Computer Engineering (ECE)

Major in Computer Engineering

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

Chairperson: Serge Luryi
Undergraduate Program Director: Ridha Kamoua
Senior Staff Assistant: Carolyn Huggins
Office: 267 Light Engineering
Phone: (631) 632-8415
E-mail: postmaster@ece.sunysb.edu
Web address: http://www.ece.sunysb.edu

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

Computer Engineering (ECE)

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.

Requirements for the Major in Computer Engineering (ECE)

Note that there have been changes to this program. Please click here for more information.

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

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 or ESG 198 are accepted in lieu of CHE 131.

3. Freshman Introduction to Electrical Engineering

ESE 123 Introduction to Electrical and Computer Engineering
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.  
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++ or ESE 224 Computer Techniques for Electronic Design II  
ESE 333 Real-time Operating Systems or CSE 306 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 Sequential B.E. Computer Engineering/M.S. Computer Engineering or Electrical Engineering Degrees

The intent of the sequential 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 sequential 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 3.30) as well as undergraduate research
and professional activities. The sequential program is as rigorous as the current B.E. and M.S. programs taken separately. The requirements for the sequential 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.

Sample Course Sequence for the Major in Computer Engineering

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<th>Freshman Fall</th>
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<td>AMS 210 (or MAT 211)</td>
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<td>ESE 218#</td>
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<td>ESE 372#</td>
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<td>CSE 230# or ESE 224</td>
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<td>CSE 114#</td>
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<td>ESE 314</td>
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<td>ESE 380#</td>
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<td>AMS 301</td>
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<td>ESE 345#</td>
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ESE 123: Introduction to Electrical and Computer Engineering
Introduces basic electrical and computer engineering concepts in a dual approach that includes: laboratories for hands-on wired and computer simulation experiments in analog and logic circuits, and lectures providing concepts and theory relevant to the laboratories. Emphasizes physical insight and applications rather than theory.
Pre- or Corequisites: AMS 151 or MAT 125 or 131 or 141; PHY 125 or 131 or 141
4 credits

ESE 124: Computer Techniques for Electronic Design I
An extensive introduction to problem solving in electrical engineering using the ANSI C language. Topics covered include data types, operations, control flow, functions, data files, numerical techniques, pointers, structures, and bit operations. Students gain experience in applying the C language to the solution of a variety of electrical engineering problems, based on concepts developed in ESE 123. Knowledge of C at the level presented in this course is expected of all electrical engineering students in subsequent courses in the major.
Pre- or Corequisites: AMS 151 or MAT 125 or 131 or 141; ESE 123 or equivalent
3 credits

ESE 211: Electronics Laboratory A
Introduction to the measurement of electrical quantities; instrumentation; basic circuits, their operation and applications; electronic devices; amplifiers, oscillators, power supplies, wave-shaping circuits, and basic switching circuits.
Prerequisite: ESE 271
Corequisite for ESE and ECE majors: ESE 372
2 credits

ESE 218: Digital Systems Design
Develops methods of analysis and design of both combinational and sequential systems regarding digital circuits as functional blocks. Utilizes demonstrations and laboratory projects consisting of building hardware on breadboards and simulation of design using CAD tools. Topics include: number systems and codes; switching algebra and switching functions; standard combinational modules and arithmetic circuits; realization of switching functions; latches and flip-flops; standard sequential modules; memory, combinational, and sequential PLDs and their applications; design of system controllers.
Prerequisite for engineering majors: PHY 127 or 132/134 or 142 or ESE 124
Prerequisite for computer science majors: CSE 220
4 credits

ESE 224: Computer Techniques for Electronic Design II
Introduces C++ programming language for problem solving in electrical and computer engineering. Topics include C++ structures, classes, abstract data types, and code reuse. Basic object-oriented programming concepts as well as fundamental topics of discrete mathematics and algorithms are introduced.
Prerequisite: ESE 124
3 credits

