

HANDBOOK

The Electrical Engineering Program Office

The Program Office [102B Riggs Hall] represents the first and most important interface with the academic programs of the ECE Department. The staff and procedures of the Program Office are oriented toward treating each student as an individual with a unique set of needs and goals. In order to accomplish these goals, it is the student's responsibility to maintain close contact with the Program Office. Among other things, the student will find that the Program Office will provide:

- Updates on the available offerings in the curriculum and academic requirements.
- Faculty advisor assignments.
- Registration materials.
- Transfer and change-of-major information.
- Projected course offerings.
- Sign-ups for student professional organization events.
- Notices of group meetings for Electrical Engineering majors.
- Job interview notices.

The staff of the Program Office is especially attuned to serving as the initial contact in a triage-like structure of academic offices. The other offices to which the Program Office may refer a student include the Co-op Advising Office, the Michelin Career Center, the College of Engineering and Science Dean's Office, the Bursar's Office and the Registrar's Office.

Advising

http://www.clemson.edu/ces/ece/resources/undergrad_resources/advising_list.html

Each student is assigned a faculty advisor upon entry into the Electrical Engineering program. This assignment will remain the same through graduation, unless the student chooses to change advisors for the purpose of obtaining advice related to a particular specialty. The primary purpose of the advisor is to assist the student in planning the academic program to be followed by that student. The student is responsible for meeting with his or her advisor to select courses for the next semester. The student may also consult his/her advisor at others times if questions arise. The Clemson University catalog publishes an 8-semester study plan that leads to a degree in Electrical Engineering. This plan is highly recommended, satisfies all prerequisite requirements, and guarantees the availability of each course. Any student who deviates from this plan is responsible for designing a plan with the assistance from an advisor that satisfies prerequisites and is consistent with course availability. The 2004-2005 curriculum has a 135 credit hour graduation requirement that requires the student to average approximately 17 credits per semester. The 2005-2006, 2006-2007, 2007-2008, 2008-2009 and 2009-2010 curricula have 126 credit hour graduation

requirements that require the student to average approximately 15-16 credits per semester.

The Electrical and Computer Engineering Department has a Student Services Coordinator, Janet Bean, Room 102-B, Riggs Hall, and an Undergraduate Coordinator, Dr. John Gowdy, Room 211, Riggs Hall, who can assist you in your choice of coursework, curriculum related problems, etc. should your assigned advisor not be available to assist you or answer particular questions. The student is responsible for ensuring that all policies are followed and that all requirements are fulfilled. The student can access his or her official record via SIS at Clemson.edu. The University, not the Department, maintains the official records.

Registration

Each semester, students are required to implement their academic plan by enrolling in courses for the coming semester. The registration materials are available from the student's academic advisor. During the advising period just before registration begins, each student should make an appointment to meet with his/her advisor. The student is expected to take an active role in preparing a schedule that follows the academic policies of the Department, including meeting all prerequisites. Students should take to each advising meeting a completed Course Completion Plan and a projected schedule for the coming semester. Students will receive their registration number during the advising meetings. They may then complete the registration process once their registration window opens. The program office will check all registrations for conformance to the academic rules and policies.

Curriculum Overview

The Holcombe Department of Electrical and Computer Engineering offers a four-year program leading to a degree of Bachelor of Science in Electrical Engineering. This program is accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET), the recognized national accrediting agency for professional curricula in engineering. ABET has defined the curricular objective of an engineering education as follows:

"Engineering is that profession in which knowledge of the mathematical and physical sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind. A significant measure of an engineering education is the degree to which it has prepared the graduate to pursue a productive engineering career that is characterized by continued professional growth. Included are the development of (1) a capability to delineate and solve in a practical way the problems of society that are susceptible to engineering treatment, (2) a sensitivity to the socially-related technical problems which confront the profession, (3) an

understanding of the ethical characteristics of the engineering profession and practice, (4) an understanding of the engineer's responsibility to protect both occupational and public health and safety, and (5) an ability to maintain professional competence through lifelong learning. These objectives are normally met by a curriculum in which there is a progression in the course work and in which fundamental scientific and other training of the earlier years is applied in later engineering courses."

