ELECTRICAL ENGINEERING - BACHELOR OF SCIENCE (BSEE)

A degree in electrical engineering provides the opportunity to enter the profession of engineering and to engage in work as a design, production, testing, consulting, research, teaching or management professional in a wide variety of careers in the computer industry, embedded systems, telecommunications, instruments, the power and renewable energy industry, the biomedical industry, aerospace and academia. Some graduates also go on to develop careers in other professions like law and medicine.

Examples of career opportunities include development of new electrical or electronic devices, instruments or products; design of equipment or systems; production and quality control of electrical products for private industry or government; sales or management for a private firm or government; and teaching and research in a university.

Requirements

Required courses in engineering, physical science, and mathematics are interwoven throughout the curriculum to provide a balanced education in the fundamentals of the electrical engineering profession. The core courses are complemented by technical electives, humanities and social sciences electives, free electives, and a writing course, for a total of 128 credits required for the degree.

Prerequisites and Passing Grades

The Electrical, Computer and Energy Engineering Department reserves the right to drop students enrolled in ECEN courses who have not met the minimum prerequisite requirements. It is the student's responsibility to communicate with the department if summer coursework and/or transfer credit will be used to meet the prerequisite requirement.

All courses must be taken for a letter grade. The minimum passing grade for a course that is a prerequisite or corequisite for another required course is C-. If a grade of D+ or lower is received in a course which is a prerequisite to another, the student may not register for the subsequent course until the first grade has been raised to a C- or higher. If a grade of D+ or lower is received in a course which is a corequisite to another, the course must be repeated until a grade of C- or higher is achieved. ECEN 4610 Capstone Laboratory Part 1 and ECEN 4620 Capstone Lab, Part 2 both require a grade of C- or better for graduation.

The minimum passing grade for a course that is not specifically a prerequisite or corequisite for another required course is D-.

Required Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humanites, Social Sciences and Writing</td>
<td>Complete the College's Humanities, Social Sciences and Writing requirements</td>
<td>18</td>
</tr>
<tr>
<td>Math and Science</td>
<td>APPM 1350 Calculus 1 for Engineers</td>
<td>4</td>
</tr>
</tbody>
</table>

Electrical Engineering

ECEN 1100 Exploring ECE 1
or AREN 1316 Introduction to Architectural Engineering
or CVEN 1317 Introduction to Civil and Environmental Engineering
ECEN 1400 Introduction to Digital and Analog Electronics
or GEEN 1400 Engineering Projects
or ASEN 1400 Gateway to Space
ECEN 1310 C Programming for ECE 4
or CSCI 1300 Computer Science 1: Starting Computing
ECEN 2310 Programming with Mathematical Software 1
ECEN 2250 Introduction to Circuits and Electronics 3
ECEN 2260 Circuits as Systems 3
ECEN 2270 Electronics Design Lab 3
ECEN 2350 Digital Logic 3
ECEN 2370 Embedded Software Engineering 3
ECEN 2360 Programming Digital Systems 3
ECEN 3250 Microelectronics 3
ECEN 3300 Linear Systems 3
ECEN 3400 Electromagnetic Fields and Waves 3
ECEN 4610 Capstone Laboratory Part 1 3
ECEN 4620 Capstone Lab, Part 2 3

Sophomore Elective

Choose two from:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>ECEN 2410 Renewable Sources and Efficient Electrical Energy Systems</td>
<td>3</td>
<td></td>
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</tbody>
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General Science Elective
Choose from:

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>PHYS 2130 General Physics 3</td>
<td>4</td>
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<tr>
<td>or PHYS 217 Foundations of Modern Physics</td>
<td>4</td>
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<tr>
<td>EBIO 1210 General Biology 1 (With or without EBIO 1230 General Bio. Lab)</td>
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<tr>
<td>MCDB 1150 Introduction to Cellular and Molecular Biology</td>
<td>4</td>
<td></td>
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<tr>
<td>IPHY 3410 Human Anatomy</td>
<td>4</td>
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<tr>
<td>CHEN 1211 Accelerated Chemistry for Engineers (With or without CHEM 1221 General Chem. Lab)</td>
<td>4</td>
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Math and Science

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPM 1350 Calculus 1 for Engineers</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

or MATH 1300 Calculus 1
APPM 1360 Calculus 2 for Engineers 4
or MATH 2300 Calculus 2
APPM 2360 Introduction to Differential Equations with Linear Algebra 4
APPM 2350 Calculus 3 for Engineers 4
or MATH 2400 Calculus 3
ECEN 3810 Introduction to Probability Theory 3
or STAT 3100 Applied Probability
or MATH 4510 Introduction to Probability Theory
or APPM 3570 Applied Probability

PHYS 1110 General Physics 1 4
or PHYS 1115 General Physics 1 for Majors
PHYS 1120 General Physics 2 4
or PHYS 1125 General Physics 2 for Majors
PHYS 1140 Experimental Physics 1 1
## Sample Four-Year Plan of Study: Electrical Engineering

The following information represents a sample 8-semester sequence of study only. Up-to-date curricular information and policies can be found on the ECEE Advising website (https://www.colorado.edu/ecee/undergraduate-program/advising).

