

# Computer Engineering (ECE)

Major in

## Computer Engineering

Department of Electrical and Computer Engineering, College of Engineering and Applied Sciences

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Minors of particular interest to students majoring in Electrical or Computer Engineering: Applied Mathematics and Statistics (AMS), Computer Science (CSE), Science and Engineering (LSE)

### Faculty

Please see the faculty listing in the entry for the Electrical Engineering major.

The Department of Electrical and Computer Engineering offers two majors leading to the Bachelor of Engineering (B.E.) degree. The Department's teaching and research areas include computer engineering, computer networks, microprocessors, computer architecture, communications, signal and image processing, pattern recognition, electronic circuits, solid-state electronics, lasers and fiber-optics, electromagnetics, microwave electronics, systems and control, biomedical engineering, VLSI, computer-aided design, parallel and distributed processing, computer vision, and computer graphics. Both program majors are accredited by the Accreditation Board of Engineering and Technology (ABET).

The objective of the electrical and computer engineering programs is to give students an excellent preparation for professional careers or graduate studies in the electrical and computer engineering fields. The programs provide students with depth and breadth of knowledge in engineering science and engineering design as well as in mathematics and the natural sciences. Development of non-technical skills such as communication and teamwork is also emphasized. The curriculum of the two programs is shared in the freshman year, and diverges in the sophomore year. See the Electrical Engineering entry in the alphabetical listings of Approved Majors, Minors, and Programs for the requirements for that major.

### Program Educational Objectives

The undergraduate program in Computer Engineering has the following five specific program educational objectives (PEOs):

1. Our graduates should excel in engineering positions in industry and

other organizations that emphasize design and implementation of engineering systems and devices.

2. Graduates should excel in the best graduate schools, reaching advanced degrees in engineering and related disciplines.
3. Within several years from graduation alumni should have established a successful career in an engineering-related multidisciplinary field, possibly leading or participating effectively in interdisciplinary engineering projects, as well as continuously adapting to changing technologies.
4. We expect graduates to continue personal development through professional study and self-learning.
5. We expect graduates to be good citizens and cultured human beings, as well as to appreciate the importance of professional, ethical, and societal responsibilities.

### Program Outcomes

To prepare students to meet the above program educational objectives, a set of program outcomes that describes what students should know and be able to do when they graduate, have been adopted. We expect our graduates to attain:

- a. an ability to apply knowledge of mathematics, science, and engineering;
- b. an ability to design and conduct experiments, as well as to analyze and interpret data;
- c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- d. an ability to function on multidisciplinary teams;

- e. an ability to identify, formulate, and solve engineering problems;
- f. an understanding of professional and ethical responsibility;
- g. an ability to communicate effectively;
- h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
- i. a recognition of the need for ability to engage in life-long learning;
- j. a knowledge of contemporary issues; and
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

More details about program educational objectives and outcomes can be found at <http://www.ece.sunysb.edu/peos>

Following graduation many students choose immediate employment in industry from Long Island to the West Coast. Electrical and computer engineers are recruited in diverse fields for a variety of challenging positions: a communications engineer may work on improving the flow of traffic in communications networks; a command and control engineer may work on systems in tactical and traffic control, satellite and surveillance systems, or in commercial applications; a circuit design engineer designs, develops, and manufactures electronic circuits for many applications including microcomputers; and computer engineers design microprocessor-based systems that include a range of consumer products, industrial machinery, and specialized systems such as those used in flight control, automobiles, and in financial institutions. Graduates also pursue advanced degrees in engineering, business, finance, medicine, law, and other professions in which their problem-solving skills and technical knowledge are valuable qualities.

## Acceptance into the Computer Engineering Major

Freshman and transfer applicants who have specified their interest in the major in Computer Engineering may be accepted into the major upon admission to the University. Applicants admitted to the University but not immediately accepted into the Computer Engineering major may apply for acceptance at any time during the academic year. The Department's undergraduate committee will consider an application only if the following conditions have been met:

1. the student has completed at least 11 credits of mathematics, physics, electrical and computer engineering, or computer science courses required for the major;
2. the student has earned a grade point average of 3.00 or higher in these courses with no grade in any of them lower than C;
3. no courses required for the major have been repeated;
4. all transfer courses have been evaluated.

## Requirements for the Major in Computer Engineering (ECE)

The solutions to current system design problems are based on both hardware and software. It is important for students who wish to specialize in computer hardware to be fluent in modern software techniques and familiar with digital electronics and the application of large-scale integrated devices.

Completion of the major requires approximately 110 credits.

### 1. Mathematics

AMS 151, 161 Applied Calculus I, II  
AMS 210 or MAT 211 Applied Linear Algebra  
AMS 361 or MAT 303 Applied Calculus IV  
AMS 301 Finite Mathematical Structures

Note: The following alternate calculus course sequences may be substituted for AMS 151, 161 in major requirements or prerequisites:

MAT 125, 126, 127  
or MAT 131, 132  
or MAT 141, 142  
or MAT 171

### 2. Natural Sciences

PHY 131/133, 132/134 Classical Physics I, II and laboratories  
CHE 131 General Chemistry I and laboratory

Note: The physics course sequence PHY 125, 126, 127 or 141, 142 is accepted in lieu of PHY 131/133, 132/134. (Students are advised to take PHY 127 before PHY 126.)  
CHE 141/143 or ESG 198 are accepted in lieu of CHE 131/133.