ESE 231: Introduction to Semiconductor Devices
The principles of semiconductor devices. Energy bands, transport properties and generation recombination phenomena in bulk semiconductors are covered first, followed by junctions between semiconductors and metal-semiconductor. The principles of operation of diodes, transistors, light detectors, and light emitting devices based on an understanding of the character of physical phenomena in semiconductors. Provides background for subsequent courses in electronics.
Prerequisites: AMS 361 or MAT 303; PHY 127 or 132/134 or 142
3 credits

ESE 271: Electrical Circuit Analysis I
Kirchoff's Laws, Ohm's Law, nodal and mesh analysis for electric circuits, capacitors, inductors, and steady-state AC; transient analysis using Laplace Transform. Fundamentals of AC power, coupled inductors, and two-ports.
Prerequisites: AMS 161 or MAT 127 or 132 or 142 or 171; PHY 127 or 132/134 or 142
4 credits

ESE 290: Transitional Study
A vehicle used for transfer students to remedy discrepancies between a Stony Brook course and a course taken at another institution. For example, it allows the student to take the laboratory portion of a course for which he or she has had the theoretical portion elsewhere. Open elective credit only.
Prerequisite: Permission of department
1-3 credits

ESE 300: Technical Communication for Electrical and Computer Engineers
Topics include how technical writing differs from other forms of writing, the components of technical writing, technical style, report writing, technical definitions, proposal writing, writing by group or team, instructions and manuals, transmittal letters, memoranda, abstracts and summaries, proper methods of documentation, presentations and briefings, and analysis of published engineering writing. Also covered are the writing of resumes and cover letters.
Prerequisite: WRT 102; ESE or ECE major, U3 standing;
Pre- or Corequisite: ESE 314 or 324 or 380 or 382
3 credits

ESE 301: Engineering Ethics and Societal Impact
The study of ethical issues facing engineers and engineering related organizations and the societal impact of technology. Decisions involving moral conduct, character, ideals and relationships of people and organizations involved in technology. the interaction of engineers, their technology, the society and the environment is examined using case studies.
Prerequisites: U3 or U4 standing, one D.E.C. category E course
3 credits

ESE 304: Applications of Operational Amplifiers
Design of electronic instrumentation: structure of basic measurement systems, transducers, analysis and characteristics of operational amplifiers, analog signal conditioning with operational amplifiers, sampling, multiplexing, A/D and D/A conversion; digital signal conditioning, data input and display, and automated measurement systems. Application of measurement systems to pollution and to biomedical and industrial monitoring is considered.
Prerequisite: ESE 372
3 credits

ESE 305: Deterministic Signals and Systems
response and filtering. Provides general background for subsequent courses in control, communication, electronics, and digital signal processing.

Pre- or Corequisite: ESE 271

3 credits

ESE 306: Random Signals and Systems
Random experiments and events; random variables, probability distribution and density functions, continuous and discrete random processes; Binomial, Bernoulli, Poisson, and Gaussian processes; system reliability; Markov chains; elements of queuing theory; detection of signals in noise; estimation of signal parameters; properties and application of auto-correlation and cross-correlation functions; power spectral density; response of linear systems to random inputs.

Pre- or Corequisite: ESE 305

4 credits

ESE 307: Analog Filter Design
Introduces basic concepts of analog filter theory and implementation. Topics include: filter types; transfer functions; Bode plots; implementation of first- and second-order filters using op amps, maximally flat, and equal-ripple filters; frequency transformations; LC ladders; transconductance-C realizations; switched capacitor circuits; and filter sensitivity.

Prerequisites: ESE 305 and 372

3 credits

ESE 310: Electrical Circuit Analysis II
Network elements, graph theory, linear network analysis; fundamental loops and cutsets, matrix solutions, nonlinear network analysis; state variables, small and large signal analysis, numerical methods.

Prerequisite: ESE 271

3 credits

ESE 311: Analog Integrated Circuits
Engineering design concepts applied to electronic circuits. Basic network concepts, computational analysis and design techniques: models of electronic devices; biasing and compensation methods; amplifiers and filters designed by conventional and computer-aided techniques.

Prerequisite: ESE 372

3 credits

ESE 314: Electronics Laboratory B
Coordinated with, and illustrates and expands upon, concepts presented in ESE 372. Experiments include diode circuits, class A BJT, FET and differential amplifiers as well as analog signal processing. Laboratory fee required.

