

Computer Science and Engineering, B.S.E.

The Bachelor of Science in Engineering (B.S.E.) 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. 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.

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 with a major in computer science and engineering (CSE) requires a minimum of 129 s.h. of credit. Students must have a g.p.a. of at least 2.00 on all college work used to satisfy degree requirements as well as on all work undertaken at the University of Iowa.

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; see "Focus Area Courses" below. 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 complete the B.S.E. core requirements, which include RHET:1030 Rhetoric, ENGR:1100 Introduction to Engineering Problem Solving, ENGR:1300 Introduction to Engineering Computing, and courses in chemistry, engineering mathematics and fundamentals, and physics.

They also complete the curriculum designed for their major program, which covers four major stems: mathematics and basic sciences, engineering topics, a focus area, and the General Education Component (GEC). For information about the curriculum stems, see the Bachelor of Science in Engineering, B.S.E. in the Catalog.

CSE students must complete core courses; math, science, and communication courses; required computer science and engineering program courses; a constrained program elective course; approved focus area courses; General Education Component (GEC) courses; and a two-semester capstone design sequence.

The B.S.E. with a major in computer science and engineering requires the following coursework.

Core Computing Courses

Code	Title	Hours
All of these:		
CS:1210	Computer Science I: Fundamentals	4
ENGR:1300	Introduction to Engineering Computing	3
ENGR:2730	Computers in Engineering	3

Core Engineering Courses

Code	Title	Hours
All of these:		
ENGR:1000	Engineering Success for First-Year Students	1
ENGR:1100	Introduction to Engineering Problem Solving	3
ENGR:2120	Electrical Circuits	3

Math, Science, and Communication Courses

Code	Title	Hours
All of these:		
CHEM:1110	Principles of Chemistry I	4
PHYS:1611	Introductory Physics I	4
PHYS:1612	Introductory Physics II	4
MATH:1550	Engineering Mathematics I: Single Variable Calculus	4
MATH:1560	Engineering Mathematics II: Multivariable Calculus	4
MATH:2550	Engineering Mathematics III: Matrix Algebra	2
MATH:2560	Engineering Mathematics IV: Differential Equations	3
RHET:1030	Rhetoric	4
STAT:2020	Probability and Statistics for the Engineering and Physical Sciences	3

Required Program Courses

Code	Title	Hours
All of these:		
ECE:2400	Linear Systems I	3
ECE:2410	Principles of Electronic Instrumentation	4
ECE:3000	Electrical and Computer Engineering Professional Seminar	1
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: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

Theory Elective

Code	Title	Hours
One of these:		
ECE:5330	Graph Algorithms and Combinatorial Optimization	3
ECE:5450	Machine Learning	3
ECE:5520	Introduction to Information and Coding Theories	3
ECE:5810	Formal Methods in Software Engineering	3
ECE:5995	Contemporary Topics in Electrical and Computer Engineering (when topic is cryptography)	3
CS:4330	Theory of Computation	3
CS:4350	Logic in Computer Science	3
CS:4720	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

Focus Area Courses

Students select a focus area to personalize their curriculum and to prepare them for certain jobs or research study they intend to seek. A number of areas are available, such as bioinformatics, business, medical imaging, embedded systems, and software engineering. Students also may work

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

Students complete six focus area elective courses (17 s.h.), which they select according to guidelines established by the department. For a complete list of focus areas and course selection guidelines, see Focus Areas on the Department of Electrical and Computer Engineering website.

Students who choose their focus area and General Education Component (GEC) carefully may be able to earn the Certificate in Sustainability, the Certificate in Technological Entrepreneurship, or one of several undergraduate minors offered by the University by taking minimal additional coursework beyond that required for the computer science and engineering major.

General Education Component

Students are required to take at least 15 s.h. of General Education Component (GEC) courses; see General Education Component on the College of Engineering website.

The requirements are:

Engineering Be Creative

Students complete 3 s.h. A full list of approved courses can be found on the College of Engineering GEC Options: Be Creative Course List web page.

Diversity and Inclusion

Students complete 3 s.h. They must complete 3 s.h. of coursework from the GE CLAS Core Diversity and Inclusion area.

Approved Course Subjects

Students complete 9 s.h. See the College of Engineering GEC Options: Approved Course Subjects web page.

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. The capstone design experience emphasizes teamwork, professionalism, open-ended problem solving, and the ability to work within real-world constraints and engineering standards.

