

Electrical Engineering, BSE

Electrical engineers develop technologies and systems for a wide variety of applications ranging from telecommunications to medical imaging. They play a central role in the design and implementation of any technology that is powered by electricity as well as the generation and distribution of electric power. Topics covered in the electrical engineering curriculum include the design of electronic circuits, communication systems, control systems, and semiconductor devices. Students may opt to specialize in any of these areas as well as others that include electrical power generation and distribution, medical image processing, computer systems, or design of micro- and nano-scale optical and electronic devices.

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 electrical engineering program will:

- exhibit leadership and vision in contributing to the technical and policy decisions of industry, government, and research enterprises;
- demonstrate problem-solving abilities that permit them to contribute to 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 engineers and other 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 electrical engineering requires a minimum of 128 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 curriculum is built on a common core of electrical and computer engineering courses taken by all students. Beginning in their sophomore year, students select either the electrical or computer curricular track and begin taking more specialized courses. The electrical track is intended to provide a broad background in electrical engineering concepts and practice that prepares students for graduate study or electrical engineering careers in a wide range of industries and organizations. The computer track provides focus and depth for students preparing for graduate study or a career in computer hardware or software engineering. Students begin taking track and 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 electrical 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 electrical 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, Computer Track	46
Focus Area, Computer Track	27
Major Requirements, Electrical Track	49
Focus Area, Electrical Track	24

Major Requirements

Major requirements include a set of common courses (29 s.h.), required courses within one of two tracks (16 s.h. in the computer track, 19 s.h. in the electrical track), 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 (with lab)	4

Tracks

Beginning in the second year of study, students select either the electrical or computer curricular track and begin taking more specialized courses. The options for breadth and depth

courses in the focus area are in part informed by the track a student is completing; see the section titled "Focus Area."

Computer Track 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	3
CS:2230	Computer Science II: Data Structures	4
CS:3330	Algorithms	3

Electrical Track Required Courses

Course #	Title	Hours
All of these:		
ECE:3400	Linear Systems II	3
ECE:3410	Electronic Circuits	4
ECE:3500	Communication Systems	3
ECE:3600	Control Systems	3
ECE:3720	Semiconductor Devices	3
PHYS:2704	Physics IV (without lab)	3

Departmental Seminar

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

Capstone Design Courses

In their 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 electrical 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.), two technical electives that align with the focus area (at least 6 s.h.), and two additional elective courses (6 s.h.). Students completing the computer track take an additional elective course (at least 3 s.h.) in electrical and computer engineering (prefix ECE).

The options for breadth and depth courses in the focus area are in part informed by the track a student is completing—computer or electrical. 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 on the computer track 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

Students in the computer track must choose their breadth elective from the list of required electrical track courses. Students in the electrical track must choose their breadth elective from the list of required computer track courses. See the section titled "Tracks." Students in either track may instead use ECE:3540 Communication Networks as their breadth elective.

Depth Elective

The depth elective must be an advanced course, normally numbered 4000 or above, in a subject area within a student's track.

Computer Track

Options for the computer track include the following.

Course #	Title	Hours
ECE:5320/CS:5610	High Performance Computer Architecture	3
ECE:5450/IGPI:5450	Machine Learning	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	Artificial Intelligence	3

Electrical Track

Options for the electrical track include the following.

Course #	Title	Hours
ECE:5320/CS:5610	High Performance Computer Architecture	3
ECE:5410	Advanced Circuit Techniques	3
ECE:5415	Radio Frequency Electronics	3

ECE:5455	Statistical Foundations of Inference and Machine Learning	3
ECE:5480/IGPI:5480	Digital Image Processing	3
ECE:5500	Digital Communications	3
ECE:5600	Control Theory	3
ECE:5620	Electric Power Systems and Renewable Energy	3
ECE:5640/IGPI:5641	Computer-Based Control Systems	3
ECE:5700	Advanced Electromagnetic Theory	3

Advanced Electrical and Computer Engineering Electives

Students complete at least two Department of Electrical and Computer Engineering courses (prefix ECE) numbered above 5000. Specific recommendations vary based on focus area.

Additional Electives

Students select additional courses from the focus area categories or from a list of suggested electives for their specific focus area. Additional electives for students pursuing the computer track total at least 15 s.h. (typically five courses) while electrical track electives total at least 12 s.h. (typically four courses).

Students may select courses in the Department of Electrical and Computer Engineering (prefix ECE) not already taken for the major. Courses not listed here may be able to count toward the focus area requirements; students should consult an academic advisor.