The specific Electrical Engineering curriculum is provided subsequently in this document, and some of the key features are as follows:

- There are a number of topical areas that are considered necessary in the preparation for professional practice as an Electrical Engineer.
- There is a progression from the mathematical and scientific courses to the application of both mathematics and scientific principles to specific engineering uses, i.e., the development of engineering sciences and their applications through design to achieve specific goals.
- There are required studies in the humanities and social sciences, although the subjects for these studies are for the most part unspecified.

Your advisor will be glad to discuss this with you and help you explore the elective choices with respect to how you should prepare yourself to reach particular career objectives.

What is perhaps not so clear from examining the curriculum for Electrical Engineering is the extent to which the courses build upon each other. This can be partly understood by examining, through the Clemson University Undergraduate Announcements, the prerequisite courses for a given required course in the curriculum. More subtle, however, is the expected "carryover" of knowledge and skills from not only the prerequisite courses, but also those courses that precede even the prerequisites.

While proceeding through the curriculum you will be expected to "build a structure" of knowledge and skills that act as the foundations for subsequent work. Since this structure will be "in your head," only you can build it by patient study and practice. In this regard, your instructors act as guides who indicate some (but not all) of the important things to be learned and provide you feedback, through critiquing and grading your work, on how well you are preparing your foundation for the practice of Electrical Engineering.

Curriculum

http://www.clemson.edu/ces/departments/ece/resources/undergrad_resources/curriculum.html

When reviewing the requirements for graduation, a student should check their degree progress report in SIS to determine which curricula year that he/she is following. Curricula years can be changed, but by doing so, a student is then responsible for both the engineering and general education requirements of the new curricula year.

Technical Requirements

Electrical Engineering Advanced Mathematics Technical Requirement

3 credit hours required. Choose one of the following courses:

- MTHSC 419 Discrete Mathematical Structures I
- MTHSC 434 Advanced Mathematics for Engineers
- MTHSC 435 Complex Variables
- MTHSC 453 Advanced Calculus I
- MTHSC 454 Advanced Calculus II

Electrical Engineering Technical Requirement

6 credit hours are required for curriculum year 2004-2005; 9 credit hours are required for curricula years 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010 and 2010-2011.

Electrical Engineering Technical Requirement Depth

The 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010 and 2010-2011 curricula require a 3 credit technical depth. Two courses must be completed from the same EE subject area to satisfy this requirement. ECE 222 can NOT be used as a technical elective for students on the 2004-2005 curriculum.

The ECE Technical Requirement choices of courses, listed by subject area, are as follows:

Applied Electromagnetics (AEM)

- ECE 435 Grounding and Shielding
- ECE 436 Microwave Circuits
- ECE 439 Fiber Optics
- ECE 446 Antennas and Propagation

Computer Systems and Architecture (CSA)

- ECE 417 Elements of Software Engineering
- ECE 429 Organization of Computers
- ECE 442 Knowledge Engineering
- ECE 468 Embedded Computing
- ECE 473 Introduction to Parallel Systems

Communications Systems and Networks (CSN)

- ECE 430 Digital Communications
- ECE 438 Computer Communications
- ECE 440 Performance Analysis of Local Computer Networks

Digital Signal Processing (DSP)

- ECE 442 Knowledge Engineering
- ECE 467 Introduction to Digital Signal Processing

Electronics (ELE)

- ECE 404 Semiconductor Devices
- ECE 406 Introduction to Microelectronics Processing
- ECE 422 Electronic System Design I
- ECE 432 Instrumentation
- ECE 459 Integrated Circuit Design

Intelligent Systems (CRB)

- ECE 442 Knowledge Engineering
- ECE 455 Robot Manipulators
- ECE 457 Fundamentals of Wind Power
- ECE 467 Introduction to Digital Signal Processing
- ECE 468 Embedded Computing

Power (POW)

- ECE 418 Power System Analysis
- ECE 419 Electric Machines and Drives

Biomedical Systems

- BIOE 201 Introduction to Biomedical Engineering
- BIOE 370 Bioinstrumentation and Bioimaging
- BIOE 471 Biomedical Imaging in Biophotonics

Renewable Energy and Electric Vehicles

- ECE 420 Renewable Energy Penetration on the Power Grid
- ECE 457 Fundamentals of Wind Power
- ECE 461 Fundamentals of Solar Energy
- ECE 470 Vehicle Electronics
- ECE 471 Electric Vehicles and Energy Storage

Other

- ECE 405 Design Projects in Electrical and Computer Engineering
- ECE 460 Computer-Aided Analysis and Design
- ECE H491 Undergraduate Honors Research
- ECE 492 Special Problems
- ECE 493 Selected Topics

BE 440 Renewable Energy Resource Engineering
ME 493 Collaborative Mechatronic Systems and Material Handling Processing
ECE 222 Systems Programming Concepts for Computer Engineering
ECE 499/H499 Creative Inquiry

Note: One course may be substituted by three hours of any of the courses listed under Other.

