UNIVERSITY OF
ARKANSAS
COLLEGE OF
ENGINEERING

# Electrical Engineering Program

**2024-2025 Undergraduate Student Handbook**


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***Electronic copies available http://electrical-engineering.uark.edu***

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# ELECTRICAL ENGINEERING AT THE UNIVERSITY OFARKANSAS

## What is Electrical Engineering?

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 components, integrated circuits, integrated chips, 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 and power.

The electrical engineering graduate is at the forefront of technologies leading to the dramatic increase in accelerated use of electric power, applications of real time embedded control systems for smart highways, the dominating influence of the computer on modern society, global communications, the miniaturization of electronics, smart vehicles and smart gadgets, the use of wireless chemical and biological nano-sensors for hazard detection, and a host of other developments. The increased use of electronic equipment for communication, control, measurement, and networking has spread into such diverse areas as agricultural production, automotives, computer networks and hardware, health care, information technology, manufacturing, marketing, recreation, renewable energy, transportation, underwater and space explorations, and many others. This widespread and expanding use of electrical and electronic equipment in virtually all fields has made electrical engineering the largest of all scientific disciplines and assures a continuing demand for electrical engineering graduates throughout business and government. Information regarding the average salary of an electrical engineer is available on the Electrical Engineering website (http://electrical-engineering.uark.edu).

## Electrical Engineering Research Areas

**Analog and Mixed-Signal Circuit Design/Test** deals with modeling, designing, and testing integrated circuits and electronic systems that interface the digital world with the real world, including several forms of signal processing.

The **Biomedical** area applies electrical engineering to the field of medicine, including the design of medical equipment (e.g., MRI), implantable medical devices (e.g., pacemaker), neural interfaces (e.g., cochlear implants for the deaf), and electrical therapies (e.g., electrical brain stimulus to minimize shaking effects of Parkinson's).

**Communications** deals with developing algorithms, protocols, hardware, software, and performance evaluation techniques, for wireless and wired communications networks and systems.

**Computer Hardware and Digital Circuit Design** deals with designing digital integrated circuits (i.e., computer chips) that are pervasively integrated into today's technological society, including computers, cell phones, MP3 players, DVRs, video games, etc.

The **Control Systems** area deals with developing algorithms and associated hardware to regulate

complex systems, including robotics, factory automation, flight control, automobile stability, camera focusing and image stability, etc.

**Electronic Packaging** deals with interfacing integrated circuit die to connectors such that they can be soldered on printed circuit boards. Packaging objectives include decreasing size, increasing performance, and decreasing electrical interference.

**Embedded Systems Design** combines digital and analog integrated circuit chips along with software to develop complex systems, such as cell phones, MP3 players, digital cameras, etc.

**Microwave and Radar Engineering** exploits the relationship between electricity, magnetism, and waves for applications such as medical imaging, radar systems, wireless communications, antenna design, and defense applications.

**Nanophotonics** exploits the special properties of metals and dielectrics at THz, optical, UV, and IR frequencies for the development of plasmonic solar cells, plasmonic biosensors, and a variety of optical devices.

**Nanotechnology/Microelectronics/Optoelectronics** deals with the study of materials used to fabricate electronic devices as well as the actual fabrication of miniaturized electronic devices, including sensors, MEMs (Micro Electro Mechanical devices), and optical devices, such as LAZERs.

**Power Electronics** design deals with the modeling, design and test of discrete higher power circuitry from fractional horsepower to very large systems.

**Renewable Energy and Power** deals with designing motors, generators, and the circuitry to control high-power devices, as well as designing power generation and distribution systems, which include green technology, such as solar energy, wind turbines, and hydroelectric power.

## Mission of the Electrical Engineering Department

The University of Arkansas, the state land grant university, is a nationally competitive, student-centered, teaching and research university serving Arkansas and the world. As part of the University of Arkansas. The Electrical Engineering Department will provide the education necessary to establish the best foundation for electrical engineers at all degree levels, and prepare them to be nationally competitive leaders, skillful at undertaking the current and future challenges facing our world. (www.uark.edu).

## Undergraduate Commitment

The electrical engineering department is committed to producing graduates with a Bachelor of Science in Electrical Engineering who:

1. Are valued as reliable and competent employees by a wide variety of industries, in particular electrical 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.

In addition to the above program educational objectives, the department is also committed to challenge gifted undergraduate students to participate in the honors program (http://honorscollege.uark.edu). The honors program gives a structure for a student to work closely with faculty members and other students in a team environment. As a result, the honors student gains a more in-depth academic insight along with a quality research experience.

## Research Commitment

The Electrical Engineering Department's research commitment 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 that keep our faculty at the cutting edge of electrical engineering;

3. Advance quickly to management positions in research and development;

4. Provide financial support for graduate students and gifted undergraduate students; and

5. Improve the quality of life for the citizens of Arkansas and the world.

Faculty, students, administrators, and staff conduct the service mission of the department. The electrical engineering program, including faculty, students, staff, and facilities, is a major resource of the state, region, and nation. Faculty members are encouraged to provide services to both the community and the profession. Thus, our faculty members are active in local, state, national, and international professional and service organizations, as well as public and private schools involving grades K-12. A full listing of the faculty, their areas of interest, and email addresses are shown in the Appendix (which is on the website).

In summary, the Electrical Engineering program is designed to offer a high-quality path of instruction involving classroom, laboratory, and extracurricular activities that results in graduates who will be nationally competitive leaders, skillful at undertaking the current and future challenges facing our world.

## The Electrical Engineering Undergraduate Curriculum

The electrical engineering undergraduate 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, manufacturing and processing, research and development, and/ or management. The outcomes of the electrical engineering undergraduate curriculum are the following:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and 2019-2020 Criteria for Accrediting Engineering Programs – Proposed Changes 40 welfare, as well as global, cultural, social, environmental, and economic factors.

