ELECTRICAL AND COMPUTER ENGINEERING - BACHELOR OF SCIENCE (BSEC)

A degree in electrical and computer engineering provides graduates 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.

Colorado Mesa University/University of Colorado Boulder Partnership Program (Electrical & Computer Engineering)

Colorado Mesa University (CMU) (http://www.coloradomesa.edu/engineering/) and CU Boulder have created a partnership to deliver specific engineering baccalaureate programs in their entirety in Grand Junction, Colorado. The first two years of coursework are taught by CMU faculty and the second two years of coursework are taught by CU Boulder faculty located in Grand Junction. Students completing the programs will be awarded a Bachelor of Science from CU Boulder.

Degrees are offered in mechanical engineering, civil engineering, and electrical & computer engineering, with additional details on the partnership website (https://www.coloradomesa.edu/engineering/partnership-program/).

Coursework requirements and plans of study specific to this partnership can be found on the Colorado Mesa University electrical and computer engineering partnership website (https://www.coloradomesa.edu/engineering/degrees/electrical_computer-engineering-partnership.html). Learn more about this program on the CU Boulder partnership website (https://www.colorado.edu/academics/cmu-cu-boulder-bs-electrical-computer-engineering/).

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 (http://www.colorado.edu/engineering/academics/policies/hss/), free electives, and a writing course (http://www.colorado.edu/engineering/academics/policies/hss/), for a total of 128 credits required for the degree. Electrical and computer engineering is also offered in partnership with Colorado Mesa University (https://www.coloradomesa.edu/engineering/partnership-program/) in Grand Junction, Colorado. Specific coursework requirements and plans of study can be found on the partnership website (https://www.coloradomesa.edu/engineering/degrees/electrical_computer-engineering-partnership.html).

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>
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<tbody>
<tr>
<td>EBIO 1210</td>
<td>General Biology 1</td>
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<tr>
<td>PHYS 1110</td>
<td>General Physics 1</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>PHYS 2130</td>
<td>General Physics 3</td>
<td></td>
</tr>
<tr>
<td>PHYS 2170</td>
<td>Foundations of Modern Physics</td>
<td></td>
</tr>
<tr>
<td>APPM 1345</td>
<td>Introduction to Differential Equations with Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>APPM 2350</td>
<td>Calculus 3 for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>APPM 2360</td>
<td>Introduction to Probability Theory</td>
<td>3</td>
</tr>
<tr>
<td>APPM 2360</td>
<td>Calculus 2 for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>EBIO 1210</td>
<td>General Biology 1</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 2130</td>
<td>General Physics 3</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 2170</td>
<td>Foundations of Modern Physics</td>
<td>1</td>
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<tr>
<td>INTRO 3010</td>
<td>General Science Elective</td>
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<tr>
<td>PHYS 1110</td>
<td>General Physics 1</td>
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<tr>
<td>PHYS 1120</td>
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<tr>
<td>PHYS 2130</td>
<td>General Physics 3</td>
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<tr>
<td>PHYS 2170</td>
<td>Foundations of Modern Physics</td>
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<tr>
<td>EBIO 1210</td>
<td>General Biology 1</td>
<td>1</td>
</tr>
</tbody>
</table>
### Electrical and Computer Engineering - Bachelor of Science (BSEC)

- **MCDB 1150** Introduction to Cellular and Molecular Biology
- **IPHY 3410** Human Anatomy
- **CHEN 1211** Accelerated Chemistry for Engineers
  - or **CHEN 1201** General Chemistry for Engineers 1
  - or **CHEM 1113** General Chemistry 1

