The Department of Electrical and Computer Engineering (ECE) strives to provide high-quality degree programs that emphasize fundamental principles, respond to the changing demands and opportunities of new technology, challenge the exceptional abilities of Rice students, and prepare students for roles of leadership in their chosen careers. Undergraduate and graduate programs in ECE offer concentrations in the areas of Computer Engineering, Photonics and Nanoengineering and Systems. Computer Engineering topics include: computer architecture, high performance application specific systems, mobile and embedded systems, integrated circuits and antennas for medical imaging and bio-sensing, and parallel I/O for large-scale network storage.
systems. Photonics and nanoengineering topics include: nanophotonics/nanospectroscopy, molecular electronics, biophotonics, ultrafast optics and optoelectronics, semiconductor optics and devices, multispectral imaging and terahertz imaging, and condensed matter physics/materials science. Systems topics include: communications systems, dynamical systems and computation, networks, signal and image processing, wireless networking, pattern recognition, scalable personal healthcare, and computational neuroscience and neuroengineering. The latest information on the department’s faculty, research areas, and degree programs and requirements can be found on the ECE website: www.ece.rice.edu/.

Undergraduate Degree Programs

The department offers two undergraduate degrees: the bachelor of arts (BA) and the bachelor of science in electrical engineering (BSEE). The BA degree provides a basic foundation in electrical and computer engineering that the student can build on to construct a custom program. Because of its flexibility and large number of free electives, the BA can be combined easily with courses from other departments to create an interdisciplinary program. This may be particularly appropriate for students planning further study in law, business, or medicine.

The BSEE degree is the usual degree taken by those students planning a career of engineering practice. It is accredited by the (EAC) Engineering Accreditation Commission of ABET* (http://www.abet.org) and can reduce the time required to become a licensed professional engineer. The program for the BSEE requires more hours and greater depth than the BA degree but still provides considerable flexibility.

Both degrees are organized around a core of required courses and a selection of elective courses from three specialization areas: computer engineering; photonics and nanoengineering; and systems: control, communication, and signal processing. Each student’s program must contain a depth sequence in one area and courses from at least two areas to provide breadth. The specialization electives provide the flexibility to create a focus that crosses traditional areas. Because of the number of options, students should consult early with departmental advisors to plan a program that meets their needs.

BSEE Degree Requirements—See Graduation Requirements for general university requirements.

A BSEE program must have a total of at least 134 semester hours and include the following courses. A course can satisfy only one program requirement. Students who place out of required courses without transcript credit must substitute other approved courses in the same area. Current degree requirements and planning sheets can be found on the ECE website: www.ece.rice.edu.

Mathematics and Science Courses

CHEM 121 General Chemistry
ELEC 261 Electronic Materials and Quantum Devices
ELEC 303 Random Signals
MATH 101 Single Variable Calculus I
MATH 102 Single Variable Calculus II
MATH 212 Multivariable Calculus

MATH 355 Linear Algebra or CAAM 335 Matrix Analysis
PHYS 101 Mechanics
PHYS 102 Electricity and Magnetism
Additional approved mathematics and science courses to bring the total to 32 hours.

* ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, Phone: 410-347-7700, E-mail: eac@abet.org, Website: http://www.abet.org
**ECE Core Courses**

ELEC 220 Fundamentals of Computer Engineering  
ELEC 241 Fundamentals of Electrical Engineering I  
ELEC 242 Fundamentals of Electrical Engineering II  
ELEC 301 Introduction to Signals  
ELEC 305 Introduction to Physical Electronics  
ELEC 326 Digital Logic Design  

**Computation Course:** One from  
CAAM 210 Introduction to Engineering Computation  
COMP 140 Computational Thinking  

**BSEE Design Requirement**

All BSEE degree candidates must complete a design sequence of courses taken during the junior and senior years.

There are three related components to the BSEE Senior Design sequence: a design laboratory course, a seminar in professional issues and project management, and the actual design project. In the Junior year, students choose one of the approved Design Laboratory courses based on their Specialization Area:

a) Elec 327: Implementation of Digital Systems for Computer Engineering Area  
b) Elec 332: Electronic Systems Principles and Practice for Systems Area  
c) Elec 364: Photonic Measurements: Principles and Practice for Photonics and Nanoengineering Area

A seminar required to be taken in the spring of the junior year, ELEC 394 Professional Issues and Project Management for Electrical Engineers, provides instruction in professional engineering topics, and the nontechnical aspects of the design process, including ethics, design methodology, project planning, technical presentations, and documentation. **NOTE: The required Design Laboratory does not count as specialization.**

Both semesters of the senior year are devoted to the team design project using the resources of the Oshman Engineering Design Kitchen through the ELEC 494 Senior Design course. In the fall semester of the senior year, students finalize their project topics in coordination with the faculty and begin the design project. In the spring semester, students continue in the laboratory to complete their design project. Several presentations and design contests within the ECE department and the School of Engineering occur in the spring in which to showcase the projects.