Code	Title	Hours
Both of these:		
ECE:4880	Principles of Electrical and Computer Engineering Design	3
ECE:4890	Senior Electrical and Computer Engineering Design	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

B.S.E./M.S. 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 a M.S. in electrical and computer engineering. B.S.E./M.S. 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 B.S.E., and they normally complete the M.S. one year later.

To be admitted to the degree program, students must have completed at least 80 s.h., must have a cumulative g.p.a. of at least 3.25, and must submit a letter of application to the chair of the Department of Electrical and Computer Engineering. For more information, see Joint B.S./M.S. Degree on the Department of Electrical and Computer Engineering website.

B.S.E./M.C.S.

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, M.C.S. 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, television, 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. 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 an engineering career fair and other career-development programming each semester.

Engineering Career Services also offers individual advising and class presentations on résumé and cover letter preparation, job and internship search strategies, interviewing skills, and job offer evaluation.

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
First Year		
Fall		
MATH:1550	Engineering Mathematics I: Single Variable Calculus ^{a, b}	4
CHEM:1110	Principles of Chemistry I ^{c, d}	4
ENGR:1100	Introduction to Engineering Problem Solving ^e	3
ENGR:1300	Introduction to Engineering Computing ^a	3
ENGR:1000	Engineering Success for First-Year Students ^e	1
CSI:1600	Success at Iowa	0
Hours		15
Spring		
RHET:1030	Rhetoric ^c	4
PHYS:1611	Introductory Physics I ^c	4
MATH:1560	Engineering Mathematics II: Multivariable Calculus ^c	4
MATH:2550	Engineering Mathematics III: Matrix Algebra ^c	2
CS:1210	Computer Science I: Fundamentals ^c	4
Hours		18
Second Year		
Fall		
GE: Engineering Be Creative ^f		3
MATH:2560	Engineering Mathematics IV: Differential Equations ^c	3
PHYS:1612	Introductory Physics II ^a	4
ENGR:2120	Electrical Circuits ^c	3
ENGR:2730	Computers in Engineering ^a	3
Hours		16
Spring		
GE: Diversity and Inclusion ^g		3
CS:2210	Discrete Structures ^c	3
CS:2230	Computer Science II: Data Structures ^c	4
ECE:2400	Linear Systems I ^a	3
ECE:2410	Principles of Electronic Instrumentation ^a	4
Hours		17
Third Year		
Fall		
GE: Approved Course Subjects ^h		3
STAT:2020	Probability and Statistics for the Engineering and Physical Sciences ^c	3
ECE:3320	Introduction to Digital Design ^e	3
ECE:3330	Introduction to Software Design ^a	3
Elective: focus area CS course ⁱ		3
ECE:3000	Electrical and Computer Engineering Professional Seminar ^e	1
Hours		16

Spring

GE: Approved Course Subjects ^h		3
CS:3330	Algorithms ^c	3
CS:3820	Programming Language Concepts ^a	3
ECE:3350	Computer Architecture and Organization ^j	3
ECE:3360	Embedded Systems ^a	3
Elective: focus area course ⁱ		2
Hours		17

Fourth Year**Fall**

CS:3620	Operating Systems ^a	3
ECE:3540	Communication Networks ^e	3
ECE:4880	Principles of Electrical and Computer Engineering Design ^a	3
Elective: focus area ECE course ⁱ		3
Elective: focus area course ⁱ		3
Hours		15

Spring

GE: Approved Course Subjects ^h		3
ECE:4890	Senior Electrical and Computer Engineering Design ^a	3
Elective: theory course ^k		3
Elective: focus area CS course numbered 4000 or higher ⁱ		3
Elective: focus area ECE course numbered 5000 or higher ⁱ		3
Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall) ^l		
Hours		15

Total Hours	129
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- 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 Typically this course is offered in fall, spring, and summer sessions. Check MyUI for course availability since offerings are subject to change.
- d Enrollment in chemistry courses requires completion of a placement exam.
- e Typically this course is offered in fall semesters only. Check MyUI for course availability since offerings are subject to change.
- f 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. See the College of Engineering General Education Component website for more information.
- g Students select a course from the GE CLAS Core Diversity and Inclusion area.
- h A full list of approved course subjects can be found on the College of Engineering General Education Component website.
- i Focus area courses total 17 s.h. and must include 6 s.h. of elective ECE courses, including at least 3 s.h. numbered 5000 or higher; and 6 s.h. of approved CS courses, including at least 3 s.h. numbered 4000 or higher. See the electrical and computer engineering website 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 See General Catalog for list of approved courses.
- l Please see Academic Calendar, 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 Graduation Services.