3. An ability to communicate effectively with a range of audiences.

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The electrical engineering undergraduate curriculum is divided into three phases: the first year, the second and third years, and the senior year. The first-year concentrates on developing a sound understanding of basic sciences and mathematics and introduces general engineering concepts. The College of Engineering has adopted a common first year for all new first-year students. For more information about the first year, please refer to the electrical engineering undergraduate curriculum in this handbook and also http://first-year-engineering.uark.edu/.

Following the first year, students enter the heart of the EE undergraduate curriculum. The sophomore year provides a transition into electric circuits and digital systems, and largely completes the required mathematics. This leads to the junior year containing the majority of the *required* technical courses within electrical engineering. The senior year is composed primarily of technical electives, both within and outside electrical engineering, where students can explore several areas of interest. At this time, the student in conjunction with *their adviser* may select technical electives to concentrate in one or more of the technical specializations within electrical engineering, namely, 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 his or her individual career objectives. Students progressively build their design experience throughout the curriculum and demonstrate this ability in Electrical Engineering Design I and II, where they conceptualize a project, design the system, and build a working prototype, over the course of two semesters.

For those students enrolled in the Honors program, their design experience culminates in the Honors Electrical Engineering Design I and II, and the senior honors thesis. In addition, Honors sections of several electrical engineering courses provide further information on special issues in the electrical engineering discipline.

Lastly, the curriculum also introduces students to subjects in the humanities, social sciences, and professional success and ethics so they may better understand the interaction of technology and society.

The graduation requirement in electrical engineering is 125 semester hours. A full listing, flowchart, and specific details of the present curriculum are given below.

Though faculty advisors are quite knowledgeable about the technical aspects of an engineering education, other students are a good resource when it comes to charting a path through the curriculum. Students are advised to inquire in order to be well informed about various curriculum issues.

Please be aware that, in all cases, the curriculum requirements set forth in the University Catalog of Studies supersedes the requirements set forth in this Handbook.

# ELECTRICAL ENGINEERING CURRICULUM 2024-2025

| | | | | | |
|---|---|---|---|---|---|
| **Freshman Year** | | | | | |
| 1 | GNEG 11101 | Intro to Engineering I | 1 | GNEG 11201 | Intro to Engineering II |
| 4 | MATH 24004 | Calculus I[a] | 4 | MATH 25004 | Calculus II |
| 3 | CHEM 14103 | University Chemistry I | 4 | PHYS 20304 | University Physics I |
| 3 | HIST 20003, HIST 20103, or PLSC 20003 | | 4 | Sophomore Science Elective[b] | |
| 3 | ENGL 10103 | Technical Composition I | 3 | ENGL 10303 | Technical Composition II |
| 14 | semester hours | | 16 | semester hours | |
| **Sophomore Year** | | | | | |
| 4 | ELEG 21003 and ELEG 21001 | Electric Circuits I w/Lab | 4 | CSCE 20004 | Programming Foundations I |
| 3 | Humanities Elective[c] | | 4 | ELEG 21103 and ELEG 21101 | Electric Circuits II w/Lab |
| 4 | MATH 25804 | Differential Equations | 4 | MATH 26004 | Calculus III |
| 4 | PHYS 20404 | University Physics | 4 | ELEG 29004 | Digital Design w/Lab |
| 15 | semester hours | | 16 | semester hours | |
| **Junior Year** | | | | | |
| 4 | ELEG 31204 | Systems & Signals Analysis w/Lab | 3 | Math/Science/Technical Elective[d] | |
| 4 | ELEG 32103 and ELEG 32101 | Electronics I w/Lab | 4 | ELEG 32203 and ELEG 32201 | Electronics II w/Lab |
| 4 | ELEG 37004 | Applied Electromagnetics w/Lab | 4 | ELEG 33004 | Energy Systems w/Lab |
| 4 | ELEG 39204 | Microprocessor System Design | 3 | ELEG 31403 | Probability & Stochastic Processes w/Lab |
| | | | 3 | Social Science Elective[e] | |
| 16 | semester hours | | 17 | semester hours | |
| **Senior Year** | | | | | |
| 3 | ELEG 40603 | Electrical Engineering Design I | 1 | ELEG 40701 | Electrical Engineering Design II |
| 3 | ELEG Technical Elective[f] | | 3 | ELEG Technical Elective[f] | |
| 3 | ELEG Technical Elective[f] | | 3 | Technical Elective | |
| 3 | Engineering Science/Technical Elective[g] | | 3 | Technical Elective[h] | |
| 3 | ECON 21003, ECON 22003, or ECON 21403 | | 3 | Social Science Elective[i] | |
| | | | 3 | Fine Arts Elective[j] | |
| 15 | semester hours | | 16 | semester hours | |