Humanities and Social Science Requirements

In addition to completing coursework in the major, all students are to complete coursework in general education. The general education requirements must be from the same curricula year in which the student is completing his/her engineering program. For example, a student on the 2006-2007 engineering curricula will also follow the 2006-2007 general education curricula while a student on the 2008-2009 engineering curricula will follow the 2008-2009 general education curricula. The courses which meet the University requirements for graduation are found for each curricula year in Undergraduate Announcements.

2004-2005: http://www.registrar.clemson.edu/publicat/catalog/2004/gen_ed.html
2005-2006: http://www.registrar.clemson.edu/publicat/catalog/2005/gen_ed.html
2006-2007: http://www.registrar.clemson.edu/publicat/catalog/2006_PDF/gened.pdf
2007-2008: <http://www.registrar.clemson.edu/publicat/catalog/2007/gened.pdf>
2008-2009: <http://www.registrar.clemson.edu/publicat/catalog/2008/gened.pdf>
2009-2010: <http://www.registrar.clemson.edu/publicat/catalog/2009/gened.pdf>
2010-2011: <http://www.registrar.clemson.edu/publicat/catalog/2010/gened.pdf>
2011-2012: <http://www.registrar.clemson.edu/publicat/catalog/2011/2011.htm>

General Rules and Policies

The following general policies have been excerpted from the University Undergraduate Announcements and are provided as general constraints to be considered in planning an individual academic program.

A. Requirement on Number of Attempts

"No student may exceed a maximum of two attempts, excluding a W, to successfully complete any electrical and computer engineering course."

B. 300 Level Course Prerequisite

"A cumulative grade-point ratio of 2.0 or higher is required for registration in all engineering courses numbered 300 or higher."

"All Electrical Engineering students must have a cumulative Engineering grade-point ratio of 2.0 in order to enroll in any 300- or 400- level electrical and computer engineering courses."

C. Requirements for Graduation

"A cumulative grade-point ratio of 2.0 is required for graduation."

"For graduation, candidates will be required to have a 2.0 or higher cumulative grade-point ratio in all engineering courses taken at Clemson University. All of these courses exclusively utilize the word 'Engineering' in the course designator (i.e., AGE 221, ME 499, etc.)."

D. Withdrawals

"Each undergraduate student is allowed to withdraw or be withdrawn with grade of W from no more than 17 hours of course work during the entire academic career at Clemson University. Transfer students may withdraw from no more than 12 percent of the total work remaining to be done."

E. Prerequisite Requirements

"A student is allowed to enroll in ECE courses (excluding ECE 307, 309) only when all prerequisites, as defined by current official listings for that course, have been passed with a grade of C or higher."

F. ePortfolios

Beginning fall 2006, all incoming students are required to develop an electronic portfolio. A student's ePortfolio is a purposeful collection of work created during the academic career. This ePortfolio will provide students an opportunity to reflect on their work and its relationship to Clemson's general education program. In addition, the ePortfolio will allow students to highlight individual achievements that occur during their Clemson experience. The ePortfolio is a requirement for graduation for all students entering Clemson beginning in fall 2006. Additional information about ePortfolios can be found at <http://www.clemson.edu/ugs/eportfolio/contactus.html>

G. Variances

http://www.clemson.edu/ces/ece/resources/undergrad_resources/forms.html

While ECE students are expected to meet prerequisite requirements [see General Rules and Policies E], it is possible for students to request a variance from a requirement to take an ECE course. At the start of each semester, a committee made up of faculty from both Electrical and Computer engineering

review student requests to take ECE 3XX courses with a gpr below 2.0 and to take an ECE course while retaking a pre-requisite. If the variance request is denied, the student will be dropped from that class.

