ELECTRICAL ENGINEERING, BSE

Degree: Bachelor of Science in Engineering (BSE)
Major: Electrical Engineering

Program Overview

The Bachelor of Science in Engineering degree program with a major in Electrical Engineering provides our students with a broad foundation in electrical engineering through combined classroom and laboratory work which prepares our students for entering the profession of electrical engineering, as well as for further study at the graduate level.

The Bachelor of Science in Engineering degree program with a major in Electrical Engineering is accredited by the Engineering Accreditation Commission of ABET.

The Department of Electrical, Computer, and Systems Engineering also offers a double major in Systems and Control Engineering and Electrical Engineering.

Mission

The educational mission of the electrical engineering program is to graduate students who have fundamental technical knowledge of their profession and the requisite technical breadth and communications skills to become leaders in creating the new techniques and technologies that will advance the general field of electrical engineering.

Program Educational Objectives

a. Graduates will be successful professionals obtaining positions appropriate to their background, interests, and education.
b. Graduates will use continuous learning opportunities to improve and enhance their professional skills.
c. Graduates will demonstrate leadership in their profession.

Learning Outcomes

As preparation for achieving the above educational objectives, the Bachelor of Science in Engineering degree program with a major in Electrical 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.

BS/MS Program in Electrical Engineering

The department encourages highly motivated and qualified students to apply for admission to the BS/MS 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.

Major Requirements

Code	Title	Hours
Required Mathematics, Science and Engineering Courses:		
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 200	Statics and Strength of Materials	3
or ENGR 225	Thermodynamics, Fluid Dynamics, Heat and Mass Transfer	
ENGR 210	Introduction to Circuits and Instrumentation	4
ENGR 399	Impact of Engineering on Society	3

Code	Title	Hours
Core major courses:		
ECSE 132	Programming in Java	3
ECSE 245	Electronic Circuits	4
ECSE 246	Signals and Systems	4
ECSE 281	Logic Design and Computer Organization	4
ECSE 309	Electromagnetic Fields I	3
ECSE 313	Signal Processing	3
ECSE 321	Semiconductor Electronic Devices	4

Core courses provide our students with a strong background in signals and systems, computers, electronics (both analog and digital), and semiconductor devices. Students are required to develop depth in at least one of the following technical areas: signals and control, solid state, computer hardware, computer software, circuits, robotics, and biomedical applications. In addition to the core courses, each electrical engineering student must complete the following requirements:

Technical Elective Requirement
Each student must complete 18 credit hours of approved technical electives. Technical electives shall be chosen to fulfill the depth requirement (see next) and otherwise increase the student's understanding of electrical engineering. Technical electives not used to satisfy the depth requirement are more generally defined as any course related to the principles and practice of electrical 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 academic advisor.

Statistics Requirement
Code	Title	Hours
STAT 332	Statistics for Signal Processing	3

Design Requirement
Code	Title	Hours
ECSE 395	Junior Engineering Design Seminar	3
ECSE 398	Senior Engineering Design Projects	4

In consultation with a faculty advisor, a student completes the program by selecting technical and open elective courses that provide in-depth training in one or more of a spectrum of specialties, such as, control, signal processing, electronics, integrated circuit design and fabrication, and robotics. With the approval of the advisor, a student may emphasize other specialties by selecting elective courses from other programs or departments.

Additionally, math and statistics classes are highly recommended as an integral part of the student's technical electives to prepare for work in industry and government and for graduate school. The following math/statistics classes are recommended and would be accepted as approved technical electives:

Code	Title	Hours
MATH 201	Introduction to Linear Algebra for Applications	3
MATH 307	Linear Algebra	3
MATH 330	Introduction to Scientific Computing	3
MATH 380	Introduction to Probability	3

Other Math/Statistics courses may be used as technical electives with the approval of the student's academic advisor.

Many courses have integral or associated laboratories in which students gain "hands-on" experience with electrical 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.

Depth Requirement
Each student must show a depth of competence in one technical area by taking at least three courses from one of the following areas. This depth requirement may be met using a combination of the above core courses and a selection of open and technical electives. Alternative depth areas may be considered by petition to the program faculty.

Area I: Signals & Control
Code	Title	Hours
ECSE 304	Control Engineering I with Laboratory	3
ECSE 313	Signal Processing	3
ECSE 316	Wireless Communications	3
ECSE 351	Communications and Signal Analysis	3
ECSE 354	Digital Communications	3
ECSE 374	Advanced Control and Energy Systems	3
ECSE 375	Applied Control	3
MATH 307	Linear Algebra	3

Area II: Computer Software
Code	Title	Hours
ECSE 233	Introduction to Data Structures	4
ECSE 302	Discrete Mathematics	3
ECSE 338	Intro to Operating Systems and Concurrent Programming	4
ECSE 373/473	Modern Robot Programming	3
CSDS 293	Software Craftsmanship	4
CSDS 310	Algorithms	3
CSDS 391	Introduction to Artificial Intelligence	3
CSDS 393	Software Engineering	3

