Computer Science and Engineering, BSE

The Bachelor of Science in Engineering (BSE) program in computer science and engineering combines the technical content of a computer science degree and a computer engineering degree in a single degree program. The program curriculum is jointly taught by faculty from the Department of Electrical and Computer Engineering and the Department of Computer Science (College of Liberal Arts and Sciences). The program provides students with a strong theoretical and conceptual understanding of the principles underlying computer software and hardware along with the engineering analysis, design, and multidisciplinary teamwork skills needed to develop large and complex systems containing both software and hardware components.

The computer science and engineering program encompasses the technical rigor of a Bachelor of Science program in computer science and a Bachelor of Science program in computer engineering. This major is jointly accredited in computer science and computer engineering by the Accreditation Board for Engineering and Technology (ABET). Graduates gain the foundational knowledge provided by a computer science education together with the critical thinking, problem-solving, and system design skills at the heart of a computer engineering curriculum.

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 and interests. Students choose one of several focus areas according to the type of job or research they plan to pursue; students also have the opportunity to work with their academic advisor to build a focus area plan that adheres to their goals and interests. Students select a focus area to personalize their curriculum and to prepare them for certain jobs or research studies they intend to seek.

In their senior year, 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.

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 science and engineering program will:

- exhibit leadership and vision in contributing to the computing-related technical and policy decisions of industry, government, and research enterprises;
- demonstrate computing skills and problem-solving abilities that permit them to contribute in a variety of technical, business, and academic careers;
- thrive in diverse, global, and multidisciplinary environments;
- possess the ability to communicate effectively and participate collaboratively in interactions with other computing and engineering professionals; and
- understand the importance of participating in lifelong learning activities that enhance their professional and personal development.

Requirements

The Bachelor of Science in Engineering (BSE) with a major in computer science and engineering requires a minimum of 128 s.h. of credits. 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.

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 science and engineering fulfill the collegiate statistics requirement by completing STAT:2020 Probability and Statistics for the Engineering and Physical Sciences.

The major in computer science and engineering includes ECE:3000 Electrical and Computer Engineering Professional Seminar, typically taken in the third year.

The BSE with a major in computer science and 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	52
Focus Area	21

Major Requirements

Major requirements include a set of common courses (52 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:3330	Introduction to Software Design	3
ECE:3350	Computer Architecture and Organization	3
ECE:3360	Embedded Systems	3
ECE:3540	Communication Networks	3
CS:1210	Computer Science I: Fundamentals	4
CS:2210	Discrete Structures	3
CS:2230	Computer Science II: Data Structures	4
CS:3330	Algorithms	3
CS:3620	Operating Systems	3

CS:3820	Programming Language Concepts	3
ENGR:2120	Electrical Circuits	3
ENGR:2730	Computers in Engineering	3
PHYS:1612	Introductory Physics II (with lab)	4

Capstone Design Courses

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

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 may also work with their academic advisor to create a customized plan tailored to their goals and interests.

Students complete a minimum of 21 s.h. in electives, including at least one complementary theory elective course (3 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.

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.

Electrical and Computer Engineering Electives

Students choose two focus area electives from electrical and computer engineering courses (prefix ECE) not already required for the major. Students must consult an academic advisor and gain approval from the undergraduate curriculum chair to count ECE:5998 Individual Investigations: Electrical and Computer Engineering toward this requirement.

Course #	Title	Hours
Both of these:		
Technical course in electrical and computer engineering (prefix ECE) numbered 3400 or above, excluding ECE:3998, ECE:5000, and ECE:5999		3
Advanced course in electrical and computer engineering (prefix ECE) numbered 5001-5995		3

Computer Science Electives

Students choose two focus area electives (at least 6 s.h.) from computer science courses (prefix CS) not already required

for the major. At least one course must be numbered 4000 or above.

