

# COMPUTER ENGINEERING, BSE

**Degree:** Bachelor of Science in Engineering (BSE)

**Major:** Computer Engineering

## Program Overview

The Bachelor of Science in Engineering degree program with a major in Computer Engineering is designed to give a student a strong background in the fundamentals of computer engineering through combined classroom and laboratory work. A graduate of this program will be able to use these fundamentals to analyze and evaluate computer systems, both hardware and software. A computer engineering graduate would also be able to design and implement a computer system for general purpose or embedded computing incorporating state-of-the-art solutions to a variety of computing problems. This includes systems which have both hardware and software components, whose design requires a well-defined interface between the two and the evaluation of the associated trade-offs.

Many courses have integral or associated laboratories in which students gain "hands-on" experience with computer engineering principles and instrumentation. Students have ready access to the teaching laboratory facilities and are encouraged to use them during non-scheduled hours in addition to the regularly scheduled laboratory sessions. Opportunities also exist for undergraduate student participation in the wide spectrum of research projects being conducted in the department.

The Bachelor of Science in Engineering degree program with a major in Computer Engineering is accredited by the Engineering Accreditation Commission of ABET, under the commission's General Criteria and Program Criteria for Electrical, Computer, Communications, Telecommunication(s), and Similarly Named Engineering Programs.

## Mission

The educational mission of the computer engineering program is to graduate students who have fundamental technical knowledge of their profession along with requisite technical breadth and communications skills to become leaders in creating the new techniques and technologies which will advance the general field of computer engineering. Core courses provide our students with a strong background in digital systems design, computer organization, hardware architecture, and digital electronics.

## Program Educational Objectives

- Graduates will be successful professionals obtaining positions appropriate to their background, interests, and education.
- Graduates will engage in life-long learning to improve and enhance their professional skills.
- Graduates will demonstrate leadership in their profession by using their knowledge, communication skills, and engineering ability.

## Learning Outcomes

As preparation for achieving the above educational objectives, the Bachelor of Science in Engineering degree program with a major in Computer Engineering is designed so that students attain:

- 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.

## Co-op and Internship Programs

Opportunities are available for students to alternate studies with work in industry or government as a co-op student, which involves paid full-time employment over seven months (one semester and one summer). Students may work in one or two co-ops, beginning in the third year of study. Co-ops provide students the opportunity to gain valuable hands-on experience in their field by completing a significant engineering project while receiving professional mentoring. During a co-op placement, students do not pay tuition but maintain their full-time student status while earning a salary. Alternatively or additionally, students may obtain employment as summer interns.

## Undergraduate Policies

For undergraduate policies and procedures, please review the Undergraduate Academics section of the General Bulletin.

## Accelerated Master's Programs

Undergraduate students may participate in accelerated programs toward graduate or professional degrees. For more information and details of the policies and procedures related to accelerated studies, please visit the Undergraduate Academics section of the General Bulletin.

## Combined Bachelor's/Master's Program in Computer Engineering

The department encourages highly motivated and qualified students to apply for admission to the Combined Bachelor's/Master's Program in the junior year. This integrated program permits up to 9 credit hours of graduate level coursework to be counted towards both BS and MS degree requirements (including an option to substitute 3 credit hours of MS thesis work for ECSE 399). It also offers the opportunity to complete both the Bachelor of Science in Engineering and Master of Science degrees within five years.

## Program Requirements

Students seeking to complete this major and degree program must meet the general requirements for bachelor's degrees and the Unified General Education Requirements. Students completing

this program as a secondary major while completing another undergraduate degree program do not need to satisfy the school-specific requirements associated with this major.

### Required Courses:

Code	Title	Credit Hours
<b>Required Mathematics, Science and Engineering Courses:</b>		
MATH 121	Calculus for Science and Engineering I	4
MATH 122	Calculus for Science and Engineering II	4
or MATH 124	Calculus II	
MATH 223	Calculus for Science and Engineering III	3
or MATH 227	Calculus III	
MATH 224	Elementary Differential Equations	3
or MATH 228	Differential Equations	
PHYS 121	General Physics I - Mechanics	4
or PHYS 123	Physics and Frontiers I - Mechanics	
PHYS 122	General Physics II - Electricity and Magnetism	4
or PHYS 124	Physics and Frontiers II - Electricity and Magnetism	
CHEM 111	Principles of Chemistry for Engineers	4
ENGR 130	Foundations of Engineering and Programming	3
ENGR 145	Chemistry of Materials	4
ENGR 210	Introduction to Circuits and Instrumentation	4
ENGR 399	Impact of Engineering on Society	3