Area III: Solid State
Code	Title	Hours
ECSE 321	Semiconductor Electronic Devices	4
ECSE 322	Integrated Circuits and Electronic Devices	3
or ECSE 415	Integrated Circuit Technology I	

Code	Title	Hours
ECSE 422	Solid State Electronics II	3
PHYS 221	Introduction to Modern Physics	3

Area IV: Circuits

Code	Title	Hours
ECSE 245	Electronic Circuits	4
ECSE 326	Instrumentation Electronics	3
ECSE 344	Electronic Analysis and Design	3
ECSE 371	Applied Circuit Design	4
ECSE 426	MOS Integrated Circuit Design	3
EBME 310	Principles of Biomedical Instrumentation	3

Area V: Computer Hardware

Code	Title	Hours
ECSE 281	Logic Design and Computer Organization	4
ECSE 303	Embedded Systems Design and Laboratory	3
ECSE 314	Computer Architecture	3
ECSE 315	Digital Systems Design	4
ECSE 317	Computer Design - FPGAs	3
ECSE 318	VLSI/CAD	4

Area VI: Biomedical Applications

Code	Title	Hours
EBME 201	Physiology-Biophysics I (and 2 of the following 4 courses)	3
EBME 310	Principles of Biomedical Instrumentation	3
EBME 320	Biomedical Imaging	3
EBME 327	Bioelectric Engineering	3
EBME 401D	Biomedical Instrumentation and Signal Processing	3

Area VII: Robotics

Code	Title	Hours
ECSE 246	Signals and Systems	4
ECSE 275	Fundamentals of Robotics	4
ECSE 304	Control Engineering I with Laboratory	3
ECSE 373/473	Modern Robot Programming	3
ECSE 376 or ECSE 476	Mobile Robotics / Mobile Robotics	3-4
ECSE 484	Computational Intelligence I: Basic Principles	3
ECSE 489	Robotics I	3

Sample Plan of Study

The following is a suggested program of study. Current students should always consult their advisors and their individual graduation requirement plans as tracked in SIS.

First Year

Fall

Code	Title	Hours
CHEM 111	Principles of Chemistry for Engineers	4
ENGR 130	Foundations of Engineering and Programming	3
MATH 121	Calculus for Science and Engineering I	4
Academic Inquiry Seminar, Breadth, or Elective course [a]		3
Open elective [b]		3
Hours		**17**

Spring

Code	Title	Hours
ENGR 145	Chemistry of Materials	4
MATH 122	Calculus for Science and Engineering II	4
PHYS 121	General Physics I - Mechanics [c]	4
Academic Inquiry Seminar, Breadth, or Elective course [a]		3
Hours		**15**

Second Year

Fall

Code	Title	Hours
ECSE 281	Logic Design and Computer Organization	4
ENGR 210	Introduction to Circuits and Instrumentation	4
MATH 223	Calculus for Science and Engineering III	3
PHYS 122	General Physics II - Electricity and Magnetism [c]	4
Hours		**15**

Spring

Code	Title	Hours
ECSE 132	Programming in Java	3
ECSE 245	Electronic Circuits	4
ECSE 309	Electromagnetic Fields I	3
MATH 224	Elementary Differential Equations	3
Breadth, or Elective course [a]		3
Hours		**16**

Third Year

Fall

Code	Title	Hours
ECSE 246	Signals and Systems	4
ENGR 200 or ENGR 225	Statics and Strength of Materials or Thermodynamics, Fluid Dynamics, Heat and Mass Transfer	3
STAT 332	Statistics for Signal Processing	3
Breadth, or Elective course [a]		3
Technical Elective [d]		3
Hours		**16**

Spring

Code	Title	Hours
ECSE 313	Signal Processing	3
ECSE 321	Semiconductor Electronic Devices	4
ECSE 395	Junior Engineering Design Seminar	3
Breadth, or Elective course [a]		3
Technical Elective [d]		3
Hours		**16**

Fourth Year

Fall

Code	Title	Hours
ECSE 398	Senior Engineering Design Projects	4
Breadth, or Elective course [a]		3
Technical Elective [d]		3
Technical Elective [d]		3
Open elective		3
Hours		**16**

Spring

Code	Title	Hours
ENGR 399	Impact of Engineering on Society	3
Breadth, or Elective course [a]		3

Technical Elective [d]	3
Technical Elective [d]	3
Open elective	3
Hours	**15**
Total Hours	**126**

a   Unified General Education Requirement.
b   Students who have complementary interests in computer software or computer science can take ECSE 132/CSDS 132 as an alternative.
c   Selected students may be invited to take PHYS 123 and PHYS 124 in place of PHYS 121 and PHYS 122.
d   Technical electives will be chosen to fulfill the depth requirement and otherwise increase the student's understanding of electrical engineering. Courses used to satisfy the depth requirement must come from the department's list of depth areas and related courses. Technical electives not used to satisfy the depth requirement are more generally defined as any course related to the principles and practice of electrical 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.