**TOTAL: 125 semester hours**

| 2024-2025 Curriculum: List of Required Courses with Pre- and Co-Requisites for ELEG | | | | |
|---|---|---|---|---|
| **Semester** | **Number** | **Course Title** | **Pre-Requisites** | **Co-Requisites** |
| **Freshman Year** | | | | |
| Freshman 1 | GNEG 11101 | Introduction to Engineering 1 | First Year Engineering | |
| Freshman 1 | MATH 24004 | Calculus I[a] | As Indicated in Catalog | |
| Freshman 1 | CHEM 14103 | University Chemistry 1 | | |
| Freshman 1 | XXXX | History/Political Science Elective | | |
| Freshman 1 | ENGL 10103 | Technical Composition I | | |
| Freshman 2 | GNEG 11201 | Introduction to Engineering II | GNEG 11101 | |
| Freshman 2 | MATH 25004 | Calculus II | MATH 24004 | |
| Freshman 2 | PHYS 20304 | University Physics I | MATH 24004 | |
| Freshman 2 | XXXX | Sophomore Science Elective[b] | As Indicated in Catalog | |
| Freshman 2 | ENGL 10303 | Technical Composition II | ENGL 10103 | |
| **Sophomore Year** | | | | |
| Sophomore 1 | ELEG 21003 | Electric Circuits I | | MATH 25004 and ELEG 21001 |
| Sophomore 1 | ELEG 21001 | Electric Circuits I Lab | | ELEG 21003 |
| Sophomore 1 | XXXX | Humanities Elective[c] | As Indicated in Catalog | |
| Sophomore 1 | MATH 25804 | Differential Equations | MATH 25004 | |
| Sophomore 1 | PHYS 20404 | University Physics II | PHYS 20304 | |
| Sophomore 2 | ELEG 29004 | Digital Design w/ Lab | | |
| Sophomore 2 | CSCE 20004 | Programming Foundations I | MATH 25004 | |
| Sophomore 2 | ELEG 21103 | Electric Circuits II | ELEG 21003 | MATH 25804 and ELEG 21101 |
| Sophomore 2 | ELEG 21101 | Electric Circuits II Lab | | ELEG 21103 |
| Sophomore 2 | MATH 26004 | Calculus III | MATH 25004 | |
| **Junior Year** | | | | |
| Junior 1 | ELEG 31204 | System and Signal Analysis w/ Lab | ELEG 21003 | MATH 25804 |
| Junior 1 | ELEG 32103 | Electronics I | | MATH 26004, ELEG 21103, and ELEG 32101 |
| Junior 1 | ELEG 32101 | Electronics I Lab | | ELEG 32103 |
| Junior 1 | ELEG 37004 | Applied Electromagnetics w/ Lab | ELEG 21103 | PHYS 20404 and MATH 26004 |
| Junior 1 | ELEG 39204 | Microprocessor System Design w/ Lab | | ELEG 29004 |
| Junior 2 | XXXX | Math/Science/Technical Elective[d] | As Indicated in Catalog | |
| Junior 2 | ELEG 32203 | Electronics II | ELEG 32103, ELEG 21103, MATH 25804 | ELEG 32201 |
| Junior 2 | ELEG 32201 | Electronics II Lab | | ELEG 32203 |
| Junior 2 | ELEG 33004 | Energy Systems w/ Lab | ELEG 21103 | |
| Junior 2 | ELEG 31403 | Probability and Stochastic Processes | | ELEG 31204 |
| Junior 2 | XXXX | Social Science Elective[e] | As Indicated in Catalog | |

| Senior Year | | | | |
|---|---|---|---|---|
| Senior 1 | ELEG 40603 | EE Design I | ELEG 32203, ELEG 39204 | |
| Senior 1 | ELEG | ELEG Technical Elective[f] | As Indicated in Catalog | |
| Senior 1 | ELEG | ELEG Technical Elective[f] | As Indicated in Catalog | |
| Senior 1 | XXXX | Engineering Science/Technical Elective[g] | As Indicated in Catalog | |
| Senior 1 | XXXX | Economics Elective | As Indicated in Catalog | |
| Senior 2 | ELEG 40701 | EE Design II | ELEG 40603 | |
| Senior 2 | ELEG | ELEG Technical Elective[f] | As Indicated in Catalog | |
| Senior 2 | XXXX | Technical Elective[h] | As Indicated in Catalog | |
| Senior 2 | XXXX | Technical Elective[h] | As Indicated in Catalog | |
| Senior 2 | XXXX | Social Science Elective[i] | As Indicated in Catalog | |
| Senior 2 | XXXX | Fine Arts Elective[j] | As Indicated in Catalog | |

NOTES:

a. Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 24004.

b. Sophomore Science Elective – CHEM 14203/CHEM 14201L or BIOL 10103/BIOL 10101L or BIOL 24103/BIOL 24101, or PHYS 20504 or GEOL 11103/GEOL 11101L

c. The Humanities Elective courses that satisfy General Education Outcomes 3.2 and 5.1 include: CLST 10003, CLST 100H3, CLST 10103, HUMN 112H4, PHIL 20003, PHIL 200H3, or PHIL 21003.

d. MATH SCIENCE/TECHNICAL ELECTIVES: Any Engineering/Science/Math Technical Elective, suggested classes BIOL 10103/BIOL 10101, CHEM 14203/CHEM 14201, CHEM 35004, CHEM 36053, MATH 30803, MATH 44403, PHYS 35404, PHYS 36103, MEEG 27003 or STAT 30043.

e. The Social Sciences Electives courses that satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 10203, COMM 10203, HDFS 14003, HDFS 24103, HIST 11193, HIST 111H3, HIST 11293, HIST 112H3, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20103, PLSC 28103, PLSC 28103H, RESM 28503, SOCI 10103, SOCI 20103, or SOCI 201H3.

f. ELEG TECHNICAL ELECTIVES are defined as ELEG 40000 or ELEG 50000 level courses. CSCE 41104, CSCE 46103, or CSCE 42303 are approved ELEG Technical Electives for students pursuing a dual ELEG/CSCE undergraduate degree. No more than 6 hours may be ELEG 4880V or ELEG 400HV courses.

g. Engineering Science/Technical Elective: Any Engineering/Science/Math Technical Elective or one of these 20000 level courses: MEEG 20103, MEEG 23003, MEEG 24003, CHEG 23103, or INEG 24103

h. TECHNICAL ELECTIVES are 30000 or above level courses in Math, Engineering, or the sciences after the approval by ELEG advisor. CSCE 20104 Programming 2, CSCE 22104 Computer Organization, and SEVI 52103 Business Foundations for Entrepreneurs are allowable non-ELEG technical electives. Courses not eligible for technical elective credit include ELEG 39003, ELEG 39903 and any history courses in math and the sciences (e.g., MATH 31303).

i. The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 11003, AGEC 21003, ANTH 10203, COMM 10203, ECON 21003, ECON 22003, ECON 21403, EDST 20003, HDFS 14003, HDFS 24103, HDFS 26003, HIST 11103, HIST 111H3, HIST 11293, HIST 112H3, HIST 20003, HIST 20103, HIST 20903, HUMN 111H4, HUMN 211H4, INST 28103, INST 281H3, PLSC 20003, PLSC 20103, PLSC 28103, PLSC 281H3, PSYC 20003, RESM 28503, SOCI 10103,SOCI 20103, or SOCI 201H3. Note, courses cannot be counted twice in degree requirements.

j. Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 10003, ARHS 10003, COMM 10003, DANC 10003, LARC 10003, MUSC 10003, MUSC 100H3, MUSC 10103, MUSC 101H3, MUSC 13303, THTR 10003, THTR 10103, or THTR 101H3.