Code	Title	Credit Hours
<b>Major Requirements:</b>		
ECSE 132	Programming in Java	3
ECSE 233	Introduction to Data Structures	4
ECSE 281	Logic Design and Computer Organization	4
ECSE 301	Digital Logic Laboratory	2
ECSE 302	Discrete Mathematics	3
ECSE 303	Embedded Systems Design and Laboratory	3
ECSE 314	Computer Architecture	3
ECSE 315	Digital Systems Design	4
ECSE 318	VLSI/CAD	4
ENGR 210	Introduction to Circuits and Instrumentation	4

#### Statistics Requirement:

Choose one of the following:

STAT 312	Basic Statistics for Engineering and Science
STAT 313	Statistics for Experimenters
STAT 332	Statistics for Signal Processing
STAT 333	Uncertainty in Engineering and Science

#### Design Requirement:

ECSE 398	Senior Engineering Design Projects	4
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#### Additional Requirements:

ECSE 395	Junior Engineering Design Seminar	3
Technical Electives <sup>a</sup>		16

<sup>a</sup> In consultation with a faculty advisor, a student completes the program by selecting technical and open elective courses that provide in-depth training in the principles and practice of computer engineering. Students must take 4 courses, that add up to 16 credit hours of technical electives, to fulfill this requirement.

With the approval of the advisor, a student may emphasize a specialty of their choice by selecting elective courses from other programs or departments.

## Sample Plan of Study

### First Year

Fall	Credit Hours
CHEM 111 Principles of Chemistry for Engineers	4
MATH 121 Calculus for Science and Engineering I	4
ENGR 130 Foundations of Engineering and Programming	3
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>	3
<b>Credit Hours</b>	<b>14</b>

### Spring

PHYS 121 General Physics I - Mechanics	4
MATH 122 Calculus for Science and Engineering II	4
ENGR 145 Chemistry of Materials	4
ECSE 132 Programming in Java	3
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>	3
<b>Credit Hours</b>	<b>18</b>

### Second Year

#### Fall

PHYS 122 General Physics II - Electricity and Magnetism	4
MATH 223 Calculus for Science and Engineering III	3
ENGR 210 Introduction to Circuits and Instrumentation	4
ECSE 233 Introduction to Data Structures	4
Breadth, or Elective course <sup>a</sup>	3
<b>Credit Hours</b>	<b>18</b>

#### Spring

MATH 224 Elementary Differential Equations	3
ECSE 281 Logic Design and Computer Organization	4
Breadth, or Elective course <sup>a</sup>	3
Technical Elective <sup>b</sup>	3
Open Elective	3
<b>Credit Hours</b>	<b>16</b>

### Third Year

#### Fall

ECSE 303 Embedded Systems Design and Laboratory	3
ECSE 302 Discrete Mathematics	3
Breadth, or Elective course <sup>a</sup>	3
Technical Elective <sup>b</sup>	6
<b>Credit Hours</b>	<b>15</b>

#### Spring

ENGR 399 Impact of Engineering on Society	3
ECSE 301 Digital Logic Laboratory	2
ECSE 314 Computer Architecture	3
ECSE 315 Digital Systems Design	4

ECSE 395	Junior Engineering Design Seminar	3
<b>Credit Hours</b>		<b>15</b>
<b>Fourth Year</b>		
<b>Fall</b>		
ECSE 318	VLSI/CAD	4
Breadth, or Elective course <sup>a</sup>		3
Technical Elective <sup>b</sup>		3
Statistics Elective <sup>c</sup>		3
Open Elective		3
<b>Credit Hours</b>		<b>16</b>
<b>Spring</b>		
ECSE 398	Senior Engineering Design Projects	4
Breadth, or Elective course <sup>a</sup>		3
Technical Elective <sup>b</sup>		3
Open Elective		4
<b>Credit Hours</b>		<b>14</b>
<b>Total Credit Hours</b>		<b>126</b>

a Unified General Education Requirement.

b Technical electives are more generally defined as any course related to the principles and practice of computer engineering. This includes all ECSE courses at the 200 level and above, and can include courses from other programs. All non-ECSE technical electives must be approved by the student's advisor.

c Chosen from: STAT 312, STAT 313, STAT 332, STAT 333.