Career Opportunities

Electrical Engineering, like other branches of Engineering, is a very dynamic profession. Since its inception, the subject matter that must be studied and mastered has steadily grown. Starting before the beginning of the 20th Century with the devices for generating and distributing electrical power, initially used for lighting and then for driving motors, the applications of electricity have rapidly grown. Electronics developed rapidly with the invention and quick spread of radio. Soon electronic devices were being used in telephone systems and various measuring instruments. During the 20th century television, radar, computers, control systems and video/audio products were developed into massive industry sectors, each becoming a specialty.

The Electrical Engineering curriculum gives breadth and depth in the subject areas of circuits, computer engineering, electromagnetic fields, electronics, controls, signal analysis, power systems, and communications. Technical electives in the senior year provide specialization.

The current scope of Electrical Engineering can be observed by referring to the January issue each year of the *IEEE Spectrum*, a magazine published by the Institute of Electrical and Electronic Engineers (IEEE). This issue surveys recent and anticipated developments in various branches of the profession. You, as an Electrical Engineering student, are encouraged to join the local student branch of the IEEE and participate in its many activities. The *IEEE Spectrum* is one of the publications you will receive as a Student Member. Through this organization you will begin to learn of the many interesting and challenging career paths open to Electrical Engineers.

Many Electrical Engineers will work for firms that offer engineering design services, often called consulting firms or "A&E" (architectural and engineering) firms. In these firms, which offer engineering design to "the public," it is imperative to become a registered profession engineer or "PE." Professional registration is required by every state in the union for those individuals who offer engineering services to the public. Many private employers also encourage their engineers to become PE's.

In order to become a registered Professional Engineer, you must do the following:

- Take and pass the Fundamentals of Engineering (FE) examination, a nationally administered standardized test. The morning session of the test covers the topics of Chemistry, Computers, Dynamics, Economics, Electrical Circuits, Ethics, Fluids, Materials Science, Mathematics, Mechanics of Materials, Statics, and Thermodynamics. For the afternoon session, EE students can either take a general test, covering the same areas as the morning test, or the discipline specific Electrical Engineering test, covering the following topics: Circuits,

Communications, Computer Systems, Control Systems, Digital Systems, Electromagnetics, Power, Signal Processing, and Electronics.

- Complete several years of acceptable engineering practice. Four years are required in South Carolina.
- Take and pass the Principles and Practice of Engineering (PE) examination, a nationally administered and standardized test.
- Make application, which includes statements from PE's who know you and your work about your character and perceived professional ability, to the State Board of Registration for Professional Engineering in the state of your choice.

More detailed information on the FE and PE examinations and the process of registration is available in the Office of the Dean of the College of Engineering and Science. Information is also available from the [National Society of Professional Engineers](#) and the South Carolina [Board of Registration for Professional Engineers and Land Surveyors](#).

Note that some of the topics cited above in the FE examination are not required in the Electrical Engineering curriculum. You can prepare yourself for this examination by taking coursework outside of the department. Your advisor will be glad to discuss this with you. Some students want to gain industrial experience before graduation. This can be explored through the [Cooperative Education Office](#) or through the Michelin Career Center's internship offerings.

If you have a B or better average as you enter your Senior Year, you will probably want to contact the Graduate Program Office in Electrical Engineering and consider applying for the Masters degree program. A Masters degree will significantly extend the student's engineering knowledge and better prepare the student for the task of "lifelong learning." There is also a direct-entry PhD program for students with outstanding undergraduate records. Most graduate students receive financial support in the form of Teaching Assistantships, Research Assistantships, or Fellowships.

If you are not interested in a Masters degree as you enter your Senior Year in the Electrical Engineering curriculum you will probably want to contact and work through the Michelin Career Center to schedule interviews with firms which visit the campus for recruiting purposes.

It should be noted that firms usually use the Grade Point Ratio as an indicator of future performance, although this is by no means the only indicator used. This practice has led to an unwarranted emphasis on "points" by students, as if it were the numerical indicator, rather than the knowledge and skills that should be learned, that provides magic entry into a job. This is misleading because it is the ability to build on the foundation which the Electrical Engineering curriculum provides which will determine the degree of success of the practicing engineer. As already stated, engineering is a dynamic occupation. It is always changing and the ability to learn new things - i.e. "lifelong learning" - is necessary for professional growth and success.