# Advising Form for 2024-2025 EE Plan of Study

| NAME | | STUDENT ID NUMBER |
|---|---|---|

indicates pre-Req

indicates Co/Pre-Req

indicates drop down box selection

## FRESHMAN YEAR

| Pre-Req | Co-Req | Fall Semester | 14 | Sem | GR |
|---|---|---|---|---|---|
| First Year Engineering | | GNEG 11101 Intro to Engineering I | 1 | | |
| | | MATH 24004 Calculus I | 4 | | |
| | | CHEM 14103 University Chemistry I | 3 | | |
| | | History Political Science Elective | 3 | | |
| | | ENGL 10103 Composition I | 3 | | |
| | | University Credits | 0 | | |
| | | Transfer and Credit Hours | 0 | | |
| | | Number of "D" Hours | 0 | | |

| Pre-Req | Co-Req | Spring Semester | 16 | Sem | GR |
|---|---|---|---|---|---|
| GNEG 11101 | | GNEG 11201 Intro to Engineering II | 1 | | |
| MATH 24004 | | MATH 25004 Calculus II | 4 | | |
| | | Sophomore Science Elective | 4 | | |
| MATH 24004 | | PHYS 20304 University Physics I | 4 | | |
| ENGL 10103 | | ENGL 10303 Technical Composition II | 3 | | |
| | | University Credits | 0 | | |
| | | Transfer and Credit Hours | 0 | | |
| | | Number of "D" Hours | 0 | | |

## SOPHOMORE YEAR

| Pre-Req | Co-Req | Fall Semester | 15 | Sem | GR |
|---|---|---|---|---|---|
| PHYS 20304 | | PHYS 20404 University Physics II | 4 | | |
| | MATH 25004<br>ELEG 21001 | ELEG 21003 Electric Circuits I | 3 | | |
| | ELEG 21003 | ELEG 21001 Electric Circuits I Lab | 1 | | |
| MATH 25004 | | MATH 25804 Differential Equations | 4 | | |
| | | Humanities Elective | 3 | | |
| | | | | | |
| | | University Credits | 0 | | |
| | | Transfer and Credit Hours | 0 | | |
| | | Number of "D" Hours | 0 | | |
| | | Number of "D" Hours | 0 | | |

| Pre-Req | Co-Req | Spring Semester | 16 | Sem | GR |
|---|---|---|---|---|---|
| | | ELEG 29004 Digital Design w/Lab | 4 | | |
| MATH 24004 | | CSCE 20004 Programming Foundations I | 4 | | |
| ELEG 21003 | MATH 25804<br>MATH 21101 | ELEG 21103 Electric Circuits II | 3 | | |
| | ELEG 21103 | ELEG 21101 Electric Circuits II Lab | 1 | | |
| MATH 25004 | | MATH 26004 Calculus III | 4 | | |
| | | University Credits | 0 | | |
| | | Transfer and Credit Hours | 0 | | |
| | | Number of "D" Hours | 0 | | |
| | | Number of "D" Hours | 0 | | |

## JUNIOR YEAR

| Pre-Req | Co-Req | Fall Semester | 16 | Sem | GR |
|---|---|---|---|---|---|
| ELEG 21003 | MATH 25804 | ELEG 31204 System & Signal Analysis (With Lab) | 4 | | |
| | ELEG 21103<br>MATH 26004<br>ELEG 32101 | ELEG 32103 Electronics I | 3 | | |
| | ELEG 32103 | ELEG 32101 Electronics I Lab | 1 | | |
| ELEG 21103 | PHYS 20404<br>MATH 26004 | ELEG 37004 Applied Electromagnetics (With Lab) | 4 | | |
| | ELEG 29004 | ELEG 39204 Microprocessor System Design (With Lab) | 4 | | |
| | | University Credits | 0 | | |
| | | Transfer and Credit Hours | 0 | | |
| | | Number of "D" Hours | 0 | | |

| Pre-Req | Co-Req | Spring Semester | 17 | Sem | GR |
|---|---|---|---|---|---|
| | | Math/Science/Technical Elective | 3 | | |
| ELEG 32103<br>ELEG 21103<br>MATH 25804 | ELEG 32201 | ELEG 32203 Electronics II | 3 | | |
| | ELEG 32203 | ELEG 32201 Electronics II Lab | 1 | | |
| ELEG 21103 | | ELEG 33004 Energy Systems (With Lab) | 4 | | |
| | ELEG 31204 | ELEG 31403 Probability & Stochastic Processes | 3 | | |
| | | Social Science Elective | 3 | | |
| | | University Credits | 0 | | |
| | | Transfer and Credit Hours | 0 | | |
| | | Number of "D" Hours | 0 | | |

| SENIOR YEAR | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pre-Req** | **Co-Req** | **Fall Semester** | **15** | **Sem** | **GR** | **Pre-Req** | **Co-Req** | **Spring Semester** | **16** | **Sem** | **GR** |
| ELEG 32203, ELEG 39204 | | ELEG 40603 Electrical Engineering Design I | 3 | | | ELEG 40603 | | ELEG 40701 Electrical Engineering Design II | 1 | | |
| | | ELEG Technical Elective | 3 | | | | | ELEG Technical Elective | 3 | | |
| | | ELEG Technical Elective | 3 | | | | | Technical Elective* | 3 | | |
| | | Engineering Science OR Technical Elective* | 3 | | | | | Technical Elective* | 3 | | |
| | | Economics Elective | 3 | | | | | Social Science Elective | 3 | | |
| | | University Credits | 0 | | | | | Fine Arts Elective | 3 | | |
| | | Transfer and Credit Hours | 0 | | | | | University Credits | 0 | | |
| | | Number of "D" Hours | 0 | | | | | Transfer and Credit Hours | 0 | | |
| | | | | | | | | Number of "D" Hours | 0 | | |
| | | | | | | | | Did you enroll before Fall 2014? | No | | |
| | | | | | | | | TOTAL TRANSFER AND CREDIT HOURS | 0 | | |
| | | | | | | | | TOTAL UNIVERSITY CREDIT HOURS | 0 | | |
| | | | | | | | | TOTAL NUMBER OF "D" HOURS | 0 | | |
| | | | | | | | | ONLY 8 HOURS OF 'D' | No | | |

**NOTES**

Faculty Signature: _____ Date: _____

Student Signature: _____ Date: _____

*30000 or above level courses in Math, Engineering, or the science after the approval of an ELEG advisor; history courses in the Math and the sciences (e.g., MATH 31303) are not eligible for technical elective credit.