**BSEE Specialization Area Courses**

Upper-level ECE courses are organized into three specialization areas: computer engineering; photonics and nanoengineering; and systems: control, communication, and signal processing. The computer engineering area provides a broad background in computer systems engineering, including computer architecture, digital hardware engineering, software engineering, and computer systems performance analysis. The systems area focuses on wireless
communication systems, digital signal processing, image processing, and networking. The photonics and nanoengineering area encompasses studies of electronic materials, including nanomaterials, semiconductor and optoelectronic devices, lasers and their applications.

For the BSEE Program, a minimum of six specialization area courses, including three or more in one major area, and courses from at least two areas are required. Each course must be at least 3 semester hours. The department may add or delete courses from the areas, and graduate courses and equivalent courses from other departments may be used to satisfy area requirements with permission. Graduate courses, in the 500 level series, can often count as specialization courses with Advisor's approval. Consult with department advisors and the ECE Web Site www.ece.rice.edu for the latest area courses.

NOTE: If the Design Laboratory requirement (ELEC 327, 332, or 364) is satisfied with the lab in their chosen Major Specialization Area, then the student takes 3 of 6 courses in their chosen Major Specialization Area. However, if the Design Laboratory requirement is satisfied with the lab in their Minor Area, then it is recommended that the student takes 4 of 6 courses in their chosen Major Specialization Area. It is important to consult a departmental advisor in this situation or if interested in taking a second Design Laboratory course.

Computer engineering: ELEC 323+, 342, 421+, 424, 425, 429+ and 446 and COMP 221+ and 430+  
*Note: Elec 323/Comp 322, Elec 421/Comp 421, Elec 429/Comp 429, Comp 221 and Comp 430 are courses listed or crosslisted with Computer Science. Additional prerequisites have been added for 2011-2012.

Comp 211 or the sequence of Comp 182 with Comp 215 are recommended in addition for Computer Engineering Area.

Photonics and nanoengineering: ELEC 262, 306, 342, 361, 462 and PHYS 302 and 311


BSEE Unrestricted Electives
Additional courses to provide the BSEE minimum requirement of at least 134 semester hours.

BA Degree Requirements—See Graduation Requirements for general university requirements. A BA program must have a total of at least 121 semester hours and include the following courses. A course can satisfy only one program requirement, except for laboratory. Students who place out of required courses without transcript credit must substitute other approved courses in the same area. Current degree requirements and planning sheets may be found on the ECE website: www.ece.rice.edu.

Mathematics and Science Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>ELEC 261</td>
<td>Electronic Materials and Quantum Devices</td>
</tr>
<tr>
<td>ELEC 303</td>
<td>Random Signals (Note: ELEC 303 is required for BA and must have instructor's approval)</td>
</tr>
<tr>
<td>MATH 101</td>
<td>Single Variable Calculus I</td>
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<tr>
<td>MATH 102</td>
<td>Single Variable Calculus II</td>
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</tbody>
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Electrical and Computer Engineering 5

**ECE Core Courses**

ELEC 220 *Fundamentals of Computer Engineering*

ELEC 241 *Fundamentals of Electrical Engineering I*

ELEC 242 *Fundamentals of Electrical Engineering II*

ELEC 305 *Introduction to Physical Electronics*

ELEC 326 *Digital Logic Design*

**Computation Course:** One from

CAAM 210 *Introduction to Engineering*

**BA Specialization Area Courses**

For the BA Program, a minimum of four specialization area courses, including two or more in one major area, and courses from at least two areas are required. Each course must be at least 3 semester hours. The department may add or delete courses from the areas, and graduate courses and equivalent courses from other departments may be used to satisfy area requirements with permission.

Graduate courses, in the 500 level series, can often count as specialization courses with Advisor's approval. Consult with department advisors and the ECE Web Site [www.ece.rice.edu](http://www.ece.rice.edu) for the latest area courses.

