The Department of Electrical and Computer Engineering (ECE) offers a Bachelor of Science degree in Electrical Engineering (B.S. EE) and a Bachelor of Science degree in Computer Engineering (B.S. CpE). Individuals enrolled in these degree programs are given opportunities to develop a strong background in the engineering sciences and to learn the analysis, design, and synthesis tools necessary to function successfully as active participants in traditional, new, and emerging areas of electrical and computer engineering related technologies. The ECE department continues to be recognized locally and nationally for the quality of its undergraduate programs. As a result, ECE graduates continue to find high-paying jobs or are accepted into graduate schools nationwide.

Program Educational Objectives
The educational objectives of the Electrical Engineering program are that our graduates will:

1. contribute their technical knowledge to better their lives and society.
2. assume positions of leadership and responsibility in their electrical engineering related careers.
3. pursue graduate and professional studies.
4. conduct themselves in a professional manner that meets or exceeds the expectations of their employers.

The educational objectives of the Computer Engineering program are that our graduates will:

1. engage in life-long learning, remaining current and becoming leaders in their profession.
2. advance and expand in their computer engineering related careers by applying their engineering knowledge and skills.
3. contribute productively to the workforce in state, regional, national and international industries and government organizations.
4. communicate effectively, provide enabling solutions to societal challenges, and respond to technical, business, social, ethical, and human needs of the society through their professional endeavors.

Meeting Program Objectives
To meet the program objectives, the curriculum for the Bachelor of Science (B.S.) degree in Electrical Engineering and the curriculum for the Bachelor of Science degree in Computer Engineering are organized into a flexible 126-semester-credit-hour structure that provides high-quality education in the fundamentals of engineering, in addition to a thorough coverage of the major specialties within electrical engineering and computer engineering. For electrical engineering students, a selection of technical electives is provided to allow in-depth concentration in selected areas such as: communication; computer; digital signal processing (DSP); electronic materials and devices; systems and control; and electric power engineering. For students seeking the B.S. degree in Computer Engineering, the selection of technical electives are from areas of digital system design, computer architecture, VLSI design, engineering programming languages and embedded systems.

Department faculty of outstanding quality work in concert to provide the two degree programs that are challenging to students, with depth in engineering sciences, design orientation, and modern laboratory experience. The program objectives are accomplished via a three-tiered curriculum structure comprised of the lower-division core (the first two years), the upper-division core (concentrated primarily in the third year), and the senior-level electives, each of which are briefly described below.

Lower-Division Core
The lower-division core provides students with a diverse range of courses over a broad base of basic technical and specialized courses in mathematics, physics, and chemistry; computer hardware and software fundamentals; electric circuit fundamentals and electrical engineering laboratory experience; statics and dynamics; and communication skills, humanities, and social sciences.

Upper-Division Core
The upper-division core for electrical engineering and computer engineering provides students with a basic education in the fundamentals of electrical and computer engineering.

The upper-division core in electrical engineering includes: fundamentals of circuits (3 semester credit hours), controls (3 semester credit hours), electromagnetics (3 semester credit hours), electronics (6 semester credit hours), electronic devices (3 semester credit hours), and probability and random processes (3 semester credit hours). Many of these fundamental courses include the use of modern software tools for design and analysis. These fundamentals are supplemented with one hands-on laboratory course (3 semester credit hours). Written and technical communication is further emphasized in the laboratory course.

The upper-division core in computer engineering includes: fundamentals of circuits (3 semester credit hours), C++ and data structures (3 semester credit hours), microcomputer systems (3 semester credit hours), electronics (6 semester credit hours), electronic devices (3 semester credit hours), and probability and random processes (3 semester credit hours). Many of these fundamental courses include the use of modern software tools for design and analysis. These fundamental courses are supplemented with one hands-on laboratory course (3 semester credit hours). Written and technical communication is further emphasized in the laboratory course.