*CSCE 20104 Programming II and CSCE 22104 Computer Organization are allowable non-ELEG technical electives
*Students who have (1) Talked to the departmental co-op coordinator, Robert Saunders, about the intention of taking three GNEG 38101 courses for 3 hours of non-ELEG technical electives, and (2) The grades in these courses were A or B, may get credit for three hours of non-ELEG technical electives. Please consult the department regarding this if you have any further questions.

*Students cannot use ELEG 39003 or ELEG 39303 to meet this requirement.

The above form is designed so that students and advisors can keep record of the courses they have taken, the grades received, and whether the pre- and co-requisites have been met. An interactive version is available at https://electrical-engineering.uark.edu/academics/undergraduatestudents/index.php.

# NOTES FOR 2024-2025

## Electrical Engineering Undergraduate Curriculum

GPA REQUIREMENTS

All students must have at least a 2.0 grade-point average on: (*i*) all courses in Electrical Engineering,
(*ii*) all engineering courses and (*iii*) all work presented for the degree. No more than 8 hours of
**coursework taken at UA-Fayetteville** and presented for the degree can be "D" grades.

RESIDENCY REQUIREMENTS

All students must complete 30 hours in residence, 20 of which must be ELEG courses 30000 level and above.

COMMON FIRST YEAR

Please refer to http://first-year-engineering.uark.edu/ for a description of the common first year.

SOPHOMORE SCIENCE ELECTIVE

CHEM 14203 and CHEM 14201 – University Chemistry II; BIOL 10103 and 10101 – Principles of Biology; BIOL 24103 and 24101 – Human Physiology; PHYS 20504 – University Physics III or GEOL 11103/GEOL 11101

ELEG TECHNICAL ELECTIVES

- ELEG 40000 or ELEG 50000 level courses
- For students pursuing a dual degree in CSCE and ELEG: CSCE 41104, CSCE 46103, CSCE 42303.
- Not more than 6 hours may be ELEG 4880V or ELEG 400HV courses are approved ELEG Technical Electives.

TECHNICAL ELECTIVES

*30000 or above level courses in Math, Engineering, or the sciences after the approval ELEG advisor. History courses in the Math and the sciences (e.g., MATH 31303) are not eligible for technical elective credit.
**CSCE 20104, Programming 2, and CSCE 22104, Computer Organization, are allowable non- ELEG technical electives.

*Students who have (1) talked to the departmental co-op coordinator, Mr. Robert Saunders, about the intention of taking three GNEG 38101 courses for 3 hours of non-ELEG technical electives, and (2) the grades in these courses were A or B, may get credit for three hours of non-ELEG technical electives. Please consult the department regarding this if you have any further questions. GNEG 38001 cannot be used for technical elective credit.

**Students cannot use ELEG 39003 or ELEG 39903 to meet this requirement.

| ENGINEERING SCIENCE/TECHNICAL ELECTIVES | MATH/SCIENCE/TECHNICAL ELECTIVES |
|---|---|
| MEEG 20103 Dynamics<br>MEEG 23003 Introduction to Materials<br>MEEG 24003 Thermodynamics<br>CHEG 23103 Thermodynamics of Single-Component Systems<br>INEG 24103 Engineering Economics Analysis<br>Or another Technical Elective | BIOL 10103 & 10101 Principles of Biology<br>CHEM 14203 & 14201 University Chemistry II<br>CHEM 35004 Physical Chemistry I<br>CHEM 36053 Organic Chemistry I<br>MATH 30803 Linear Algebra<br>MATH 44403 Complex Variables<br>PHYS 35404 Optics<br>PHYS 36103 Modern Physics<br>MEEG 27003 Computer Methods in ME STAT 30043 Statistical Methods<br>Or another Technical Elective |

ELEG HUMANITIES / SOCIAL SCIENCE ELECTIVES

Select **one course** from U.S. History, fine arts, humanities, and economics for a total of 12 credit hours. Select **two courses** from the social sciences for a total of 6 credit hours. You must select from two different fields of study.

| SELECT ONE<br>U.S. HISTORY | SELECT ONE<br>FINE ARTS | SELECT ONE<br>HUMANITIES | SELECT TWO<br>SOCIAL SCIENCES | SELECT ONE<br>ECONOMICS |
|---|---|---|---|---|
| HIST 20003<br>HIST 20103<br>PLSC 20003 | ARCH 10003<br>ARHS 10003<br>COMM 10003<br>DANC 10003<br>LARC 10003<br>MUSC 10003/100H3<br>MUSC 10103/101H3<br>MUSC 13303<br>THTR 10003<br>THTR 10103/101H3 | CLST 10003/100H3<br>CLST 10103<br>HUMN 112H4<br>PHIL 20003/200H3<br>PHIL 21003 | AGEC 11003<br>AGEC 21003<br>ANTH 10203<br>COMM 10203<br>ECON 21003<br>ECON 22003<br>ECON 21403<br>EDST 20003<br>HDFS 14003<br>HDFS 24103<br>HDFS 26003<br>HIST 11193/119H3<br>HIST 11293/112H3<br>HIST 20003<br>HIST 20103<br>HIST 20903<br>HUMN 111H4<br>HUMN 211H4<br>INST 28103/281H3<br>PLSC 20003<br>PLSC 21003<br>PLSC 28103/281H3<br>PSYC 20003<br>RESM 28503<br>SOCI 10103<br>SOCI 20103/201H3 | ECON 21003<br>ECON 22003<br>ECON 21403 |

## Study Abroad for Electrical Engineering Students

A growing number of electrical engineering students are participating in Study Abroad. Though this is a worthwhile experience for students, it does cause problems in completing coursework and could delay graduation. However, it is possible for a student to take the lecture part of the course online and receive a grade of "Incomplete" for the course. Upon returning from the study abroad program, the student can then complete the lab section of the course and receive a grade.

