering major consist of one breadth elective (at least 3 s.h.), one depth elective (3 s.h.), two electrical and computer engineering courses (prefix ECE) numbered above 5000 (6 s.h.), one additional electrical and computer engineering course (prefix ECE), two technical electives that align with the focus area (at least 6 s.h.), and two additional elective courses (6 s.h.).

Carefully selected elective and general education courses may contribute to earning a minor and/or certificate, including the Certificate in Sustainability (College of Liberal Arts and Sciences) or the Certificate in Technological Entrepreneurship (College of Engineering). Students who take an additional advanced math course meet the requirements for a minor in mathematics (College of Liberal Arts and Sciences). Students who take an additional approved computer science course (prefix CS) meet the requirements for a minor in computer science (College of Liberal Arts and Sciences).

For a complete list of focus areas and course selection guidelines, see Focus Areas on the Department of Electrical and Computer Engineering website. Although general guidelines and requirements for elective courses are listed, course recommendations for specific focus areas differ. While some courses may apply to more than one focus area requirement, a single course may only count once toward completing a focus area.

Breadth Elective

Course #	Title	Hours
One of these:		
ECE:3400	Linear Systems II	3
ECE:3410	Electronic Circuits	4
ECE:3500	Communication Systems	3
ECE:3540	Communication Networks	3
ECE:3600	Control Systems	3
ECE:3720	Semiconductor Devices	3

Depth Elective

The depth elective must be an advanced course, normally numbered 4000 or above, in a subject area within a student's track, excluding seminars. The following courses are options for the depth elective.

Course #	Title	Hours
ECE:5200/IGPI:5450	Machine Learning	3
ECE:5320/CS:5610	High Performance Computer Architecture	3
ECE:5460/IGPI:5460	Digital Signal Processing	3
ECE:5480/IGPI:5480	Digital Image Processing	3
ECE:5525	Cryptography	3
ECE:5800/CS:5800	Fundamentals of Software Engineering	3
ECE:5810/CS:5810	Formal Methods in Software Engineering	3
ECE:5840	Software Security	3
ECE:5845	Modern Databases	3
CS:4400	Database Systems	3
CS:4420	Advanced Artificial Intelligence	3

Advanced Electrical and Computer Engineering Electives

Students complete at least two electrical and computer engineering courses (prefix ECE) numbered above 5000, excluding seminars. Specific recommendations vary based on focus area.

Additional Electives

Students complete at least 15 s.h. selected from additional courses in the preceding focus area categories or from a list of suggested electives for their specific focus area. At least one elective must be selected from electrical and computer engineering courses (prefix ECE) not already taken for the major.

While course recommendations for specific focus areas differ, the following is a list of potential elective courses. Courses not listed here may be able to count toward the focus area requirements; students should consult an academic advisor.

Course #	Title	Hours
ACCT:2100	Introduction to Financial Accounting	3

ACCT:2200	Managerial Accounting Analytics and Data Visualization	3
CEE:4107/CBE:4410	Sustainable Systems	3
CHEM:1120	Principles of Chemistry II	4
CHEM:2220	Organic Chemistry II	3
CHEM:2410	Organic Chemistry Laboratory	3
ENGR:2130	Thermodynamics	3
ENTR:2000	Entrepreneurship and Innovation	3
ENTR:3100	Entrepreneurial Finance	3
ISE:2500	Engineering Economy	3
ISE:4172	Big Data Analytics	3
MATH:3800/ CS:3700	Introduction to Numerical Methods	3
MATH:4200	Complex Variables	3
SEES:2013/ BUS:2013/ URP:2013	Introduction to Sustainability	3
STAT:4143/ PSQF:4143	Introduction to Statistical Methods	3
STAT:4520/ IGPI:4522/ PSQF:4520	Bayesian Statistics	3
STAT:4580/ DATA:4580/ IGPI:4580	Data Visualization and Data Technologies	3

Double Major in Computer Engineering/Electrical Engineering

Students may earn a double major in computer engineering and electrical engineering. They must satisfy all requirements of the electrical engineering major and all requirements of the computer engineering major.

Students completing the major in computer engineering (CE) may not also complete a major in computer science (CS) or in computer science and engineering (CSE). Students who are interested in both computer science and computer engineering should pursue the computer science and engineering degree.

Combined Programs

BSE/MS in Electrical and Computer Engineering

The College of Engineering offers a Bachelor of Science in Engineering/Master of Science for computer engineering undergraduate students who intend to earn an MS in electrical and computer engineering. BSE/MS students may take up to 12 s.h. of graduate-level coursework and do thesis-level research while they are still undergraduates. They may count 9 s.h. of graduate coursework toward both degrees. Once students complete the requirements for the bachelor's degree, they are granted the BSE, and they normally complete the MS one year later.

To be admitted to the degree program, students must have completed at least 80 s.h., have a cumulative grade-point average of at least 3.25, and submit a letter of application to the chair of the Department of Electrical and Computer Engineering. For more information, see Joint BS/MS Degree Program Undergraduate to Graduate (U2G) on the Department of Electrical and Computer Engineering website.

BSE/MCS

The College of Engineering and the Department of Computer Science (College of Liberal Arts and Sciences) offer a combined Bachelor of Science in Engineering/Master of Computer Science for computer engineering undergraduate students.

The combined degree program allows students to count a limited amount of credit toward both degrees. For more information, see the Master of Computer Science, MCS in the catalog.

Career Advancement

Computer engineering graduates pursue careers in software development, systems engineering, cybersecurity, embedded systems, data science, artificial intelligence, networking, and related technical fields. They work in industries such as technology, aerospace, healthcare, telecommunications, manufacturing, and energy, and many also engage in research or entrepreneurial ventures. Graduates may continue their education in computer science, engineering, or other disciplines that rely on advanced computational and analytical skills.

Engineering Career Services connects students with experiential learning and professional opportunities that support their development as emerging engineers. Staff coordinate the college's co-op and internship program, sustain strong employer relationships, and offer a variety of opportunities for students to engage with industry, including engineering career fairs and additional career-focused programming. The office provides individual advising on resumes, job and internship search strategies, interviewing, and evaluating job offers. Engineering Career Services works closely with the Pomerantz Career Center to facilitate on-campus interviewing, collect postgraduation data, and manage the university's recruiting system, Handshake.

Academic Plans

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Computer Engineering, BSE

This sample plan is currently being reviewed and will be added at a later date.