### 3. Freshman Introduction to Electrical Engineering

ESE 123 Introduction to Electrical and Computer Engineering

## Sample Course Sequence for the Major in Computer Engineering

Freshman Fall		Credits		Spring		Credits	
First Year Seminar 101	1	First Year Seminar 102	1				
AMS 151 (or MAT 131)#	3-4	AMS 161 (or MAT 132)#	3-4				
PHY 131/133#	4	PHY 132/134#	4				
ESE 123	4	ESE 124	3				
D.E.C. A#	3	CHE 131	4				
<b>Total</b>	<b>15-16</b>	<b>Total</b>	<b>15-16</b>				

Sophomore Fall		Credits		Spring		Credits	
AMS 361 (or MAT 303)	4	AMS 210 (or MAT 211)	3				
ESE 271#	4	ESE 211#	2				
ESE 218#	4	ESE 372#	4				
CSE 230#	3	CSE 114#	3				
D.E.C.	3	D.E.C.	3				
<b>Total</b>	<b>18</b>	<b>Total</b>	<b>15</b>				

Junior Fall		Credits		Spring		Credits	
ESE 305	3	ESE 300#	3				
ESE 314	3	ESE 382#	4				
ESE 380#	4	ESE 306	4				
AMS 301	3	ESE xxx#	3				
CSE 214#	3	CSE 219	3				
<b>Total</b>	<b>16</b>	<b>Total</b>	<b>17</b>				

Senior Fall		Credits		Spring		Credits	
ESE 440	3	ESE 441	3				
ESE xxx#	3	ESE xxx#	4				
ESE 345#	3	ESE xxx#	3				
ESE 333 (or CSE 306)	3	D.E.C.	3				
2 D.E.C. courses	6	D.E.C.	3				
<b>Total</b>	<b>18</b>	<b>Total</b>	<b>16</b>				

Note: Courses with a # must be passed with a grade of C or higher. Total credits must equal 128 or more.

ESE 124 Computer Techniques for Electronic Design I

### 4. Engineering Topics

Engineering topics include engineering science and engineering design. Content of the former category is determined by the creative application of basic science skills, while the content of the latter category focuses on the procedure of devising systems, components, or processes.

#### a. Engineering Sciences

ESE 211 Electronics Laboratory A  
ESE 218 Digital Systems Design  
ESE 271 Electrical Circuit Analysis

ESE 305 Deterministic Signals and Systems

ESE 345 Computer Architecture

ESE 372 Electronics

**b. Engineering Design**

ESE 314 Electronics Laboratory B

ESE 380 Embedded Microprocessor Systems Design I

ESE 382 Digital Design Using VHDL and PLDs

ESE 440 Engineering Design I

ESE 441 Engineering Design II

Note: ESE 440 and 441 are engineering design projects that must be carried out at Stony Brook under the supervision of an Electrical and Computer Engineering faculty member.

**5. Probability and Statistics**

ESE 306 Random Signals and Systems

**6. Computer Science**

CSE 114 Computer Science I

CSE 214 Computer Science II

CSE 219 Computer Science III

CSE 230 Intermediate Programming in C and C++

ESE 333 Real-time Operating Systems

**7. Engineering Technical Electives**

4 ESE electives chosen from:

ESE 311 Analog Integrated Circuits

ESE 319 Electromagnetics and Transmission Line Theory

ESE 330 Integrated Electronics

ESE 337 Digital Signal Processing Theory

ESE 344 Software Techniques for Engineers

ESE 346 Computer Communications

ESE 347 Digital Signal Processing

ESE 349 Introduction to Fault Diagnosis of Digital Systems

ESE 355 VLSI System Design

ESE 356 Digital System Specification and Modeling

ESE 357 Digital Image Processing

ESE 358 Computer Vision

ESE 360 Network Security Engineering

ESE 366 Design using Programmable Mixed-Signal Systems-on-Chip

ESE 381 Embedded Microprocessor Systems Design II

ESE 476 Undergraduate

Instructional Laboratory Development Practicum

**8. Upper-Division Writing Requirement:**

**ESE 300 Writing in Electrical/Computer Engineering**

All degree candidates must demonstrate skill in written English at a level acceptable for computer engineering majors. Students must register for the writing course ESE 300 concurrently with or after completion of ESE 314, 324, 380, or 382. Students whose writing does not meet the required standard are referred for remedial help. Detailed guidelines are provided by the Department.

**Grading**

All courses taken to satisfy requirements 1 through 7 must be taken for a letter grade. A letter grade of C or higher is required in the following courses:

AMS 151 and 161 (or MAT 125, 126, and 127 or MAT 131 and 132)

PHY 131/133 and 132/134 (or PHY 125, 126, and 127)

ESE 211, 218, 271, 300, 345, 372, 380, and 382

CSE 114, 214, and 230

Four ESE technical electives

**Requirements for the Combined B.E. Computer Engineering/ M.S. Electrical Engineering Degrees**

The intent of the combined five-year Bachelor of Engineering in Computer Engineering and Master of Science in Electrical Engineering program is to prepare high-achieving and highly motivated undergraduate computer engineering students for either doctoral studies or a variety of advanced professional positions. Computer engineering students interested in the combined program should apply through the undergraduate office of the Department of Electrical and Computer Engineering. The program is highly selective and is offered to the top 10 to 20 percent of the junior undergraduate class. Admission is based on academic performance (a major g.p.a. of at least 3.40) as well as undergraduate research and professional activities. The combined program is as rigorous as the current B.E. and M.S. programs taken separately. The requirements for the combined program are the same as the requirements for the B.E. and M.S. programs except that two 300-level electives in the B.E. program are substituted by two 500-level graduate courses. Therefore six graduate credits will be counted towards the undergraduate degree. Detailed guidelines and sample course sequences are provided by the Department.