## Electrical Engineering Academic Emphasis Areas

### Integrated Circuit Design

**ELEG 42003. Semiconductor Devices. 3 Hours.**

Crystal properties and growth of semiconductors, energy bands and charge carriers in semiconductors, excess carriers in semiconductors, analysis and design of p/n junctions, analysis and design of bipolar junction transistors, and analysis and design of field-effect transistors. Students may not receive credit for both ELEG 42003 and ELEG 52003. Prerequisite: MATH 28504 and ELEG 32103 or equivalent.

**ELEG 420H3. Semiconductor Devices. 3 Hours.**

Crystal properties and growth of semiconductors, energy bands and charge carriers in semiconductors, excess carriers in semiconductors, analysis and design of p/n junctions, analysis and design of bipolar junction transistors, and analysis and design of field-effect transistors. Students may not receive credit for both ELEG 42003 and ELEG 52003. Prerequisite: MATH 28504 and ELEG 32103 or equivalent.

**ELEG 42303. Introduction to Integrated Circuit Design. 3 Hours.**

Design and layout of large scale digital integrated circuits using CMOS technology. Topics include MOS devices and basic circuits, integrated circuit layout and fabrication, dynamic logic, circuit design, and layout strategies for large scale CMOS circuits. Students may not receive credit for both ELEG 42303 and ELEG 59203. Prerequisite: ELEG 32103 or ELEG 3933 and ELEG29004 or equivalent.

**ELEG 42403. Analog Integrated Circuits. 3 Hours.**

Theory and design techniques for linear and analog integrated circuits. Current mirrors, voltage to base emitter matching, active loads, compensation, level shifting, amplifier design techniques, circuit simulation using computer-assisted design programs. Prerequisite: ELEG 32203.

**ELEG 42503. Integrated Circuit Design. 3 Hours.**

This course will cover digital VLSI design and integrated circuit design tools. The course is structured with lectures. This course is offered to both senior undergraduate and graduate students. Students cannot get credit for both the undergraduate and graduate version of the course. Students cannot receive credit for both ELEG 42503 and ELEG 52503. Prerequisite: ELEG 42303 or ELEG 59203**.**

**ELEG 42803. Mixed Signal Test Engineering. 3 Hours.**

Overview of mixed signal testing, the test specification process, DC and parametric measurements, measurement accuracy, tester hardware, sampling theory, DSP-based testing, analog channel testing, digital channel testing. Prerequisite: Senior standing.

**ELEG 4870V. Special Topics in Electrical Engineering. 1-3 Hour.**

Consideration of current electrical engineering topics not covered in other courses. Prerequisite: Senior standing. May be repeated for up to 6 hours of degree credit.

## Power Electronics

**ELEG 45003. Design of Advanced Electric Power Distribution Systems. 3 Hours.**

Design considerations of electric power distribution systems, including distribution transformer usage, distribution system protection implementation, primary and secondary networks design, applications of advanced equipment based on power electronics, and use of capacitors and voltage regulation. Students may not receive credit for both ELEG 45003 and ELEG 55003. Prerequisite: ELEG 33004.

**ELEG 45103. Power and Energy Systems Analysis. 3 Hours.**

Modeling and analysis of electric power systems: Energy sources and conversion; load flow analysis; reference frame transformations; symmetrical and unsymmetrical fault conditions; load forecasting and economic dispatch. Students may not receive credit for both ELEG 45103 and ELEG 55103. Prerequisite: ELEG 21103.

**ELEG 45303. Power Electronics and Motor Drives. 3 Hours.**

Characteristics of Insulated Gate Bipolar Transistors (IGBTs), Silicon Carbide (SiC) MOSFETs, Gallium Nitride (GaN) devices, Design of driver and snubber circuits for IGBTs and SiCMOSFETs, and an introduction to electric motor drives. Students may not receive credit for both ELEG 45303 and ELEG 55303. Prerequisite: ELEG 33004 and ELEG 32203.

**ELEG 45403. Introduction to Power Electronics. 3 Hours.**

Presents basics of emerging areas in power electronics and a broad range of topics such as power switching devices, electric power conversion techniques and analysis, as well as their applications. Students may not receive credit for both ELEG 45403 and ELEG 55403. Prerequisite: ELEG 21103 and ELEG 32103.

**ELEG 45503. Switch Mode Power Conversion. 3 Hours.**

Basic switching converter topologies: buck, boost, buck-boost, Cuk, flyback, resonant; pulse-width modulation; integrated circuit controllers; switching converter design case studies; SPICE analyses of switching converters; state-space averaging and linearization; and switching converter transfer functions. Prerequisite: ELEG 32203 and ELEG 31204.

**ELEG 45603. EMI in Power Electronics Converters: Generation, Propagation, and Mitigation. 3 Hours.**

Concepts of electro-magnetic-interference issues in power electronics converters. Basic concepts of EMI measurement, modeling, and mitigation, with a focus on conducted EMI in power electronics converters. The course is structured with lectures and a lab session. Students cannot receive credit for both ELEG 45603 and ELEG 55603. Prerequisite: ELEG 21003 or equivalent and MATH 26004.