**NOTE:** If the Design Laboratory requirement (ELEC 327, 332, or 364) is satisfied with the lab in their chosen Major Specialization Area, then the student takes 2 of 4 courses in their chosen Major Specialization Area. However, if the Design Laboratory requirement is satisfied with the lab in their Minor Area, then it is recommended that the student takes 3 of 4 courses in their chosen Major Specialization Area. It is important to consult a departmental advisor in this situation or if interested in taking a second Design Laboratory course.

**Computer Engineering:** ELEC 323*, 342, 421+, 424, 425, 429*, 446 and COMP 221* and 430*

*Note: ELEC 323/COMP 322, ELEC 421/COMP 421, ELEC 429/COMP 429, COMP 221 and COMP 430 are courses listed or crosslisted with Computer Science. Additional prerequisites have been added for 2011-2012.

**Design Laboratory:** Students choose one of the approved design laboratory courses typically based on their Specialization Area:

- ELEC 327 *Implementation of Digital Systems*
- ELEC 332 *Electronic Systems: Principles and Practice*
- ELEC 364 *Photonic Measurements: Principles and Practice*

**Note:** The required Design Laboratory does not count as specialization.

**Electrical and Computer Engineering**

**Computation**

COMP 140 *Computational Thinking*

**Photonics and nanoengineering:** ELEC 262, 306, 342, 361, 462 and PHYS 302 and 311

**Systems:** Communications, Control, Networks and Signal Processing: ELEC 302, 306, 381, 430, 431, 433, 434, 435, 436, 437, 438, 439, 446, 481, 482, 485, and 486

**BA Unrestricted Electives**

Additional courses to provide the BA minimum requirement of at least 121 semester hours.

**Graduate Degree Programs**

The ECE department offers two graduate degree programs. The master of
electrical engineering (MEE) degree is a course-based program designed to increase a student’s mastery of advanced subjects; no thesis is required. The MEE prepares a student to succeed and advance rapidly in today's competitive technical marketplace. A joint MBA/MEE degree is offered in conjunction with the Jesse H. Jones Graduate School of Management. The doctor of philosophy (PhD) program prepares students for a research career in academia or industry. The PhD program consists of formal courses and original research conducted under the guidance of a faculty advisor, leading to a dissertation. Students in the PhD program complete a master of science (MS) degree as part of their program; the ECE department does not admit students for a terminal MS degree.

Information on admission to graduate programs is available from the ECE Graduate Committee and on the ECE website. Students must achieve at least a B (3.0) average in the courses counted toward a graduate degree. In addition, no course in which the student earned a grade lower than a C may count toward a graduate degree.

**MEE Degree Requirements**—Students are admitted to the MEE program in both fall and spring semesters. MEE students must prepare a degree plan and have it approved by their ECE faculty advisor. The plan must include at least 30 semester hours of courses, all at the 300 level and above. The program should include a major area of specialization (18 semester hours), a minor area (six semester hours), plus free electives. At least seven of the major and minor area courses must be at the 400 level and above, and at least four must be at the 500 level or above. ELEC 590 or ELEC 599 may not count as major area courses; no more than three semester hours can be transfer credit from another university, and at most one 1-hour seminar course may be included in the plan. A MEE degree planning form and current requirements may be found on the ECE website.

**PhD Degree Requirements**—Students are admitted to the PhD program only in the fall semester. ECE PhD students move through the program in stages, starting as first-year student, advancing to MS candidate, PhD-qualified student, and PhD candidate; each advancement requires the approval of the ECE graduate committee. Students entering with previous graduate work may follow a hybrid program developed in consultation with the faculty and the graduate committee. The first academic year concentrates on foundation coursework and developing a research area. Each student must successfully complete a project, ELEC 599, in his or her chosen area of research in lieu of an oral or written qualifying exam. In addition to enabling the faculty to evaluate the student’s research potential, the project encourages timely completion of the MS degree. The student must complete a master's thesis and successfully defend it in an oral examination. Students who have already acquired a master's degree elsewhere must also complete the ELEC 599 project, after which acceptance of their previous master's degree will be determined by the Graduate Committee.

A candidate for the PhD degree must demonstrate independent, original research in electrical and computer engineering. After successfully presenting a PhD research proposal and completion of all coursework, a student is eligible for PhD candidacy. The student then engages in full-time research, culminating in the completion and public defense of the PhD dissertation. Details of the PhD program requirements, the phases of study, and a timetable may be found on the ECE website.

See ELEC in the Courses of Instruction section for course descriptions.