Electrical Engineering (ESE)

Major and Minor in Electrical Engineering

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, COLLEGE OF ENGINEERING AND APPLIED SCIENCES

CHAIRPERSON: Serge Luryi  UNDERGRADUATE PROGRAM DIRECTOR: Ridha Kamoua  STAFF ASSISTANT: Carolyn Huggins

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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

Gregory L. Beneny, Professor, Ph.D., Institute of Semiconductors, Kiev, Ukraine; D.Sc., Institute of Physics and Mathematics, Baku, Russia: Semiconductor devices; physics and technology; lasers for telecommunication.

Monica Fernandez Bugallo, Assistant Professor, Ph.D., University of A Coruna, Spain: Statistical signal processing and its applications to multimuser communications, smart antenna systems, target tracking and vehicle positioning and navigation.

Sheldon S. Chang, Professor Emeritus, Ph.D., Purdue University: Optimal control; energy conservation; information theory; economic theory.

Chi-Tsong Chen, Professor, Ph.D., University of California, Berkeley: Systems and control theory; digital signal processing.

Harbans S. Dhawal, Associate Professor, Ph.D., University of London: Fiber-optic sensors; optical signal processing; photon correlation spectroscopy; inverse problems.

Petr M. Djuric, Professor, Ph.D., University of Rhode Island: Signal processing; systems theory.

Alex Doboli, Assistant Professor, Ph.D., University of Cincinnati: VLSI; CAD with emphasis on hardware/software co-design; mixed-signal synthesis and high-level systems.

Dmitri Doneisky, Assistant Professor, Ph.D., St. Petersburg Technical University, Russia; Ph.D. Stony Brook University: Design of long-wavelength detectors; photovoltaic cells and high power laser diode arrays.

Mikhail N. Dorajevets, Associate Professor, Ph.D., Russian Academy of Sciences, Novosibirsk: Parallel computer architecture; high-performance systems design.

Vera Garfinkel, Associate Professor, Ph.D., A.F. Ioffe Physical-Technical Institute, St. Petersburg, Russia: Semiconductor devices, including microwave and optoelectronics.

Sangjin Hong, Assistant Professor, Ph.D., University of Michigan: Low-power VLSI design of multimedia wireless communications and digital signal processing systems, including SOC design methodology and optimization.

Ridha Kamoua, Associate Professor, Ph.D., University of Michigan: Solid-state devices and circuits; microwave devices and integrated circuits.

Serge Luryi, Professor, Ph.D., University of Toronto: High-speed solid-state electronic and photonic devices; semiconductor physics and technology.

Velio A. Marsocci, Distinguished Service Professor Emeritus, Eng.Sc., New York University: Solid-state electronics; integrated electronics; biomedical engineering.

John Murray, Associate Professor, Ph.D., University of Notre Dame: Signal processing; systems theory.

Jayantkumar P. Parekh, Professor, Ph.D.; Polytechnic Institute of Brooklyn: Microwave acoustics; microwave magnetics; microwave electronics; microcomputer applications.

Stephen S. Rappaport, Professor Emeritus, Ph.D., New York University: Communication theory; systems theory.

Thomas G. Robertazzi, Professor, Ph.D., Princeton University: Computer communications; performance evaluation; parallel processing.

Yacov Shamash, Professor, Ph.D., Imperial College: Control systems and robotics.

Kenneth L. Short, Professor, Ph.D., Stony Brook University: Digital system design; embedded microprocessor systems; instrumentation. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1985, and the President’s Award for Excellence in Teaching, 1985.

Muralidhara Subbarao, Professor, Ph.D., University of Maryland at College Park: Computer vision; image processing.

Stephen E. Sussman-Fort, Associate Professor, Ph.D., University of California, Los Angeles: Electronic circuits; CAD; solid-state electronics; electromagnetics; semiconductor devices.

Wendy K. Tang, Associate Professor, Ph.D., University of Rochester: Parallel and distributed processing; massively parallel systems; computer architecture; neural networks.

Hang-Sheng Tuan, Professor, Ph.D., Harvard University: Electromagnetic theory; integrated optics; microwave acoustics.

Yuanyuan Yang, Professor, Ph.D., The Johns Hopkins University: Parallel and distributed computing and systems; high speed networks; optical networks; high performance computer architecture; fault-tolerant computing.

Affiliated Faculty

Gene R. Gindi, Radiology

Adjunct Faculty

Estimated number: 3

Teaching Assistants

Estimated number: 30

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. Electrical Engineering students may choose a specialization which is completed in the junior and senior years. See the Computer Engineering entry in the alphabetical listing of Approved Majors, Minors, and Programs for the requirements for that major. The current Program Educational Objectives are available at http://www.ece.sunysb.edu.
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 control and command 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.

Courses Offered in Electrical and Computer Engineering

See the Course Descriptions listing in this Bulletin for complete information.