Prerequisites: ESE 211 and 372

3 credits

ESE 315: Control System Design

Prerequisite: ESE 271

3 credits

ESE 319: Electromagnetics and Transmission Line Theory
Fundamental aspects of electromagnetics wave propagation and radiation, with application to the design of high speed digital circuits and communications systems. Topics include: solutions of Maxwell's equations for characterization of EM wave propagation in unbounded and lossy media; radiation of EM energy; guided wave propagation with emphasis on transmission lines theory.

Prerequisite: ESE 271

3 credits

ESE 321: Electromagnetic Waves and Wireless Communication
Covers the wireless radio signal environment; electromagnetic wave propagation in free space and in other media; effects of reflection, scattering, diffraction, and multi-path interference on the characteristics and quality of the received signal; cellular wireless network planning; efficient use and reuse of assigned radio frequency spectrum; effects of transmitting and receiving antenna design; introduction of basic wireless communication techniques to achieve reliable communication.

Prerequisite: ESE 319

3 credits

ESE 322: Introduction to Auto ID Technologies
Introduces theory and application of important data-capture technologies namely barcodes, biometrics and RFID. Topics to be covered include: architecture of data-capture / Auto ID systems, barcodes; overview of 1-D and 2-D barcodes and other LOS technologies biometrics; fingerprints, iris-scan, voice recognition and smart-cards; radio frequency identification (RFID); fundamentals, near-field vs. far field, UHF read range estimation, reader sensitivity limits, tag singulation and multiple access protocols, standards, privacy and security issues in RFID, real time location systems (RTLS).

Prerequisites: ESE 218, 305, and 372; Corequisite: ESE 319

3 credits

ESE 323: RFID Technology for Automatic Identification
This course covers the analysis and design of RFID technologies for automatic identification. Included are the theory of operation, analysis of RFID system components, passive and active tags, frequencies used, air interfaces, coding structures, antenna design, and regulatory compliance.

Prerequisite: ESE 319

3 credits

ESE 324: Electronics Laboratory C
Illustrates and expands upon advanced concepts presented in ESE 372. Experiments include multistage amplifiers, class B and class C power amplifiers, speech processing, active RC and switched-capacitor filters, oscillators, and switching power supplies. Laboratory fee required.

Prerequisites: ESE or ECE major; U3 standing; ESE 211 and 372

2 credits

ESE 325: Modern Sensors
The course focuses on the underlying physics principles, design, and practical implementation of sensors and transducers including piezoelectric, electric, inertial, pressure, position, flow, capacitive, magnetic, optical, and bioelectric sensors. Established as well as novel sensor technologies as well as problems of interfacing various sensors with electronics are discussed.

Prerequisite: ESE 372

3 credits

ESE 330: Integrated Electronics
An overview of the design and fabrication of integrated circuits. Topics include gate-level and transistor-level design; fabrication material and processes; layout of circuits; automated design tools. This material is directly applicable to industrial IC design and provides a strong background for more advanced courses.