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td><strong>Year One</strong></td>
<td></td>
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<tr>
<td><strong>Fall Semester</strong></td>
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<tr>
<td>ECEN 1100</td>
<td>Exploring ECE</td>
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<tr>
<td>ECEN 1400</td>
<td>Introduction to Digital and Analog Electronics</td>
<td>3</td>
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<tr>
<td>APPM 1350</td>
<td>Calculus 1 for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 1110</td>
<td>General Physics 1</td>
<td>4</td>
</tr>
<tr>
<td>Humanities/Social Sciences Elective (1)</td>
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</tr>
<tr>
<td><strong>Credit Hours</strong></td>
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<td>15</td>
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<tr>
<td><strong>Spring Semester</strong></td>
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<td></td>
</tr>
<tr>
<td>ECEN 1310</td>
<td>C Programming for ECE</td>
<td>4</td>
</tr>
<tr>
<td>APPM 1360</td>
<td>Calculus 2 for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 1120</td>
<td>General Physics 2</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 1140</td>
<td>Experimental Physics 1</td>
<td>1</td>
</tr>
<tr>
<td>Humanities/Social Sciences Elective (1)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Credit Hours</strong></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td><strong>Year Two</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fall Semester</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECEN 2310</td>
<td>Programming with Mathematical Software</td>
<td>1</td>
</tr>
<tr>
<td>ECEN 2250</td>
<td>Introduction to Circuits and Electronics</td>
<td>3</td>
</tr>
</tbody>
</table>
| APPM 2360    | Introduction to Differential Equations with Linear Algebra | 4
| ECEN 2350    | Digital Logic                               | 3            |
| ECEN 24XX Sophomore Elective \#1 \(3\) | 3 | |
| Humanities/Social Sciences Elective \(1\) | 3 | |
| **Credit Hours** |                                   | 17           |
| **Spring Semester** |                                |  | |
| ECEN 2260    | Circuits as Systems                         | 3            |
| ECEN 2270    | Electronics Design Lab                      | 3            |
| APPM 2350    | Calculus 3 for Engineers                    | 4            |
| ECEN 2360    | Programming Digital Systems                 | 3            |
| ECEN 24XX Sophomore Elective \#2 \(3\) | 3 | |
| **Credit Hours** |                                   | 16           |
| **Year Three** |                                            |              |
| **Fall Semester** |                                |  | |
| ECEN 2370    | Embedded Software Engineering                | 3            |
| ECEN 3810    | Introduction to Probability Theory           | 3            |
| ECEN 3XXX Advanced Analog Core \#1 \(5\) | 3 | |
| ECEN 3XXX Advanced Analog Core \#2 \(5\) | 3 | |
| General Science Elective \(4\) | 3 | |
| **Credit Hours** |                                   | 15           |
| **Spring Semester** |                                |  | |
| ECEN 3XXX Advanced Analog Core \#3 \(5\) | 3 | |
| Technical Elective \(6\) | 3 | |
| Technical Elective \(7\) | 3 | |
| Technical Elective \(8\) | 3 | |
| College-approved writing course \(2\) | 3 | |
| Free elective | 3 | |
| **Credit Hours** |                                   | 18           |
| **Year Four** |                                            |              |
| **Fall Semester** |                                |  | |
| ECEN 4610    | Capstone Laboratory Part 1                  | 3            |
| Advanced Concentration Elective \#1 \(6\) | 3 | |
| Advanced Concentration Elective \#2 \(6\) | 3 | |
| Humanities/Social Science Elective (Upper Division) \(1\) | 3 | |
| Free Elective | 4 | |
| **Credit Hours** |                                   | 15           |
| **Spring Semester** |                                |  | |
| ECEN 4620    | Capstone Lab, Part 2                        | 3            |
| Advanced Concentration Elective \#3 \(6\) | 3 | |
| Advanced Concentration Elective \#4 \(6\) | 3 | |
| Technical Elective \(6\) | 3 | |
| Humanities/Social Sciences Elective (Upper Division) \(1\) | 3 | |
| **Credit Hours** |                                   | 15           |
| **Total Credit Hours** |                             | 128         |

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1. View the College's Humanities, Social Sciences and Writing requirements (https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements) webpage for more information.

2. Students may choose a course from the list of college-approved humanities and social sciences (HSS) electives (http://www.colorado.edu/engineering/academics/policies/hss).

3. Students may choose from ECEN 2410, ECEN 2420, or ECEN 2440. Additional Special Topics courses may also be approved at the department's discretion.

