Electrical Engineering (ELEG)

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Electrical engineering is a professional engineering discipline that in its broader sense covers the study and application of electricity, electronics and electromagnetism. Electrical engineers are in charge of designing and utilizing electrical and electronic components, integrated circuits and computer chips, and electronic assemblies to benefit mankind. Fields of electrical engineering include analog and mixed-signal circuit design/test, biomedical, communications, computer hardware and digital circuit design, control systems, electronic packaging, embedded systems design, microwave and radar engineering, nanophotonics, nanotechnology/microelectronics/optoelectronics, pattern recognition and artificial intelligence, power electronics, and renewable energy/power.

The electrical engineering graduate is at the forefront of technologies leading to accelerated use of electric power, applications of real time embedded control systems for smart highways, smart vehicles and smart gadgets, global communications, the dominating influence of the computer and electronics on modern society, the use of electronic equipment for medical diagnosis, the use of wireless chemical and biological nanosensors for hazard detection, the miniaturization of electronics, microwave and optical technology for national defense, and a host of other developments. Therefore, the use of electrical and electronic equipment has spread into such diverse areas as agricultural production, automotives, computer hardware and networks, health care, information technology, manufacturing, marketing, recreation, renewable energy resources, outer space and underwater exploration, transportation, and many others. As a result, electrical engineering is the largest of all scientific disciplines and assures a continuing demand for electrical engineering graduates throughout private industry and government.

The University of Arkansas, the state land-grant university, is a nationally competitive, student-centered, research university serving Arkansas and the world. As such, the department’s mission is education, research, and service. Hence, the electrical engineering program is designed to offer a high-quality course of instruction involving classroom, laboratory, and extracurricular activities that results in graduates qualified and prepared to meet the demands of a professional career in the present and future work places as well as to assume a responsible role of leadership in a complex technological society.

The educational mission of the department is conducted through both the undergraduate and graduate programs.

Undergraduate Program in Electrical Engineering

The educational objectives for the undergraduate program, which leads to a Bachelor of Science degree in electrical engineering, are to produce graduates who:

1. Are recruited in a competitive market and valued as reliable and competent employees by a wide variety of industries, in particular, electrical and computer engineering industries;
2. Succeed, if pursued, in graduate studies such as engineering, science, law, medicine, business, and other professions;
3. Understand the need for life-long learning and continued professional development for a successful and rewarding career; and
4. Accept responsibility for leadership roles in their profession, in their communities, and in the global society.

Therefore, the electrical engineering curriculum is designed to provide students with knowledge of scientific principles and methods of engineering analysis to form a solid foundation for a career in design, research and development, manufacturing and processing, measurement and characterization, or management. Students progressively build their design experience throughout the curriculum and demonstrate this ability in the senior electrical engineering design laboratories. The curriculum also introduces students to subjects in the humanities, social sciences, and ethics so they may better understand the interaction of technology and society.

The electrical engineering curriculum is divided into three phases. The first year concentrates on the development of a sound understanding of basic sciences and mathematics. The second and third years further develop scientific principles and cover the basic core of electrical engineering. The fourth year is composed primarily of senior-level elective courses. At this time, the students in consultation with their advisors may choose classes related to one or more of the major areas of electrical engineering detailed (e.g., analog and mixed-signal circuit design/test, biomedical, communications, computer hardware and digital circuit design, control systems, electronic packaging, embedded systems design, microwave and radar engineering, nanophotonics, nanotechnology/microelectronics/optoelectronics, pattern recognition and artificial intelligence, power electronics, and renewable energy and power). This final year permits the student to tailor a program suited to her or his individual career objectives. The graduation requirement in electrical engineering is 125 semester hours as given below.
The department also actively participates in the Honors Program to challenge superior students with a more in-depth academic program and research experience. The Honors program enables students to work more closely with faculty members and other students in a team environment. Please see the requirements given below.

**Graduate Program in Electrical Engineering**

The graduate program offers a Master of Science degree in Electrical Engineering (on campus and online) and a Doctor of Philosophy degree in Engineering. The graduate program provides additional instruction and hands-on experience beyond the undergraduate level, and produces graduates who are prepared to promptly address critical issues and assume advanced positions in the profession, including management, design, teaching, research and development.