Prerequisite: ESE 372

3 credits
<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credits</th>
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<tr>
<td>ESE 332</td>
<td>Semiconductor Device Characterization</td>
<td>3</td>
<td>ESE 372</td>
</tr>
<tr>
<td>ESE 333</td>
<td>Real-Time Operating Systems</td>
<td>3</td>
<td>ESE 124; CSE 214; ESE 380 or CSE 220</td>
</tr>
<tr>
<td>ESE 337</td>
<td>Digital Signal Processing: Theory</td>
<td>3</td>
<td>ESE 305</td>
</tr>
<tr>
<td>ESE 340</td>
<td>Basic Communication Theory</td>
<td>3</td>
<td>ESE 305 and 306</td>
</tr>
<tr>
<td>ESE 341</td>
<td>Introduction to Wireless and Cellular Communication</td>
<td>3</td>
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<tr>
<td>ESE 342</td>
<td>Digital Communications Systems</td>
<td>3</td>
<td>ESE 340</td>
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<tr>
<td>ESE 344</td>
<td>Software Techniques for Engineers</td>
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<td>ESE 218; CSE 230 or ESE 224</td>
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<td>ESE 345</td>
<td>Computer Architecture</td>
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<td>ESE 346</td>
<td>Computer Communications</td>
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<td>ESE 340</td>
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<tr>
<td>ESE 347</td>
<td>Digital Signal Processing: Implementation</td>
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<td>ESE 337, or ESE 305 and 380</td>
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<td>ESE 350</td>
<td>Electrical Power Systems</td>
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<td>ESE 372</td>
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<td>ESE 352</td>
<td>Electromechanical Energy Converters</td>
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<td>Pre- or corequisite for ESE and ECE majors: ESE 306</td>
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<td>ESE 355</td>
<td>VLSI System Design</td>
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<td>ESE 356</td>
<td>Digital System Specification and Modeling</td>
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Introduces concepts of specification and modeling for design at various levels of abstraction. High Level specification language is used for executable models creation, representing possible architecture implementations. Topics include design space exploration through fast simulation and re-use of models and implementation.

Prerequisites: ESE 124 and ESE 380
3 credits

**ESE 357: Digital Image Processing**

Covers digital fundamentals, image transforms, image enhancement, image restoration, image compression, segmentation, representation and description, recognition and interpretation.

Prerequisites for ESE and ECE majors: ESE 305; ESE 224 or CSE 230
Prerequisites for CSE majors: CSE 214 and 220
3 credits

**ESE 358: Computer Vision**

Introduces fundamental concepts, algorithms, and computational techniques in visual information processing. Covers image formation, image sensing, binary image analysis, image segmentation, Fourier image analysis, edge detection, reflectance map, photometric stereo, basic photogrammetry, stereo, pattern classification, extended Gaussian images, and the study of human visual system from an information processing point of view.

Prerequisites for ESE and ECE majors: ESE 305; ESE 224 or CSE 230
Prerequisites for CSE majors: CSE 214 and 220
3 credits

**ESE 360: Network Security Engineering**

An introduction to computer network and telecommunication network security engineering. Special emphasis on building security into hardware and hardware working with software. Topics include encryption, public key cryptography, authentication, intrusion detection, digital rights management, firewalls, trusted computing, encrypted computing, intruders and viruses. Not for credit in addition to CSE 408.

Prerequisite: ESE/CSE 346 or CSE/IIE 310
3 credits

**ESE 363: Fiber Optic Communications**

Design of single and multi-wavelength fiber optic communications systems. Topics include analysis of optical fibers, optical transmitters and receiver design, optical link design, single-wavelength fiber optic networks with analysis of FDDI and SONET/SDH, and wavelength division multiplexing.

Prerequisite: ESE 372
4 credits

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

This course focuses on development of mixed-signal embedded applications that utilize systems on chip (SoC) technology. The course discusses design issues such as: implementation of functionality; realizing new interfacing capabilities; and improving performance through programming the embedded microcontroller and customizing the reconfigurable analog and digital hardware of SoC.

Prerequisites: ESE 380 and ESE 372; ESE 224 or CSE 230
4 credits

**ESE 372: Electronics**

The pertinent elements of solid-state physics and circuit theory are reviewed and applied to the study of electronic devices and circuits, including junction diodes, transistors, and gate and electronic switches; large- and small-signal analysis of amplifiers; amplifier frequency response; and rectifiers and wave-shaping circuits.

Prerequisite: ESE 271
Corequisite for ESE and ECE majors: ESE 211
4 credits

**ESE 373: RF Electronics for Wireless Communications**

Introduces basic concepts and key circuits of radio-frequency systems. Taught within the design and construction of a transceiver for wireless communications, the course covers fundamental principles which apply to all radio devices. Essential theoretical background, with additional emphasis on practical implementation using commercially available integrated circuits for double-balanced mixers, oscillators, and audio power amplifiers. Basic components and circuits; key elements of radio electronics, including filters, matching networks, amplifiers, oscillators, mixers, modulators, detectors, and antennae. Computer simulation via Pspice and Puff is emphasized as an integral part of the design process.