Senior-Level Electives
In the senior year, electrical engineering students enroll in five technical electives (15 semester credit hours), a senior laboratory course (3 semester credit hours), and the capstone design sequence (4 semester credit hours). Students in the technical elective courses have ample opportunities to learn and use modern software tools. The capstone sequence not only provides a major design experience but also emphasizes teamwork, proposal development, communication skills, and professional and ethical responsibility. Electrical engineering students are required to choose one of the six technical areas and to select a minimum of three technical electives (9 semester credit hours) from the chosen area. The remaining two technical electives (6 semester credit hours) may be selected either from the same area or from the other five areas, including one course at the graduate level and/or 3 semester credit hours from an engineering cooperative program. Computer engineering students are required to choose five technical electives from a list of approved technical electives for Bachelor of Science in Computer Engineering. The engineering cooperative program provides an opportunity for students to obtain practical experience by enrolling in...
three semesters (1 semester credit hour each semester) and working in an approved industry. Students who want to pursue graduate studies are encouraged to enroll in a graduate class during their last year, which will be counted as one of the remaining technical electives.

Engineering Design Experience

Design process in electrical engineering and in computer engineering is emphasized throughout all four years. Engineering design is distributed throughout the programs starting from the second semester in EE 2513 Logic Design. During their junior and senior years, students take five technical elective courses which all have design components. During the seventh semester, students also take EE 4113 Electrical and Computer Engineering Laboratory II, where they must design complex circuits. Modern software tools usage, design and analysis, and formal written report writing are integrated components of several of the electrical and computer engineering courses. EE 3113 Electrical and Computer Engineering Laboratory I and EE 4113 Electrical and Computer Engineering Laboratory II emphasize hands-on experiments using basic to advanced capability instruments and formal written, as well as oral, reports. In EE 4811 Electrical and Computer Engineering Design I, CPE 4811 Computer Engineering Design I, EE 4813 Electrical and Computer Engineering Design II, and CPE 4813 Computer Engineering Design II, students are required to design, implement, test, demonstrate and make an oral presentation on an electronic or computer system.

Other courses with design emphasis that electrical engineering students take include: EE 3213 Electromagnetic Engineering, EE 3323 Electronic Devices, EE 3413 Analysis and Design of Control Systems, EE 3463 Microcomputer Systems I, EE 4313 Electronic Circuits II, and EE 4323 Dielectric and Optoelectronic Engineering Laboratory.

Other courses with design emphasis that computer engineering students take include: EE 3313 Electronic Circuits I, EE 3323 Electronic Devices, EE 3463 Microcomputer Systems I, EE 3563 Digital Systems Design and EE 4513 Introduction to VLSI Design.

- B.S. degree in Electrical Engineering (p. 2)
- B.S. degree in Computer Engineering (p. 4)
- Integrated B.S./M.S. Program (p. 6)

Bachelor of Science Degree in Electrical Engineering

The Bachelor of Science (B.S.) degree in Electrical Engineering has concentrations in Communications; Computer Engineering; Digital Signal Processing (DSP); Electronic Materials and Devices; Systems and Control; and Electric Power Engineering. The program is accredited by the Engineering Accreditation Commission (EAC) of ABET. The B.S. degree in Electrical Engineering offers students the opportunity to prepare for careers in areas associated with electronics and microelectronics, digital systems, communications, digital signal and image processing, controls and robotics, computer-aided design (CAD), instrumentation, bioengineering, electric power engineering, and other traditional and emerging technology areas. Through the proper selection of elective courses (at least three technical elective courses must be selected from a single technical area) to augment required courses, successful students will develop a specialization pertinent to many of these areas that may lead to productive employment in the public or private sector with electronics companies, high-technology industries, and government agencies. The program will also provide the opportunity for students to develop an understanding of fundamentals and current issues important for future years of learning through such activities as graduate school, distance education, professional training, and membership in professional societies.