**ELEG 45803. Programming for Power Electronics: DSPs. 3 Hours.**

This course will focus on the development of both theoretical and practical skills needed to design and implement controls for power electronic systems using a Digital Signal Processors (DSPs). The course is structured with lectures and utilizes a project-based approach. Students cannot receive credit for both ELEG 45803 and ELEG 55803. Prerequisite: Senior standing, ELEG 29004, ELEG 39204, and CSCE 20004.

**ELEG 45903. Programming for Power Electronics: FPGA. 3 Hours.**

This course will focus on the development of both theoretical and practical skills needed to design and implement controls for power electronic systems using Field Programmable Gate Arrays (FPGAs). The course is structured with lectures and utilizes a project-based approach. Students cannot receive credit for both ELEG 45903 and ELEG 55903. Prerequisite: Senior standing, ELEG 29004, ELEG 39204, and CSCE 20004.

**ELEG 4870V. Special Topics in Electrical Engineering. 1-3 Hour.**

Consideration of current electrical engineering topics not covered in other courses. Prerequisite: Senior standing. May be repeated for up to 6 hours of degree credit.

**ELEG 49603. CPLD/FPGA Based System Design. 3 Hours.**

Field Programmable logic devices (FPGAs/CPLDs) have become extremely popular as basic building blocks for digital systems. They offer a general architecture that users can customize by inducing permanent or reversible physical changes. This course will deal with the implementation of logic options using these devices. Corequisite: Lab component. Prerequisite: ELEG 39204.

**ELEG 49803. Computer Architecture. 3 Hours.**

Design of a single board computer including basic computer organization, memory subsystem design, peripheral interfacing, DMA control, interrupt control, and bus organization. Prerequisite: ELEG 39204.

## Power Systems

**ELEG 44003. Control Systems. 3 Hours.**

Mathematical modeling of dynamic systems, stability analysis, control system architectures and sensor technologies. Time-domain and frequency-domain design of feedback control systems: lead, lag, PID compensators. Special topics in microprocessor implementation. Students may not receive credit for both ELEG 44003 and ELEG 54003. Prerequisite: ELEG 31204.

**ELEG 440H3. Honors Control Systems. 3 Hours.**

Mathematical modeling of dynamic systems, stability analysis, control system architectures and sensor technologies. Time-domain and frequency-domain design of feedback control systems: lead, lag, PID compensators. Special topics in microprocessor implementation. Students may not receive credit for both ELEG 44003 and ELEG 54003. Prerequisite: ELEG 31204.

**ELEG 44103. Advanced Control Systems. 3 Hours.**

A second course in linear control systems. Emphasis on multiple-input and multiple-output systems: State-space analysis, similarity transformations, eigenvalue and eigenvector decomposition, stability in the sense of Lyapunov, controllability and observability, pole placement, quadratic optimization. Students may not receive credit for both ELEG 44103 and ELEG 54103. Prerequisite: ELEG 44003 or equivalent course.

**ELEG 44203. Optimal Control. 3 Hours.**

Introductory theory of optimizing dynamic systems: Formulation of performance objectives; calculus of variations; linear quadratic optimal control; discrete-time optimization; robustness and frequency domain techniques; reinforcement learning and optimal adaptive control. Prerequisite: ELEG 44003.

**ELEG 44603. Control Systems Laboratory. 3 Hours.**

Experimental study of various control systems and components. The use of programmable logic controllers in the measurement of systems parameters, ladder-logic applications, process-control applications, and electromechanical systems. Prerequisite: ELEG 39203 and ELEG 31204.

**ELEG 45003. Design of Advanced Electric Power Distribution Systems. 3 Hours.**

Design considerations of electric power distribution systems, including distribution transformer usage, distribution system protection implementation, primary and secondary networks design applications of advanced equipment based on power electronics, and use of capacitors and voltage regulation. Students

may not receive credit for both ELEG 45003 and ELEG 55003. Prerequisite: ELEG 33004.

**ELEG 45103. Power and Energy Systems Analysis. 3 Hours.**

Modeling and analysis of electric power systems: Energy sources and conversion; load flow analysis; reference frame transformations; symmetrical and unsymmetrical fault conditions; load forecasting and economic dispatch. Students may not receive credit for both ELEG 45103 and ELEG 55103. prerequisite: ELEG 21103.

**ELEG 4870V. Special Topics in Electrical Engineering. 1-3 Hour.**

Consideration of current electrical engineering topics not covered in other courses. Prerequisite: Senior standing. May be repeated for up to 6 hours of degree credit.

**ELEG 49603. CPLD/FPGA Based System Design. 3 Hours.**

Field Programmable logic devices (FPGAs/CPLDs) have become extremely popular as basic building blocks for digital systems. They offer a general architecture that users can customize by inducing permanent or reversible physical changes. This course will deal with the implementation of logic options using these devices. Corequisite: Lab component. Prerequisite: ELEG 39204.

**ELEG 49803. Computer Architecture. 3 Hours.**

Design of a single board computer including basic computer organization, memory subsystem design, peripheral interfacing, DMA control, interrupt control, and bus organization. Prerequisite: ELEG 39204.

## RF and Antenna Engineering

**ELEG 46003. Deterministic Digital Signal Processing System Design. 3 Hours.**

Design of Digital Signal Processing systems with deterministic inputs. Sampling, quantitzing, oversampling, ADC trade-offs, distortion, equalizers, anti-aliasing, coherency, frequency domain design, audio and video compression. Prerequisite: ELEG 31204.

**ELEG 46203. Communication Systems. 3 Hours.**

Various modulation systems used in communications. AM and FM fundamentals, pulse modulation, signal to noise ratio, threshold in FM, the phase locked loop, matched filter detection, probability of error in PSK, FKS, and DPSK. The effects of quantization and thermal noise in digital systems. Information theory and coding. Students may not receive credit for both ELEG 46203 and ELEG 56203. Pre- or Corequisite: ELEG 31403.

**ELEG 47003. Introduction to RF and Microwave Design. 3 Hours.**

An introduction to microwave design principles. Transmission lines, passive devices, networks, impedance matching, filters, dividers, and hybrids will be discussed in detail. Active microwave devices will also be introduced. In addition, the applications of this technology as it relates to radar and communications systems will be reviewed. Prerequisite: ELEG 37004.