4. Students may choose from the following: PHYS 2130, EBIO 1210, MCDB 1150, IPHY 3410, or CHEN 1211 with or without CHEM 1221.

5. The three options for Advanced Analog Core courses are ECEN 3250, ECEN 3300 and ECEN 3400.
The electrical engineering curriculum is designed to prepare graduates to study:

During the first several years after completion of their baccalaureate studies:

- Graduates will be situated in growing careers involving the design, development or support of electrical or electronic systems, devices, instruments, or products, or will be successfully pursuing an advanced degree.
- Graduates will have advanced in professional standing based on their technical accomplishments and will have accumulated additional technical expertise to remain globally competitive.
- Graduates will have demonstrated professional and personal leadership and growth.

The electrical engineering curriculum is designed to prepare graduates to meet these objectives as follows:

- Graduates will be situated in growing careers involving the design, development or support of electrical or electronic systems, devices, instruments, or products, or will be successfully pursuing an advanced degree.
  - Graduates attaining the electrical engineering degree will have comprehensive knowledge and experience in the concepts and design of electrical and electronic devices, circuits and systems. This is achieved through a sequence of required courses in these areas, culminating in a major design project incorporating realistic engineering constraints. Moreover, graduates will have advanced, specialized knowledge and skills in elective areas such as communications and digital signal processing, control systems, analog and digital integrated circuit design, semiconductor devices and optoelectronics, electromagnetics and wireless systems, power electronics and renewable energy, bioelectronics and digital systems.
  - Electrical engineering graduates will have attained other professional skills that will be useful throughout their careers, including verbal and written communication and the ability to function on multi-disciplinary teams.
- The electrical engineering curriculum is rich in laboratory work. Graduates will have achieved extensive practical experience in the laboratory techniques, tools and skills that provide a bridge between theory and practice.
- Graduates will have advanced in professional standing based on their technical accomplishments and will have accumulated additional technical expertise to remain globally competitive.
  - Electrical engineering graduates experience a curriculum that contains a broad core of classes focused on mathematical and physical principles that are fundamental to the field of electrical engineering. Hence, they understand the physical and mathematical principles underlying electrical and electronic technology, and are able to analyze and solve electrical engineering problems using this knowledge. In addition to basic classes in mathematics, science and computing, the electrical engineering curriculum includes a sequence of courses in analog and digital electronic circuits and systems and electromagnetic fields.
  - Graduates will have demonstrated professional and personal leadership and growth.

Upon graduation, students are expected to be able to:

- Identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics.
- Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors.
- Communicate effectively with a range of audiences.
- Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts.
- Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.
- Develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions.
- Acquire and apply new knowledge as needed, using appropriate learning strategies.

**Bachelor’s–Accelerated Master’s Degree Program(s)**

The Bachelor’s–Accelerated Master’s (BAM) degree program options offer currently enrolled CU Boulder undergraduate students the opportunity to receive a bachelor’s and master’s degree in a shorter period of time. Students receive the bachelor’s degree first, but begin taking graduate coursework as undergraduates (typically in their senior year). Because some courses are allowed to double count for both the bachelor’s and the master’s degrees, students receive a master’s degree in less time and at a lower cost than if they were to enroll in a stand-alone master’s degree program after completion of their baccalaureate degree. In addition, staying at CU Boulder to pursue a bachelor’s–accelerated master’s program enables students to continue working with their established faculty mentors.

**Admissions Requirements**

**BS and MS in Electrical Engineering**

In order to gain admission to the BAM program named above, a student must meet the following criteria:
Electrical Engineering - Bachelor of Science (BSEE)

- Have a cumulative GPA of 3.250 or higher and a minimum GPA of 3.25 in ECEN courses
- Have completed 9–10 core ECEN courses (for more information, see the BAM degree (https://www.colorado.edu/ecee/undergraduate-program/degrees/bs-ms-degrees) website)
- Have at least junior class standing
- Transfer students must have completed a minimum of 24 credit hours at CU Boulder

BS in Electrical Engineering, MS in Technology, Cybersecurity and Policy
In order to gain admission to the BAM program named above, a student must meet the following criteria:

- Have a cumulative GPA of 3.250 or higher
- Have a major GPA of 3.25 or higher
- Have at least junior class standing

Program Requirements (for both programs above)
Students may take up to and including 12 hours while in the undergraduate program which can later be used toward the master’s degree. However, only six credits of coursework may be double counted toward the bachelor’s degree and the master’s degree. Students must apply to graduate with the bachelor’s degree, and apply to continue with the master’s degree, early in the semester in which the undergraduate requirements will be completed.

Please see the Electrical Engineering/Electrical Engineering BAM degree program (https://www.colorado.edu/ecee/undergraduate-program/degrees/bs-ms-degrees) or Electrical Engineering/TCP BAM degree program (https://www.colorado.edu/itp/current-students/undergraduate/bsms-degree) webpages for more information.