The minimum number of semester credit hours required for this degree is 126, at least 39 of which must be at the upper-division level. At least 42 of the required electrical engineering credits must be taken at UTSA. All candidates for this degree must fulfill the Core Curriculum requirements, the General Engineering requirements, and the Electrical Engineering requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Electrical Engineering must fulfill University Core Curriculum requirements in the same manner as other students. The courses listed below satisfy both major requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree.

MAT 1214 may be used to satisfy the core requirement in Mathematics, as well as one of the General Engineering requirements. PHY 1943 and PHY 1963 may be used to satisfy the core requirement in Life and Physical Sciences, as well as two of the General Engineering requirements.

Core Curriculum Component Area Requirements [http://catalog.utsa.edu/undergraduate/bachelorsdegereeregulations/ degereerequirements/corecurriculumcomponentarearequirements]

- First Year Experience Requirement 3
- Communication 6
- Mathematics 3
- Life and Physical Sciences 6
- Language, Philosophy and Culture 3
- Creative Arts 3
- American History 6
- Government-Political Science 6
- Social and Behavioral Sciences 3
- Component Area Option 3
- Total Credit Hours 42

General Engineering Requirements

All degree-seeking candidates in engineering must complete the following 22 semester credit hours, as well as the Core Curriculum requirements and major requirements:

- CHE 1103 General Chemistry I 3
- EGR 2323 Applied Engineering Analysis I 3
- MAT 1214 Calculus I 4
- MAT 1224 Calculus II 4
- or EGR 1324 Calculus II for Engineers 4
- PHY 1943 Physics for Scientists and Engineers I 4
- & PHY 1951 and Physics for Scientists and Engineers I Laboratory
## Gateway Courses

Students pursuing the B.S. degree in Electrical Engineering must successfully complete each of the following Gateway Courses with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete these courses within two attempts, including dropping a course with a grade of “W” or taking an equivalent course at another institution, will be required to change his or her major.

- EE 1322: Introduction to Electrical and Computer Engineering
- EGR 2323: Applied Engineering Analysis I
- MAT 1214: Calculus I

## Electrical Engineering Degree Requirements

All degree-seeking candidates in Electrical Engineering must complete the following semester credit hours, as well as the Core Curriculum requirements and General Engineering requirements:

### A. Required Courses

1. Electrical Engineering courses
   - EE 1322: Introduction to Electrical and Computer Engineering
   - EE 2423: Network Theory
   - EE 2511: Logic Design Laboratory
   - EE 2513: Logic Design
   - EE 3113: Electrical and Computer Engineering Laboratory I
   - EE 3213: Electromagnetic Engineering
   - EE 3313: Electronic Circuits I
   - EE 3323: Electronic Devices
   - EE 3413: Analysis and Design of Control Systems
   - EE 3424: Mathematics in Signals and Systems
   - EE 3463: Microcomputer Systems I
   - EE 4113: Electrical and Computer Engineering Laboratory II
   - EE 4313: Electronic Circuits II
   - EE 4811: Electrical and Computer Engineering Design I
   - EE 4813: Electrical and Computer Engineering Design II
   - EGR 2213: Statics and Dynamics
   - EGR 3323: Applied Engineering Analysis II

2. Supporting courses
   - CS 2073: Computer Programming with Engineering Applications
   - EE 3533: Probability and Stochastic Processes

Mathematics and Science Supporting Course: Select one from the following courses:
- BIO 1233: Contemporary Biology I
- CHE 1113: General Chemistry II
- MAT 2233: Linear Algebra
- MAT 3013: Foundations of Mathematics
- STA 3523: Mathematical Statistics

### B. Electrical engineering elective courses

Select at least three courses from one of the following concentrations. Topics offered under EE 4953 Special Studies in Electrical Engineering may be approved as technical electives in the relevant concentration.