#### Electrical & Computer Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECEN 1100</td>
<td>Exploring ECE</td>
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</tr>
<tr>
<td>or AREN 1316</td>
<td>Introduction to Architectural Engineering</td>
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</tr>
<tr>
<td>or ASEN 1000</td>
<td>Introduction to Aerospace Engineering Sciences</td>
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<tr>
<td>or BMEN 1000</td>
<td>Exploring Biomedical Engineering</td>
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</tr>
<tr>
<td>or CHEN 1300</td>
<td>Introduction to Chemical Engineering</td>
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<tr>
<td>or COEN 1500</td>
<td>CEAS Design Lab: Engineering Your Life</td>
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<tr>
<td>or CSCI 1000</td>
<td>Computer Science as a Field of Work and Study</td>
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</tr>
<tr>
<td>or CVEN 1317</td>
<td>Introduction to Civil and Environmental Engineering</td>
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</tr>
<tr>
<td>or EVEN 1000</td>
<td>Introduction to Environmental Engineering</td>
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<tr>
<td>ECEN 1400</td>
<td>Introduction to Digital and Analog Electronics</td>
<td>3</td>
</tr>
<tr>
<td>or GEEN 1400</td>
<td>Engineering Projects</td>
<td></td>
</tr>
<tr>
<td>or ASEN 1400</td>
<td>Gateway to Space</td>
<td></td>
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<tr>
<td>or ASEN 1403</td>
<td>Introduction to Rocket Engineering</td>
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<tr>
<td>ECEN 1310</td>
<td>C Programming for ECE</td>
<td>4</td>
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<tr>
<td>or CSCI 1300</td>
<td>Computer Science 1: Starting Computing</td>
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<tr>
<td>ECEN 2310</td>
<td>Programming with Mathematical Software</td>
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<tr>
<td>ECEN 2703</td>
<td>Discrete Mathematics for Computer Engineers</td>
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<tr>
<td>or APPM 3170</td>
<td>Discrete Applied Mathematics</td>
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<tr>
<td>or MATH 2001</td>
<td>Introduction to Discrete Mathematics</td>
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<tr>
<td>or CSCI 2824</td>
<td>Discrete Structures</td>
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<tr>
<td>CSCI 2270</td>
<td>Computer Science 2: Data Structures</td>
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<tr>
<td>ECEN 2250</td>
<td>Introduction to Circuits and Electronics</td>
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<tr>
<td>ECEN 2260</td>
<td>Circuits as Systems</td>
<td>3</td>
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<tr>
<td>ECEN 2270</td>
<td>Electronics Design Lab</td>
<td>3</td>
</tr>
<tr>
<td>ECEN 2350</td>
<td>Digital Logic</td>
<td>3</td>
</tr>
<tr>
<td>ECEN 2370</td>
<td>Embedded Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ECEN 2360</td>
<td>Programming Digital Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECEN 3753</td>
<td>Real-Time Operating Systems</td>
<td>3</td>
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<tr>
<td>ECEN 3593</td>
<td>Computer Organization</td>
<td>3</td>
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<tr>
<td>or ECEN 5593</td>
<td>Advanced Computer Architecture</td>
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<tr>
<td>ECEN 4610</td>
<td>Capstone Laboratory Part 1</td>
<td>3</td>
</tr>
<tr>
<td>ECEN 4620</td>
<td>Capstone Lab, Part 2</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Sophomore Elective

Choose one from:

- **ECEN 2410** Renewable Sources and Efficient Electrical Energy Systems
- **ECEN 2420** Electronics for Wireless Systems
- **ECEN 2440** Application of Embedded Systems

#### Advanced Analog Core

Choose one from:

- **ECEN 3250** Microelectronics
- **ECEN 3300** Linear Systems

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECEN 3400</td>
<td>Electromagnetic Fields and Waves</td>
<td></td>
</tr>
</tbody>
</table>

#### Software Elective

Choose one from:

- **ECEN 4033** Special Topics (Special Topics: Cryptocurrency Security)
- **ECEN 4133** Fundamentals of Computer Security
- **ECEN 4313** Concurrent Programming
- **ECEN 4322** Data and Network Science
- **ECEN 4553** Compiler Construction
- **CSCI 3002** Fundamentals of Human Computer Interaction
- **CSCI 3104** Algorithms
- **CSCI 3287** Design and Analysis of Database Systems
- **CSCI 3302** Introduction to Robotics
- **CSCI 3308** Software Development Methods and Tools
- **CSCI 3753** Design and Analysis of Operating Systems
- **CSCI 4113** Linux System Administration
- **CSCI 4229** Computer Graphics
- **CSCI 4253** Datacenter Scale Computing - Methods, Systems and Techniques
- **CSCI 4273** Network Systems
- **CSCI 4446** Chaotic Dynamics