While course recommendations for specific focus areas differ, the following is a list of potential elective courses for either track.

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:4040	Matrix Theory	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 Electrical Engineering/Computer Science and Engineering

Students may earn a double major in electrical engineering (EE) and computer science and engineering (CSE). 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 electrical engineering undergraduate students who intend to earn a 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 typically 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.

Career Advancement

The engineering profession is a foundation for a variety of careers in industry, medicine, law, government, and consulting. Engineering majors consistently rank among the top-paid majors for bachelor's degree graduates, according to the National Association of Colleges and Employers (NACE). Electrical engineers find employment everywhere smart technology is employed. On average, 93–98% of graduates are employed in their field of study or pursuing advanced education within seven months of graduation.

Electrical engineers 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.

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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- Computer Track [p. 4]
- Electrical Track [p. 5]

Computer Track

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 27 s.h. in elective and/or required courses. See General Catalog, the Department of Electrical and Computer Engineering website, or an advisor for more information.		
Hours		0
First Year		
Fall		
RHET:1030	Rhetoric: Writing and Communication ^a	4
MATH:1550	Engineering Calculus I ^{b, c}	4
CHEM:1110	Principles of Chemistry I ^{b, d}	4
ENGR:1100	Introduction to Engineering Problem Solving ^e	3
CSI:1600	Success at Iowa	0
Hours		15
Spring		
GE: Approved Course Subjects ^f		3
MATH:1560	Engineering Calculus II ^b	4
MATH:2550	Engineering Matrix Algebra ^b	2
PHYS:1611	Introductory Physics I ^b	4
ENGR:1300	Introduction to Engineering Computing ^b	3
Hours		16
Second Year		
Fall		
GE: Cultural Perspectives, Values, and Society ^g		3
MATH:2560	Engineering Differential Equations ^b	3
PHYS:1612	Introductory Physics II ^a	4
ENGR:2120	Electrical Circuits ^a	3
ENGR:2730	Computers in Engineering ^b	3
Hours		16
Spring		
MATH:3550	Engineering Vector Calculus ^b	3
CS:2210	Discrete Structures ^a	3
CS:2230	Computer Science II: Data Structures ^a	4

ECE:2400	Linear Systems I ^b	3
ECE:2410	Principles of Electronic Instrumentation ^b	4

Focus Area: Students fill out a focus area plan of study form by the end of their Spring semester. The form link is located on the Electrical and Computer Engineering (ECE) Undergraduate ECE Forms webpage.

Hours		17
Third Year		
Fall		
STAT:2020	Probability and Statistics for the Engineering and Physical Sciences ^b	3
CS:3330	Algorithms ^b	3
ECE:3320	Introduction to Digital Design ^e	3
ECE:3330	Introduction to Software Design ^b	3
ECE:3700	Electromagnetic Theory ^e	3
ECE:3000	Electrical and Computer Engineering Professional Seminar ^e	1
Hours		16
Spring		
GE: Engineering Be Creative ^h		3
ECE:3350	Computer Architecture and Organization ⁱ	3
ECE:3360	Embedded Systems ^b	3
Focus Area: elective ECE course ^j		3
Focus Area: technical elective ^j		3
Focus Area: additional elective ^j		3
Hours		18
Fourth Year		
Fall		
GE: Approved Course Subjects ^f		3
ECE:4880	Electrical and Computer Engineering Senior Design 1 ^b	3
Focus Area: breadth elective ^j		3
Focus Area: ECE 5000 or above course ^j		3
Focus Area: technical elective ^j		3
Hours		15
Spring		
GE: Approved Course Subjects ^f		3
ECE:4890	Electrical and Computer Engineering Senior Design 2 ^b	3
Focus Area: depth elective ^j		3
Focus Area: ECE 5000 or above course ^j		3
Focus Area: additional elective ^j		3
Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall) ^k		
Hours		15
Total Hours		128

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

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

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

- 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 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 Typically this course is offered in spring semesters only. Check MyUI for course availability since offerings are subject to change.
- j Students in the computer track complete nine focus area courses, not required in their curriculum, including: one breadth elective (3 s.h.); one depth elective (3 s.h.); two courses with prefix ECE numbered above 5000 (6 s.h.); two technical electives (6 s.h.), two additional elective courses (6 s.h.), and one ECE technical elective (3 s.h.). See General Catalog and Department of Electrical and Computer Engineering website for requirements and recommendations or consult an advisor for more information.
- 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.