ESE 123 Introduction to Electrical and Computer Engineering
ESE 124 Computer Techniques for Electronic Design
ESE 211 Electronics Laboratory A
ESE 218 Digital Systems Design
ESE 224 Computer Techniques for Electronic Design II
ESE 231 Introduction to Semiconductor Devices
ESE 271 Electrical Circuit Analysis I
ESE 290 Transitional Study
ESE 300 Technical Communication for Electrical and Computer Engineers
ESE 304 Applications of Operational Amplifiers
ESE 305 Deterministic Signals and Systems
ESE 306 Random Signals and Systems
ESE 307 Analog Filter Design
ESE 310 Electrical Circuit Analysis II
ESE 311 Analog Integrated Circuits
ESE 312 Microwave Electronics
ESE 314 Electronics Laboratory B

ESE 315 Control System Design
ESE 316 Digital Devices and Circuits
ESE 319 Introduction to Electromagnetic Fields and Waves
ESE 320 Microwave Electronics Laboratory
ESE 321 Electromagnetic Waves and Wireless Communication
ESE 324 Electronics Laboratory C
ESE 330 Integrated Electronics
ESE 332 Semiconductor Device Characterization
ESE 333 Real-Time Operating Systems
ESE 337 Digital Signal Processing: Theory
ESE 340 Basic Communication Theory
ESE 341 Information Theory and Coding
ESE 342 Digital Communications Systems
ESE 343 Modern Electronic Communications Laboratory
ESE 344 Software Techniques for Engineers
ESE 345 Computer Architecture
ESE 346 Computer Communications
ESE 347 Digital Signal Processing: Implementation
ESE 349 Introduction to Fault Diagnosis of Digital Systems
ESE 350 Electrical Power Systems
ESE 351 Energy Conversion
ESE 352 Electromechanical Energy Converters
ESE 355 VLSI System Design
ESE 356 Digital System Specification and Modeling
ESE 357 Digital Image Processing
ESE 358 Computer Vision
ESE 362 Optoelectronic Devices and Optical Imaging Techniques
ESE 363 Fiber Optic Communications
ESE 371 Computer Graphics
ESE 372 Electronics
ESE 373 RF Electronics for Wireless Communications
ESE 380, 381 Embedded Microprocessor Systems Design I, II
ESE 382 Digital Design Using VHDL and PLDs
ESE 390 Special Topics in Digital Systems

ESE 440, 441 Engineering Design I, II
ESE 475 Undergraduate Teaching Practicum
ESE 476 Instructional Laboratory Development Practicum
ESE 488 Internship in Electrical/Computer Engineering
ESE 499 Research in Electrical Sciences

Acceptance into the Electrical Engineering Major

Freshman and transfer applicants who have specified their interest in the major in Electrical Engineering may be accepted into the major upon admission to the University. Applicants admitted to the University but not immediately accepted into the Electrical 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, or electrical and computer engineering 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 Electrical Engineering (ESE)

The curriculum begins with a focus on basic mathematics and natural sciences followed by courses that emphasize engineering science and bridging courses that combine engineering science and design. The series of courses culminates in a one-year design experience that integrates various engineering skills and knowledge acquired. Technical elective courses are also required according to the student’s chosen specialization. The core sequence, technical electives, and additional courses may be chosen in consultation with a faculty advisor, taking into consideration the particular interest of the student.

Completion of the major requires approximately 100 credits.
1. Mathematics
AMS 151, 161 Applied Calculus I, II
AMS 261 or MAT 203 Applied Calculus III
AMS 361 or MAT 303 Applied Calculus IV
AMS 210 or MAT 211 Linear Algebra
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

2. Natural Sciences
PHY 131/133, 132/134 Classical Physics I, II and Laboratories
CHE 198/199 Chemistry for Engineers 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.) The chemistry course sequence CHE 131, 132, and 133 or 141, 142, and 143 is accepted in lieu of CHE 198 and 199.

3. Freshman Introduction to Electrical Engineering
ESE 123 Introduction to Electrical and Computer Engineering
ESE 124 Computer Techniques for Electronic Design

4. Core Courses
ESE 211 Electronics Lab A
ESE 218 Digital Systems Design
ESE 231 Introduction to Semiconductor Devices
ESE 271 Electrical Circuit Analysis
ESE 305 Deterministic Signals and Systems
ESE 306 Random Signals and Systems
ESE 314 Electronics Laboratory B

Notes to Sample Course Sequences
Courses with a # must be passed with a grade of C or higher.
Total credits must equal 128 or higher.