#### Additional Electives

- Advanced concentration electives, two courses required
- Technical electives
- Free electives

1. Complete the College’s Humanities, Social Sciences and Writing requirements.
2. See the ECEE Advising website for additional information on course options.
3. Six credit hours of free electives can be used towards graduation requirements.

### Recommended Four-Year Plan of Study

The following information represents a sample eight-semester sequence of study only. Up-to-date curricular information and policies can be found on the ECEE Advising website.

#### Course  | Title                                                        | Credit Hours |
------------|--------------------------------------------------------------|--------------|
**Year One** |                                                              |              |
**Fall Semester** |                                                              |              |
APPM 1350  | Calculus 1 for Engineers                                     | 4            |
ECEN 1100  | Exploring ECE                                               | 1            |
ECEN 1400  | Introduction to Digital and Analog Electronics               | 3            |
PHYS 1110  | General Physics 1                                            | 4            |

**Year Two** |                                                              |              |
**Fall Semester** |                                                              |              |
ECEN 2310  | Programming with Mathematical Software                      |              |
ECEN 2703  | Discrete Mathematics for Computer Engineers                 |              |
CSCI 2270  | Computer Science 2: Data Structures                         |              |
ECEN 2250  | Introduction to Circuits and Electronics                    |              |
ECEN 2260  | Circuits as Systems                                         |              |
ECEN 2270  | Electronics Design Lab                                      |              |
ECEN 2350  | Digital Logic                                               |              |
ECEN 2370  | Embedded Software Engineering                               |              |
ECEN 2360  | Programming Digital Systems                                 |              |
ECEN 3753  | Real-Time Operating Systems                                 |              |
ECEN 3593  | Computer Organization                                      |              |
ECEN 4610  | Capstone Laboratory Part 1                                  |              |
ECEN 4620  | Capstone Lab, Part 2                                        |              |

**Recommended Four-Year Plan of Study**

The following information represents a sample eight-semester sequence of study only. Up-to-date curricular information and policies can be found on the ECEE Advising website.
Humanities/social sciences elective ³ 3

Spring Semester
APPM 1360 Calculus 2 for Engineers 4
ECEN 1310 C Programming for ECE 4
ECEN 2350 Digital Logic 3
PHYS 1120 General Physics 2 4
PHYS 1140 Experimental Physics 1 1

Credit Hours 15

Year Four
Fall Semester
ECEN 4610 Capstone Laboratory Part 1 3
Advanced Concentration Elective #1 ³ 3
Technical Elective ⁶ 3
Free Elective 3
Humanities/Social Sciences Elective (Upper Division) ¹ 3

Credit Hours 15

Spring Semester
ECEN 4620 Capstone Lab, Part 2 3
Advanced Concentration Elective #² ⁶ 3
Humanities/Social Sciences Elective (Upper Division) ¹ 3
Technical Elective ⁶ 3
Software Elective ⁶ 3

Credit Hours 15

Total Credit Hours 128

¹ Students may choose courses from the list of college-approved humanities and social sciences (HSS) electives (https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements/).
² Students may choose a course from the list of college-approved writing courses (https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements/).
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, MCB 1150, PHY 3410, CHEN 1201 or CHEN 1211.
⁵ The three options for Advanced Analog Core courses are ECEN 3250, ECEN 3300 and ECEN 3400.
⁶ See the ECEE Advising website (https://www.colorado.edu/ecee/undergraduate-program/advising/) for additional information on course options.

Program Educational Objectives

The following set of program objectives for the Electrical and Computer Engineering program was developed by our faculty and our other stakeholders.