Course #	Title	Hours
Two of these, with at least one numbered 4000 or above:		
ECE:5320/CS:5610	High Performance Computer Architecture	3
ECE:5800/CS:5800	Fundamentals of Software Engineering	3
ECE:5810/CS:5810	Formal Methods in Software Engineering	3
ECE:5820/CS:5820	Software Engineering Languages and Tools	3
ECE:5830/CS:5830	Software Engineering Project	3
CS:3700/ MATH:3800	Introduction to Numerical Methods	3
CS:3980	Topics in Computer Science I	3
CS:4330	Theory of Computation	3
CS:4350	Logic in Computer Science	3
CS:4400	Database Systems	3
CS:4420	Artificial Intelligence	3
CS:4440	Web Mining	3
CS:4470	Health Data Analytics	3
CS:4500	Research Methods in Human-Computer Interaction	3
CS:4630	Mobile Computing	3
CS:4640	Computer Security	3
CS:4700/ MATH:4860	High Performance and Parallel Computing	3
CS:4720/ MATH:4820	Optimization Techniques	3
CS:4740/IGPI:4740/ MATH:4740/ STAT:4740	Large Data Analysis	3
CS:4980	Topics in Computer Science II	3
CS:5340	Limits of Computation	3
CS:5350	Design and Analysis of Algorithms	3
CS:5360	Randomized Algorithms	3
CS:5370	Computational Geometry	3
CS:5430	Machine Learning	3
CS:5620	Distributed Systems and Algorithms	3
CS:5630	Cloud Computing Technology	3
CS:5710/ MATH:5800	Numerical Methods I	3
CS:5720/ MATH:5810	Numerical Methods II	3
CS:5850	Programming Language Foundations	3
CS:5860	Lambda Calculus and Applications	3
CS:5980	Topics in Computer Science III	arr.

The following courses do not count towards the major; students take more advanced versions of these courses as part of their required coursework.

Course #	Title	Hours
CS:2630	Computer Organization	4
CS:2820	Introduction to Software Development	4
CS:3210	Programming Languages and Tools	arr.
CS:3640	Introduction to Networks and Their Applications	3

Additional Electives

Students select an additional 6 s.h. in courses to reach a minimum of 18 s.h. in focus area electives. Courses may be from the electrical and computer engineering (prefix ECE) or computer science (prefix CS) categories in the previous lists, or they may be chosen from outside of those lists with the approval of an academic advisor.

Theory Elective

Course #	Title	Hours
One of these:		
ECE:5330/IGPI:5331	Graph Algorithms and Combinatorial Optimization	3
ECE:5450/IGPI:5450	Machine Learning	3
ECE:5520	Introduction to Information and Coding Theories	3
ECE:5525	Cryptography	3
ECE:5810/CS:5810	Formal Methods in Software Engineering	3
CS:4330	Theory of Computation	3
CS:4350	Logic in Computer Science	3
CS:4720/ MATH:4820	Optimization Techniques	3
CS:5340	Limits of Computation	3
CS:5360	Randomized Algorithms	3
CS:5370	Computational Geometry	3
CS:5430	Machine Learning	3
CS:5620	Distributed Systems and Algorithms	3
CS:5850	Programming Language Foundations	3
CS:5860	Lambda Calculus and Applications	3

Double Major in Computer Science and Engineering/ Electrical Engineering

Students may earn a double major in computer science and engineering (CSE) and electrical engineering (EE). They must satisfy all requirements of the electrical track of the EE major and all requirements of the CSE major.

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 science and 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 science and 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

Students who earn a major in computer science and engineering work in research, design, development, manufacturing, sales, market analysis, consulting, field service, and management. They are employed in computer, semiconductor, software, aerospace, telecommunication, medical, radio, TV, and power industries, and many graduates pursue entrepreneurial ventures.

The major also prepares students for further study in many areas demanding computational and engineering skill sets.

Engineering Career Services develops and promotes experiential education and professional opportunities for students in the College of Engineering. Professional staff coordinate the college's co-op and internship program, engage in employer outreach, and provide opportunities for students to network with employers, including engineering career fairs and other programming related to career development.

Engineering Career Services offers individual advising and class presentations on résumé and cover letter preparation, job and internship search strategies, interviewing skills, job offer evaluation, and much more. Engineering Career Services partners with the Pomerantz Career Center to facilitate on-campus interviewing, postgraduate outcome collection, and the university's online 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.