Sample Course Sequences for the Major in Electrical Engineering

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<tr>
<th>Freshman Fall</th>
<th>Credits</th>
<th>Freshman Spring</th>
<th>Credits</th>
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<tr>
<td>First Year Seminar 101</td>
<td>1</td>
<td>AMS 161 (or MAT 132)</td>
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<td>AMS 151 (or MAT 131)#</td>
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<td>PHY 132/134#</td>
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<td>PHY 131/133#</td>
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<td>ESE 124#</td>
<td>3</td>
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<td>ESE 305</td>
<td>3</td>
<td>CHE 198 and 199</td>
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<tr>
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<td>AMS 361 (or MAT 303)</td>
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<td>AMS 261 (or MAT 203)</td>
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<td>ESE 231#</td>
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<td>ESE 302</td>
<td>3</td>
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<td>ESE 271#</td>
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<td>ESE 218#</td>
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<td>ESE 305</td>
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<td>ESE 211</td>
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<tr>
<td>AMS 210 (or MAT 211)</td>
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</tr>
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<td>ESE 319</td>
<td>3</td>
<td>ESE xxx#</td>
<td>3</td>
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<tr>
<td>ESE 337#</td>
<td>3</td>
<td>ESE 324</td>
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<tr>
<td>ESE xxx</td>
<td>3</td>
<td>ESE 300</td>
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<tr>
<td>2 D.E.C. courses</td>
<td>6</td>
<td>2 D.E.C. courses</td>
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<table>
<thead>
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<th>Senior Fall</th>
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<tr>
<td>ESE 440</td>
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<td>ESE 441</td>
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<tr>
<td>ESE xxx#</td>
<td>3</td>
<td>ESE xxx#</td>
<td>3</td>
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<td>ESE 380</td>
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<td>ESE xxx</td>
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<td>Technical elective</td>
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<tr>
<td>D.E.C.</td>
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<tr>
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Notes to Sample Course Sequences
Courses with a # must be passed with a grade of C or higher.
Total credits must equal 128 or higher.

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ESE 319 Introduction to Electromagnetic Fields and Waves
ESE 324 Electronics Laboratory C
ESE 337 Digital Signal Processing Theory
ESE 372 Electronics
ESE 380 Embedded Microprocessor Systems Design I

5. Specializations
Students must select the general track or one of the two specializations by the end of the sophomore year.

a. General
6 ESE technical electives and 2 non-ESE technical electives

b. Microelectronics
ESE 304 Applications of Operational Amplifiers
ESE 311 Analog Integrated Circuits
ESE 330 Integrated Electronics
ESE 355 VLSI System Design
ESE 373 RF Electronics for Wireless Communications
2 ESE technical electives
1 non-ESE technical elective

c. Telecommunications
ESE 340 Basic Communication Theory
ESE 342 Digital Communications Systems
ESE 346 Computer Communications
ESE 347 Digital Signal Processing: Implementation
ESE 363 Fiber Optic Communications
2 ESE technical electives
1 non-ESE technical elective

Note: Students should visit the Department of Electrical and Computer Engineering for a copy of a sample course sequence for each specialization.

6. Design
ESE 400 and 441, Engineering Design I and II. Students who select the Microelectronics or Telecommunications specialization must complete a senior design project designated for the relevant area.

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

7. 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 Electrical Engineering majors. Students must register for the writing course ESE 300 concurrently with or after completion of ESE 314, 324, 380, or 382 and submit approximately three long reports based on the experiments performed in one of the courses. Students whose writing does not meet the required standard are referred for remedial help. Detailed guidelines are provided by the Department. If the standard of writing is judged acceptable, the student receives an S grade for ESE 300, thereby satisfying this requirement.

Grading
All courses taken for the major must be taken for a letter grade. A grade of C or higher is required in the following courses:

1. ESE 211, ESE 218, ESE 231, ESE 271, ESE 337, ESE 372, AMS 151, AMS 161 (or MAT 131, MAT 132), PHY 131, PHY 132
2. For students in the Microelectronics Specialization: ESE 304, ESE 311, ESE 330, ESE 355, ESE 373
3. For students in the Telecommunications Specialization: ESE 340, ESE 342, ESE 346, ESE 347, ESE 363
4. For students in the General Track: Five ESE Technical Electives

Requirements for the Minor in Electrical Engineering (ESE)
The Electrical Engineering minor is intended for students with majors other than Electrical or Computer Engineering who seek to complement their chosen major through an introduction to the principles and techniques of electrical engineering. Students interested in the minor should apply through the office of the Department of Electrical and Computer Engineering, as early as possible. A cumulative grade point average of 2.75 is required for admission to the minor.

Students seeking to complete the ESE minor must meet the relevant prerequisites and corequisites of each ESE course. At least nine credits must be in upper-division courses. All courses for the minor must be passed with a letter grade of C or higher.

Completion of the minor requires 21 credits.

1. ESE 123 (4 credits)
2. ESE 271 (4 credits)
3. Four or five ESE courses for a total of at least 13 credits.

Note: Students may not take ESE 124, 275, 300, 324, 440, 441, 475, 476, 488, or 499 for credit toward the minor.

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