Prerequisite: ESE 372
3 credits

**ESE 380: Embedded Microprocessor Systems Design I**

Fundamental concepts and techniques for designing electronic systems that contain a microprocessor or microcontroller as a key component. Topics include system level architecture, microprocessors, ROM, RAM, I/O subsystems, address decoding, PLDs and programmable peripheral ICs, assembly language programming and debugging. Hardware-software trade-offs in implementation of functions are considered. Hardware and software design are emphasized equally. Laboratory work involves design, implementation, and testing of microprocessor controlled circuits.

Prerequisite: ESE 218
4 credits

**ESE 381: Embedded Microprocessor Systems Design II**

A continuation of ESE 380. The entire system design cycle, including requirements definition and system specifications, is covered. Topics include real-time requirements, timing, interrupt driven systems, analog data conversion, multi-module and multi-language systems. The interface between high-level language and assembly language is covered. A complete system is designed and prototyped in the laboratory.

Prerequisites: ESE 271 and 380
4 credits

**ESE 382: Digital Design Using VHDL and PLDs**

Digital system design using the hardware description language VHDL and system implementation using complex programmable logic devices (CPLDs) and field programmable gate arrays (FPGAs). Topics include design methodology, VHDL syntax, entities, architectures, testbenches, subprograms, packages, and libraries. Architecture and characteristics of PLDs and FPGAs are studied. Laboratory work involves writing the VHDL descriptions and testbenches for designs, compiling, and functionally stimulating the designs, fitting and timing simulation of the fitted designs, and programming the designs into a CPLD or FPGA and bench testing.

Prerequisite: ESE 218
4 credits

**ESE 440: Engineering Design I**

Lectures by faculty and visitors on typical design problems encountered in engineering practice. During this semester each student will choose a senior design project for Engineering Design II. A preliminary design report is required. Not counted as a technical elective. Laboratory fee required.
Prerequisites: ESE or ECE major, U4 standing; two ESE technical electives (excluding ESE 390 and 499); ESE 300. Students may need additional prerequisites depending on the design project undertaken.

ESE 441: Engineering Design II
Student groups carry out the detailed design of the senior projects chosen during the first semester. A comprehensive technical report of the project and an oral presentation are required. Not counted as a technical elective. Laboratory fee required.

Prerequisite: ESE 440
3 credits

ESE 475: Undergraduate Teaching Practicum
Students assist the faculty in teaching by conducting recitation or laboratory sections that supplement a lecture course. The student receives regularly scheduled supervision from the faculty instructor. May be used as an open elective only and repeated once.

Prerequisites: U4 standing; a minimum g.p.a. of 3.00 in all Stony Brook courses, and a grade of B or better in the course in which the student is to assist; permission of department.
3 credits

ESE 476: Instructional Laboratory Development Practicum
Students work closely with a faculty advisor and staff in developing new laboratory experiments for scheduled laboratory courses in electrical and computer engineering. A comprehensive technical report and the instructional materials developed must be submitted at the end of the course. May be used as a technical elective for electrical and computer engineering majors. May be repeated as an open elective.

Prerequisites: U4 standing; minimum cumulative g.p.a. of 3.0 and minimum grade of A- in the course for which the students will develop material; permission of department and instructor.
3 credits

ESE 488: Internship in Electrical/Computer Engineering
An independent off-campus engineering project with faculty supervision. May be repeated but only three credits of internship electives may be counted toward the non-ESE technical elective requirement.

Prerequisites: ECE or ESE major; U3 or U4 standing; 3.00 g.p.a. minimum in all engineering courses; permission of department.
3 credits

ESE 499: Research in Electrical Sciences
An independent research project with faculty supervision. Permission to register requires a 3.00 g.p.a. in all engineering courses and the agreement of a faculty member to supervise the research. May be repeated but only three credits of research electives (AMS 487, BME 499, CSE 487, MEC 499, ESM 499, EST 499, ISE 487) may be counted toward non-ESE technical elective requirements.

Requirements: U4 standing, 3.00 g.p.a. minimum in all engineering courses, permission of department
0-3 credits