#### Communication Concentration
- EE 3523: Discrete Signals and Systems
- EE 4613: Communication Systems
- EE 4653: Digital Communications
- EE 4673: Data Communication and Networks
- EE 4683: Wireless Communications
- EE 4693: Fiber Optic Communications

#### Computer Engineering Concentration
- EE 3223: C++ and Data Structures
- EE 3333: Systems Programming for Engineers
- EE 3563: Digital Systems Design
- EE 4243: Computer Organization and Architecture
- EE 4513: Introduction to VLSI Design
- EE 4553: VLSI Testing
- EE 4583: Microcomputer Systems II

#### DSP Concentration
- EE 3523: Discrete Signals and Systems
- EE 4623: Digital Filtering
- EE 4643: Digital Signal Processing
- EE 4663: Digital Image Processing

#### Electronic Materials and Devices Concentration
- EE 3513: Electromechanical Systems
- EE 4323: Dielectric and Optoelectronic Engineering Laboratory
- EE 4513: Introduction to VLSI Design
- EE 4523: Introduction to Micro and Nanotechnology
- EE 4543: Advanced Topics in Micro and Nanotechnology

#### Systems and Control Concentration
- EE 3523: Discrete Signals and Systems
- EE 3513: Electromechanical Systems
- EE 4443: Discrete-Time and Computer-Controlled Systems
- EE 4723: Intelligent Robotics
- EE 4733: Intelligent Control
- EE 4743: Embedded Control Systems

#### Electric Power Engineering Concentration
- EE 3513: Electromechanical Systems
- EE 4123: Power Engineering Laboratory
- EE 4753: Analysis of Power Systems
- EE 4763: Power Electronics
- EE 4773: Electric Drives

### Total Credit Hours

- 71

## B.S. in Electrical Engineering – Recommended Four-Year Academic Plan

### First Year

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<th>Semester</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Credit Hours</th>
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<td>Fall</td>
<td>AIS 1203</td>
<td>Academic Inquiry and Scholarship (core)</td>
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<td>CHE 1103</td>
<td>General Chemistry I</td>
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### Second Year

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### Fourth Year

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Bachelor of Science Degree in Computer Engineering

The Bachelor of Science (B.S.) degree in Computer Engineering gives the students the opportunity to acquire broad engineering skills and knowledge to enable them to design and implement computer and digital systems. The discipline of computer engineering includes topics such as logic design; digital systems design; discrete mathematics; computer organization; embedded systems design requiring assembly programming of microprocessors, high-level programming and interfacing of processors to other circuits; high-level digital design languages (HDL) and Field Programmable Gate Arrays (FPGA's); Very Large Scale Integrated (VLSI) circuit design; and fundamental electrical engineering, mathematics, and science. While the B.S. in CpE is not currently ABET accredited, as it is a newly established program in 2010, plans are underway for the accreditation of the program at the earliest opportunity.

The minimum number of semester credit hours required for this degree is 126, at least 39 of which must be at the upper-division level. At least 42 of the required computer engineering credits must be taken at UTSA. All candidates for this degree must fulfill the Core Curriculum requirements, the General Engineering requirements, and the Computer Engineering requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Computer Engineering must fulfill University Core Curriculum requirements in the same manner as other students. The courses listed below satisfy both major requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree.

MAT 1214 may be used to satisfy the core requirement in Mathematics, as well as one of the General Engineering requirements. PHY 1943 and PHY 1963 may be used to satisfy the core requirement in Life and Physical Sciences, as well as two of the General Engineering requirements.
Core Curriculum Component Area Requirements (http://catalog.utsa.edu/undergraduate/bachelorsdegeregulations/degreerequirements/corecurriculumcomponentarearequirements)

First Year Experience Requirement 3
Communication 6
Mathematics 3
Life and Physical Sciences 6
Language, Philosophy and Culture 3
Creative Arts 3
American History 6
Government-Political Science 6
Social and Behavioral Sciences 3
Component Area Option 3
Total Credit Hours 42