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Course	Title	Hours
Academic Career		
Any Semester		
Students select one of several established focus areas or work with their academic advisor to create a customized plan. Focus areas require at least 21 s.h. in elective courses and one theory elective (3 s.h.). See General Catalog, the Department of Electrical and Computer Engineering website, or an advisor for more information.		
	Hours	**0**
First Year		
Fall		
MATH:1550	Engineering Calculus I [a, b]	4
CHEM:1110	Principles of Chemistry I [a, c]	4
ENGR:1100	Introduction to Engineering Problem Solving [d]	3
ENGR:1300	Introduction to Engineering Computing [a]	3
CSI:1600	Success at Iowa	0
	Hours	**14**
Spring		
RHET:1030	Rhetoric: Writing and Communication [e]	4
PHYS:1611	Introductory Physics I [a]	4
MATH:1560	Engineering Calculus II [a]	4
MATH:2550	Engineering Matrix Algebra [a]	2
CS:1210	Computer Science I: Fundamentals [e]	4
	Hours	**18**
Second Year		
Fall		
GE: Approved Course Subjects [f]		3
MATH:2560	Engineering Differential Equations [a]	3
PHYS:1612	Introductory Physics II [a]	4
ENGR:2120	Electrical Circuits [e]	3
ENGR:2730	Computers in Engineering [a]	3
	Hours	**16**
Spring		
GE: Cultural Perspectives, Values, and Society [g]		3
CS:2210	Discrete Structures [e]	3
CS:2230	Computer Science II: Data Structures [e]	4
ECE:2400	Linear Systems I [a]	3
ECE:2410	Principles of Electronic Instrumentation [a]	4
Focus Area Form: Students should fill out a focus area selection form by the end of their Spring semester. Focus area forms can be updated/changed at anytime. Please see the Electrical and Computer Engineering (ECE) - Undergraduate Focus Area Forms webpage for the link.		
	Hours	**17**
Third Year		
Fall		
GE: Engineering Be Creative [h]		3
STAT:2020	Probability and Statistics for the Engineering and Physical Sciences [a]	3
ECE:3320	Introduction to Digital Design [d]	3
ECE:3330	Introduction to Software Design [a]	3
Focus Area: computer science elective [i]		3 - 4
ECE:3000	Electrical and Computer Engineering Professional Seminar [d]	1
	Hours	**16-17**
Spring		
GE: Approved Course Subjects [f]		3
CS:3330	Algorithms [a]	3
CS:3820	Programming Language Concepts [a]	3
ECE:3350	Computer Architecture and Organization [j]	3
ECE:3360	Embedded Systems [a]	3
Focus Area: additional elective [i]		3
	Hours	**18**
Fourth Year		
Fall		
CS:3620	Operating Systems [a]	3
ECE:3540	Communication Networks [d]	3
ECE:4880	Electrical and Computer Engineering Senior Design 1 [a]	3
Focus Area: ECE elective [i]		3 - 4
Focus Area: additional elective [i]		3
	Hours	**15-16**
Spring		
GE: Approved Course Subjects [f]		3
ECE:4890	Electrical and Computer Engineering Senior Design 2 [a]	3
Focus Area: theory elective [i]		3
Focus Area: advanced computer science elective [i]		3 - 4
Focus Area: Advance ECE Course [i]		3
Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall) [k]		
	Hours	**15-16**
	Total Hours	**129-132**

a Typically this course is offered in fall and spring semesters. Check MyUI for course availability since offerings are subject to change.

b Enrollment in math courses requires completion of a placement exam.

c Enrollment in chemistry courses requires completion of a placement exam.

d Typically this course is offered in fall semesters only. Check MyUI for course availability since offerings are subject to change.

e Typically this course is offered in fall, spring, and summer sessions. Check MyUI for course availability since offerings are subject to change.

f See General Catalog for list of approved course subjects.

g Students select a course from one of two GE CLAS Core areas: Understanding Cultural Perspectives or Values and Society.

h See General Catalog for list of approved courses. Students who intend to enroll in a Be Creative course with

prerequisites must request a waiver by completing the Request Prerequisite Special Permission form on MyUI.

i   Students complete 21 semester hours of focus area courses, not required in their major, composed of: one theory elective (3 s.h.), two electrical and computer engineering courses (prefix ECE) (6 s.h.), two computer science courses (prefix CS) (6 s.h.), and two additional electives (6 s.h.). See General Catalog and Department of Electrical and Computer Engineering website for specific requirements and recommendations. Or consult an advisor for more information.

j   Typically this course is offered in spring semesters only. Check MyUI for course availability since offerings are subject to change.

k   Please see Academic Calendar, on Office of the Registrar website, for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Degree Services.