Electrical Track

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 24 s.h. in elective and/or required courses. See General Catalog, the Department of Electrical and Computer Engineering website, or an advisor for more information. ^a		
Hours		0
First Year		
Fall		
RHET:1030	Rhetoric: Writing and Communication ^b	4
MATH:1550	Engineering Calculus I ^{c, d}	4
CHEM:1110	Principles of Chemistry I ^{c, e}	4
ENGR:1100	Introduction to Engineering Problem Solving ^f	3
CSI:1600	Success at Iowa	0
Hours		15
Spring		
GE: Approved Course Subjects ^g		3
MATH:1560	Engineering Calculus II ^c	4
MATH:2550	Engineering Matrix Algebra ^c	2
PHYS:1611	Introductory Physics I ^c	4
ENGR:1300	Introduction to Engineering Computing ^c	3
Hours		16

Second Year

Fall

GE: Cultural Perspectives, Values, and Society ^h		3
MATH:2560	Engineering Differential Equations ^c	3
PHYS:1612	Introductory Physics II ^c	4
ENGR:2120	Electrical Circuits ^b	3
ENGR:2730	Computers in Engineering ^c	3
Hours		16

Spring

MATH:3550	Engineering Vector Calculus ^c	3
STAT:2020	Probability and Statistics for the Engineering and Physical Sciences ^c	3
PHYS:2704	Physics IV ⁱ	3
ECE:2400	Linear Systems I ^c	3
ECE:2410	Principles of Electronic Instrumentation ^c	4

Focus Area: Students complete their focus area plan of study by the end of the Spring semester. The link is located on the Electrical and Computer Engineering (ECE) Undergraduate ECE Forms webpage.

Hours **16**

Third Year

Fall

ECE:3000	Electrical and Computer Engineering Professional Seminar ^f	1
ECE:3320	Introduction to Digital Design ^f	3
ECE:3400	Linear Systems II ^f	3
ECE:3410	Electronic Circuits ^f	4
ECE:3700	Electromagnetic Theory ^f	3
Focus Area: technical elective ^j		3

Hours **17**

Spring

GE: Engineering Be Creative ^k		3
ECE:3360	Embedded Systems ^c	3
ECE:3500	Communication Systems ⁱ	3
ECE:3600	Control Systems ⁱ	3
ECE:3720	Semiconductor Devices ⁱ	3
Focus Area: additional elective ^j		3

Hours **18**

Fourth Year

Fall

GE: Approved Course Subjects ^g		3
ECE:4880	Electrical and Computer Engineering Senior Design 1 ^c	3
Focus Area: ECE 5000 or above course ^j		3
Focus Area: technical elective ^j		3
Focus Area: breadth elective ^j		3

Hours **15**

Spring

GE: Approved Course Subjects ^g		3
ECE:4890	Electrical and Computer Engineering Senior Design 2 ^c	3
Focus Area: ECE 5000 or above course ^j		3
Focus Area: additional elective ^j		3
Focus Area: depth elective ^j		3

Degree Application: apply on MyUI before deadline
(typically in February for spring, September for fall) ^l

Hours	15
Total Hours	128

- a Students in the electrical track complete eight focus area courses including: one breadth elective (3 s.h.); one depth elective (3 s.h.); two courses with prefix ECE numbered above 5000 (6 s.h.); two technical electives (6 s.h.); and two additional elective courses (at least 6 s.h.). See General Catalog and Department of Electrical and Computer Engineering website or consult an advisor for more information.
- b Typically this course is offered in fall, spring, and summer sessions. Check MyUI for course availability since offerings are subject to change.
- c Typically this course is offered in fall and spring semesters. Check MyUI for course availability since offerings are subject to change.
- d Enrollment in math courses requires completion of a placement exam.
- e Enrollment in chemistry courses requires completion of a placement exam.
- f Typically this course is offered in fall semesters only. Check MyUI for course availability since offerings are subject to change.
- g See General Catalog for list of approved course subjects.
- h Students select a course from one of two GE CLAS Core areas: Understanding Cultural Perspectives or Values and Society.
- i Typically this course is offered in spring semesters only. Check MyUI for course availability since offerings are subject to change.
- j Students in the electrical track complete eight focus area courses including: one breadth elective (3 s.h.); one depth elective (3 s.h.); two courses with prefix ECE numbered above 5000 (6 s.h.); two technical electives (6 s.h.); and two additional elective courses (at least 6 s.h.). See General Catalog and Department of Electrical and Computer Engineering website for requirements and recommendations or consult an advisor for more information.
- k 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.
- l 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.