General Engineering Requirements
All degree-seeking candidates in engineering must complete the following 22 semester credit hours, as well as the Core Curriculum requirements and major requirements:

CHE 1103 General Chemistry I 3
EGR 2323 Applied Engineering Analysis I 3
MAT 1214 Calculus I 4
MAT 1224 Calculus II 4
or EGR 1324 Calculus II for Engineers 4
PHY 1943 Physics for Scientists and Engineers I 4
& PHY 1951 Physics for Scientists and Engineers I Laboratory 4
PHY 1963 Physics for Scientists and Engineers II 4
& PHY 1971 Physics for Scientists and Engineers II Laboratory 4
Total Credit Hours 22

Gateway Courses
Students pursuing the B.S. degree in Computer Engineering must successfully complete each of the following Gateway Courses with a grade of “C-” or better in no more than two attempts. A student who is unable to successfully complete these courses within two attempts, including dropping a course with a grade of “W” or taking an equivalent course at another institution, will be required to change his or her major.

EE 1322 Introduction to Electrical and Computer Engineering 2
EE 2513 Logic Design 3
MAT 1214 Calculus I 4

Computer Engineering Degree Requirements
All degree-seeking candidates in Computer Engineering must complete the following semester credit hours, as well as the Core Curriculum requirements and General Engineering requirements:

A. Required courses
1. Electrical and Computer engineering courses:
EE 1322 Introduction to Electrical and Computer Engineering 2
EE 2423 Network Theory 3
EE 2511 Logic Design Laboratory 1
EE 2513 Logic Design 3
EE 3113 Electrical and Computer Engineering Laboratory I 3
EE 3223 C++ and Data Structures 3
EE 3233 Systems Programming for Engineers 3
EE 3313 Electronic Circuits I 3
EE 3323 Electronic Devices 3
EE 3424 Mathematics in Signals and Systems 4
EE 3463 Microcomputer Systems I 3
EE 3563 Digital Systems Design 3
EE 4113 Electrical and Computer Engineering Laboratory II 3
EE 4243 Computer Organization and Architecture 3
CPE 4811 Computer Engineering Design I 1
CPE 4813 Computer Engineering Design II 3
EGR 3323 Applied Engineering Analysis II 3
2. Supporting courses
CS 2073 Computer Programming with Engineering Applications 3
CS 2233 Discrete Mathematical Structures 3
EE 3533 Probability and Stochastic Processes 3

B. Computer engineering electives
Select five courses including one Mathematics from the following: 15
EE 4513 Introduction to VLSI Design 3
EE 4553 VLSI Testing 3
EE 4563 FPGA-Based System Design 3
EE 4583 Microcomputer Systems II 3
EE 4593 Embedded System Design 3
EE 4643 Digital Signal Processing 3
EE 4663 Digital Image Processing 3
EE 4953 Special Studies in Electrical and Computer Engineering (Computer Engineering related topics only) 3
MAT 2233 Linear Algebra 3
MAT 3013 Foundations of Mathematics 3
MAT 3123 Fundamentals of Geometry 3
Total Credit Hours 71

B.S. in Computer Engineering – Recommended Four-Year Academic Plan

First Year
Fall
Credit Hours
AIS 1203 Academic Inquiry and Scholarship (core) 3
EE 1322 Introduction to Electrical and Computer Engineering 2
CHE 1103 General Chemistry I 3
MAT 1214 Calculus I (core and major) 4
WRC 1013 Freshman Composition I (Q) (core) 3

Spring
EE 2511 Logic Design Laboratory 1
EE 2513 Logic Design 3
CS 2073 Computer Programming with Engineering Applications 3

Total Credit Hours 71
Integrated Bachelor of Science/Master of Science Program

The integrated B.S./M.S. (Bachelor of Science and Master of Science) program administered by the Department of Electrical and Computer Engineering is designed to make possible for highly motivated and qualified B.S. students to obtain both an undergraduate degree and an advanced degree within an accelerated timeline. Through this program, motivated B.S. students can start working with the faculty advisors on research projects as early as in their senior year.