The research mission of the department is conducted mainly through the graduate program. Internal and external funded research projects serve to:

1. Discover new knowledge, address technical problems, and develop new electrical/electronic technologies;
2. Provide the tools and resources which keep the faculty at the cutting edge of electrical engineering;
3. Provide financial support for graduate students and gifted undergraduate students; and
4. Improve the quality of life for citizens of Arkansas and the world.

The graduate program supports the undergraduate program by giving top undergraduate students access to research laboratories with state-of-the-art equipment and software. Topics covered in graduate courses often migrate into senior undergraduate technical elective courses and eventually into required undergraduate courses.

**Departmental Service Mission**

Faculty, students, administrators, and staff conduct the service mission of the department and serve as a major resource for the state, the region, the nation and the world. Faculty members are encouraged to provide services to both the community and the profession. Hence, they are active in local, state, national, and international professional and service organizations, as well as public and private schools involving grades K-12.

**Degree Program Changes**

A student must meet all requirements of the degree program and is expected to stay informed concerning current regulations, policies, and program requirements in a chosen field of study. Changes made in the electrical engineering curriculum at a level beyond that at which a student is enrolled may become graduation requirements for that student. Changes made in the curriculum at a level lower than the one at which a student is enrolled are not normally required for that student. Students should consult their adviser for additional information.

**Electrical Engineering Honors Program**

To graduate with Honors in electrical engineering, students must be a member of the Honors College, have a minimum cumulative GPA of 3.50, and complete a minimum of 12 hours of honors credit of which 6 hours must be Electrical Engineering Honors courses that include the following: ELEG 4061H Honors Electrical Engineering Design I (Sp, Fa), ELEG 4073H Honors Electrical Engineering Design II (Sp, Fa), and ELEG 400VH Honors Senior Thesis (Sp, Su, Fa). Special problems credit hours (ELEG 488V) will not be counted in the requirement for graduation with Honors in Electrical Engineering.

**Electrical Engineering Honors Courses:**

- ELEG 3124H, ELEG 3143H, ELEG 3214H, ELEG 3224H, ELEG 3304H, ELEG 3704H, ELEG 3924H: Required ELEG junior courses with Honors section (all junior required courses include honors sections).
- ELEG 4061H Honors Electrical Engineering Design I (Sp, Fa)
- ELEG 4073H Honors Electrical Engineering Design II (Sp, Fa)
- ELEG 400VH Honors Senior Thesis (Sp, Su, Fa)
- ELEG 4203H, ELEG 4233H, ELEG 4403H, ELEG 4503H, ELEG 4703H, ELEG 4783H, ELEG 4914H, ELEG 4963H: ELEG technical elective courses that have an Honors section (Please check the offering of these Honors Sections for a particular semester).
- ELEG 5000 or above: Any graduate level course.

**Recommended Technical Studies**

Students in electrical engineering are required to complete 21 semester hours of technical electives of which a minimum of 9 semester hours must be 4000- or 5000-level electrical engineering elective courses. A student may select the remaining 12 semester hours from 4000- or 5000-level electrical engineering elective courses or upper-division technical courses in mathematics, engineering, and the sciences with the approval of an adviser. One of these courses may be an approved Math/Science Elective and another may be an approved Engineering Science Elective. History and social science courses taught by Math and Science departments are not eligible for technical elective credit. Not more than 6 semester hours total of ELEG 488V and ELEG 400VH may be credited toward technical electives. Students who have taken 3 full-time co-op experiences under GNEG 3811, and whose grades in these courses were A or B, may get credit for three hours of non-ELEG technical electives if the work performed is of comparable quality to a technical elective; consult with the Department Co-op Coordinator. Descriptions of all electrical engineering courses are in the Course Descriptions chapter of this Catalog of Studies. The schedule of technical electives offered in a given semester is determined the previous semester since the selection depends on a number of varying factors such as student interest in a particular topic, the importance of a particular technology for the student’s professional career, and teaching faculty availability.

**Potential Minors**

Although ELEG students can pursue any minor they desire, there are several minors that require a minimal number of extra courses, such as Computer Science, Mathematics, Microelectronics-Photonics, Physics, etc. Students are advised to review the specific rules pertaining to the minor of interest in the section of the UA Catalog of Studies corresponding to the department granting that minor.