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

- ECE-1: Graduates will be situated in growing careers involving the design, development or support of electrical, electronic, and computer hardware and software systems, software engineering, devices, instruments, or products, or will be successfully pursing an advanced degree.
- ECE-2: Graduates will have advanced in professional standing based on their technical accomplishments and will have accumulated additional technical expertise to remain globally competitive.
- ECE-3: Graduates will have demonstrated professional and personal leadership and growth.

The EE curriculum is designed to prepare our graduates to meet these objectives as follows:

- ECE-1: Graduates will be situated in growing careers involving the design, development or support of electrical, electronic, and computer hardware and software systems, software engineering, devices, instruments, or products, or will be successfully pursing an advanced degree.

Graduates attaining the ECE degree will have comprehensive knowledge and experience in the concepts and design of electrical, electronic, and computer devices, circuits, and systems. Besides emphasizing computer hardware and software, the ECE curriculum
also emphasizes design, integration, and application of computer systems, as well as experience in software development. This is achieved through a sequence of required courses in these areas, culminating in a major design project incorporating realistic engineering constraints. The curriculum also provides opportunities for specialization in areas such as compiler design, embedded systems, software engineering, and VLSI design, as well as in the electrical engineering specialties.

ECE 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 ECE curriculum is rich in laboratory work. ECE graduates will have achieved extensive practical experience in the laboratory techniques, tools, and skills that provide a bridge between theory and practice.

- ECE-2: Graduates will have advanced in professional standing based on their technical accomplishments and will have accumulated additional technical expertise to remain globally competitive.

ECE graduates experience a curriculum that contains a broad core of classes focused on mathematical and physical principles that are fundamental to the fields of electrical and computer engineering. Hence, they understand the physical and mathematical principles underlying electrical and electronic technology and computer systems and are able to analyze and solve electrical and computer engineering problems using this knowledge. In addition to basic classes in mathematics, science, and computing, the ECE curriculum includes a sequence of courses in analog and digital electronic circuits and systems, and electromagnetic fields, probability, computer software, and computer design and architecture.

- ECE-3: Graduates will have demonstrated professional and personal leadership and growth.

To lay the foundation for a long career in a rapidly changing field, a broad background of fundamental knowledge is required. This is achieved in the ECE curriculum through a sequence of required classes in mathematics, physics, chemistry, and the ECE core. In addition, the graduate must be capable of lifelong learning; this is taught through assignments and projects that require independent research and study.

The curriculum includes a significant component of electives in the humanities and social sciences. ECE graduates will have knowledge of the broader contemporary issues that impact engineering solutions in a global and societal context. They will have the verbal and written communications skills necessary for a successful career in industry or academia. Graduates also understand the meaning and importance of professional and ethical responsibility.

Student Outcomes
The ECE curriculum is designed to prepare our graduates to meet these as follows:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics
- An ability to 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
- An ability to communicate effectively with a range of audiences
- An ability to 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
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to 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 in Electrical and Computer Engineering, MS in Electrical Engineering
In order to gain admission to the BAM program named above, a student must meet the following criteria:

- Have a cumulative GPA of 3.000 or higher
- Complete all prerequisite courses with a minimum grade of solid B for 500-level coursework taken as an undergraduate student; minimum of solid C for undergraduate coursework
- Have completed 9-10 core ECEN courses (see BAM degree (https://www.colorado.edu/ecee/undergraduate-program/degrees/bs-ms-degrees/) website for more information)
- Have at least junior class standing
- Completion of all MAPS requirements and no deficiencies remaining
- Transfer students must have completed a minimum of 24 credit hours at CU Boulder

BS in Electrical and Computer 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 3.000 or higher
- Minimum grade of B in pre-requisite courses
- Have at least junior class standing
- Completion of all MAPS requirements and no deficiencies remaining
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 6 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 & Computer Engineering/Electrical Engineering BAM degree program (https://www.colorado.edu/ecce/undergraduate-program/degrees/bs-ms-degrees/) or Electrical & Computer Engineering/TCP BAM degree program (https://www.colorado.edu/itp/current-students/undergraduate/bsms-degree/) web pages for more information.