Program Admission Requirements

Applications to the B.S./M.S. program must be submitted after the completion of 75 but before 90 semester credit hours of coursework, usually when a student is enrolled in his or her junior year or in the sixth semester of the B.S. program.

The B.S./M.S. program applicants must have a minimum of 3.3 for both cumulative and major grade point averages. For qualified applicants, the department will waive the GRE examination requirement. To apply for the program, students need to:

- Apply online under the category of Integrated B.S./M.S. (B.S. in Electrical Engineering, or Computer Engineering, and M.S. in Electrical Engineering, Computer Engineering, or Advanced Materials Engineering); and
- Submit an official UTSA transcript and a Proposed Program of Study with an approval from B.S./M.S. advisors.

Submission of both recommendation letters and a personal statement is optional but highly recommended for consideration of scholarships.

Degree Requirements

B.S. Degree requirement: The current undergraduate degree programs in Electrical Engineering and Computer Engineering require 126 semester credit hours for completion with fifteen of these hours (five, 3-hour courses) as technical electives. Students accepted into the Integrated B.S./M.S. program will be required to complete 117 undergraduate credit hours and 9 graduate credit hours to replace three of the five undergraduate technical elective courses toward the B.S. degree, provided that students pass the corresponding challenge exams for the three undergraduate elective courses. The graduate courses include one of the required core graduate courses and two technical electives from the same concentration area. Students may enroll in a cross-listed course and take a challenge examination following UTSA’s challenge examination procedure (see Footnote 1) to earn undergraduate credits for the graduate course taken. Credits earned by challenging UTSA undergraduate courses by examination apply to Bachelor’s degree requirements as though the courses had been completed in the normal manner. Since a grade of “CR” is awarded, such courses are not included in the UTSA grade point average calculation.

A graduate core course taken as an undergraduate must be completed with a grade of “B” or better. If a grade lower than “B” is received, it can be counted as an undergraduate technical elective, but in order to stay in the Integrated B.S./M.S. program, a student must pass one of the graduate core courses with a grade of “B” or better. Undergraduate
students not able to satisfy this requirement, or simply wishing to voluntarily withdraw from the Integrated B.S./M.S. program, must use a combination of five undergraduate technical electives and graduate courses to satisfy the original 126-hour regular degree program requirement in order to receive their B.S. degree. Students continuing on in the Integrated B.S./M.S. program will receive their B.S. degrees once they have earned 117 undergraduate credit hours and 9 credit hours of technical elective courses by passing the challenge examinations. The 9 graduate credit hours taken as an undergraduate will be counted toward the M.S. degree requirement.

**M.S. Degree requirement:** A student enrolled in the Integrated B.S./M.S. program can graduate by completing requirements for a thesis or nonthesis (project) option.

(i) **Thesis Option:** Students must complete 30 credit hours including 6 hours of thesis work.

(ii) **Nonthesis Option:** Students must complete 33 credit hours including 3 hours of project work.

**B.S./M.S. Classification**

Once admitted to the Integrated B.S./M.S. program, students are allowed to take graduate courses as undergraduate students. Students admitted to the Integrated B.S./M.S. program will be reclassified from undergraduate to graduate student status when they have completed 126 semester credit hours of coursework (of any combination of graduate and undergraduate hours) toward their degrees. B.S./M.S. students can receive their B.S. degree upon completion of 126 semester credit hours, including those credited by passing the challenge examinations, at which point the program will certify the student's eligibility to receive the B.S. degree and request the Graduate School to change the student status in the Student Information System.

Currently the **Challenging a UTSA Course policy** at UTSA applies only to undergraduate courses; thus, this mechanism is valid only if the same graduate course is cross-listed with an undergraduate course or until the procedure is extended to graduate courses.