**Electrical Engineering B.S.E.E. Eight-Semester Degree Program**

The following section contains the list of courses required for the Bachelor of Science in Electrical Engineering and a suggested eight-semester sequence. See the Eight-Semester Degree Policy (http://catalog.uark.edu/archives/2013-14/undergraduategeneralcatalog/academicregulations/eightsemesterdegreecompletionpolicy) for more details. Not all courses
are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites.

### First Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>GNEG 1111 Introduction to Engineering I (Fa)</td>
<td>1</td>
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<tr>
<td>ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Sp, Su, Fa)</td>
<td>3</td>
<td></td>
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<tr>
<td>MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Sp, Su, Fa)</td>
<td>4</td>
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<tr>
<td>CHEM 1113 University Chemistry for Engineers I (Su, Fa)</td>
<td>3</td>
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<tr>
<td>PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034) (Sp, Su, Fa)</td>
<td>4</td>
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Select one of the following:

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<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113) (Sp, Su, Fa)</td>
<td>3</td>
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</tr>
<tr>
<td>HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123) (Sp, Su, Fa)</td>
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Freshman Science Elective II*  
Year Total: 15 15

### Second Year

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<tr>
<th>Units</th>
<th>Fall</th>
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<tr>
<td>ELEG 2104 Electric Circuits I (Fa)</td>
<td>4</td>
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<tr>
<td>ELEG 2904 Digital Design (Fa)</td>
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Sophomore Science Elective **  
MATH 2584 Differential Equations and Laplace Transform (Sp, Su, Fa)  
CSCE 2004 Programming Foundations I (Sp, Fa)  
ELEG 2114 Electric Circuits II (Sp)  
MATH 2574 Calculus III (ACTS Equivalency = MATH 2603) (Sp, Su, Fa)  
Humanities Elective (from University/State Core List)  
Year Total: 16 15

### Third Year

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<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tr>
<td>ELEG 3124 System &amp; Signal Analysis (Fa)</td>
<td>4</td>
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<tr>
<td>ELEG 3214 Electronics I (Fa)</td>
<td>4</td>
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<tr>
<td>ELEG 3924 Microprocessor Systems Design (Fa)</td>
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<tr>
<td>ELEG 3704 Applied Electromagnetics (Fa)</td>
<td>4</td>
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<tr>
<td>ELEG 3304 Energy Systems (Sp)</td>
<td>4</td>
<td></td>
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<tr>
<td>ELEG 3224 Electronics II (Sp)</td>
<td>4</td>
<td></td>
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<tr>
<td>ELEG 3143 Probability &amp; Stochastic Processes (Sp)</td>
<td>3</td>
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Social Science Elective (from University/State Core List)  
Math/Science/Technical Elective  
Year Total: 20 13

### Fourth Year

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<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tr>
<td>ELEG 4061 Electrical Engineering Design I (Sp, Fa)</td>
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Two Electrical Engineering Technical Elective  
Engineering Science/Technical Elective  
Select one of the following:  
ECON 2013 Principles of Macroeconomics (ACTS Equivalency = ECON 2103) (Sp, Su, Fa)  
ECON 2023 Principles of Microeconomics (ACTS Equivalency = ECON 2203) (Sp, Su, Fa)  
ECON 2143 Basic Economics: Theory and Practice (Sp, Su, Fa)  
Fine Arts Elective (from University/State Core List)  
Year Total: 16 15

**Total Units in Sequence:** 125

- Freshman Science Elective - CHEM 1133/CHEM 1131L Chemistry for Engineers II or PHYS 2074 University Physics II  
- If CHEM 1133/CHEM 1131L Chemistry for Engineers II was taken for Freshman Science Elective, then PHYS 2074 University Physics II  
- If PHYS 2074 University Physics II was taken for the Freshman Science Elective, then CHEM 1133/CHEM 1131L Chemistry for Engineers II or BIOL 1543/BIOL 1541L Principles of Biology or BIOL 2213/BIOL 2211L Human Physiology, PHYS 2094 University Physics III

Students should become very familiar with the Academic Regulations chapter for university requirements that apply to the electrical engineering program as well as the College of Engineering requirements (in particular the “D rule” and the “Transfer of Credit” for courses taken at another institution). In addition to these graduation requirements, candidates for an electrical engineering degree must have earned a grade-point average of no less than 2.00 on all ELEG courses.