**ELEG 47803. Introduction to Antennas. 3 Hours.**

Basic antenna types: small dipoles, half wave dipoles, image theory, monopoles, small loop antennas. Antenna arrays: array factor, uniformly excited equally spaced arrays, pattern multiplication principles, nonuniformly excited arrays, phased arrays. Use of MATLAB programming and mathematical techniques for antenna analysis and design. Emphasis will be on using simulation to visualize variety of antenna radiation patterns. Corequisite: Drill component. Prerequisite: ELEG 37004.

**ELEG 478H3. Honors Introduction to Antennas. 3 Hours.**

Basic antenna types: small dipoles, half wave dipoles, image theory, monopoles, small loop antennas. Antenna arrays: array factor, uniformly excited equally spaced arrays, pattern multiplication principles, nonuniformly excited arrays, phased arrays. Use of MATLAB programming and mathematical techniques for antenna analysis and design. Emphasis will be on using simulation to visualize a variety of antenna radiation patterns. Corequisite: Drill component. Prerequisite: ELEG 37004. This course is equivalent to ELEG 47803.

**ELEG 4870V. Special Topics in Electrical Engineering. 1-3 Hour.**

Consideration of current electrical engineering topics not covered in other courses. Prerequisite: Senior standing. May be repeated for up to 6 hours of degree credit.

**ELEG 49603. CPLD/FPGA Based System Design. 3 Hours.**

Field Programmable logic devices (FPGAs/CPLDs) have become extremely popular as basic building blocks for digital systems. They offer a general architecture that users can customize by inducing permanent or reversible physical changes. This course will deal with the implementation of logic options using these devices. Corequisite: Lab component. Prerequisite: ELEG 39204.

**ELEG 49803. Computer Architecture. 3 Hours.**

Design of a single board computer including basic computer organization, memory subsystem design, peripheral interfacing, DMA control, interrupt control, and bus organization. Prerequisite: ELEG 39204.

## Electrical Engineering Honors Program

To graduate with Honors in Electrical Engineering, a student 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 at least **6 hours must be Electrical Engineering** courses which include the following courses:

- ELEG 40603H – Honors Electrical Engineering Design I
- ELEG 40701H – Honors Electrical Engineering Design II
- ELEG 400HV – Senior Thesis

**Electrical Engineering Honors Courses**

**ELEG 3XXH3. Honors section of ELEG required junior courses. 3 hours.**

**ELEG 40603H. Electrical Engineering Design I. 3 hours.**

**ELEG 40701H. Electrical Engineering Design II. 1 hour.**

**ELEG 400HV. Honors Senior Thesis. 1-3 hours.**

**ELEG 488HV. Honors Special Problem. 1-3 hours.**

This is a special investigation where the student performs an individual study/research on a topic mutually agreeable to the student and a faculty member.

**ELEG 4XXH3. ELEG technical elective (Honors section). 3 hours.**

Several ELEG technical electives have an Honors section. Please check the offering of these Honors Sections for a particular semester.

**ELEG 5XXXX. Any graduate level course.**

See http://electrical-engineering.uark.edu/academics/undergraduate-students/honors-college.php for more information.

## The EE Curriculum and Medical School

This section provides some general guidelines for those students interested in continuing into Medical School.

Different medical schools have different requirements. Most of UA CoE graduates apply to UAMS in Little Rock whose catalog is found at: Applicant Guide and Timeline | UAMS College of Medicine general, it is required to have:

- 2 semesters of Calculus: EE curriculum has 4 semesters of MATH courses
- 2 semesters of Physics: EE curriculum has 2 semesters of PHYS courses
- 2 semesters of Chemistry: EE curriculum requires CHEM 14103/14101 plus CHEM 14203/14201 can be taken as a Sophomore Science Elective or Math/Science Elective
- 2 semesters of Organic Chemistry: CHEM 36053 and CHEM 36203 can be taken as nonEE Technical Electives
- 2 semesters of Biological Sciences: BIOL 10103/10101 taken as a Sophomore Science Elective or Math/Science Electiveplus BIOL 3xxxx taken as Engineering Science/Technical Elective
- 2 semesters of English: EE requires 3 semesters; however, note that UAMS will accept regular credit (taking the class on campus) or AP-- but not CLEP, exemptions, correspondence courses, etc. This restriction can cause trouble with students who exempt ENGL comp due to high ACT. They will need to make sure to have 2 courses from ENGL on their transcript.

Additional (advanced) courses are suggested but not required. Additional biology often helps the student with their MCAT tests which weigh heavily on med school admissions decisions. Students should try to take 1 or 2 of these courses when they can (maybe summer), hopefully prior to the last part of their junior year when the MCAT is taken. Recommended courses include anatomy, physiology, microbiology, and/or cell biology, which are basic biology courses that would help students prepare.

## FERPA Hold

The purpose of this section is to make you aware of an unwanted effect of the FERPA (Family Educational Rights and Privacy Act of 1974) hold. FERPA relates to privacy and some of you have "clicked" on the FERPA box in ISIS so we cannot release information about you. By doing this, you get the following unwanted effects:

- Your name cannot be listed in the Dean's list. You get a letter stating that you are part of the Dean's list, but your name is now shown in any publication of the list.
- Upon graduation, your name cannot be included in the "Senior Walk." So, if you comeback to campus and your name is not there, one potential reason is that you have a FERPA hold.
- Your name cannot be listed in the Commencement Program or other unwanted effects that we may not have yet identified.

Therefore, if you want your name in the Senior Walk and printed in the Commencement programs,

please, remove your FERPA hold during your last semester.

We want to let you know independently of whether you have a FERPA hold or not, the department does not release any information to third parties without your consent. This is normally done when we have an employer seeking graduates.

**NOTE: The hardcopy of the Undergraduate Handbook finishes here.** Please, refer to the website http://electrical-engineering.uark.edu/, and click on "Current Students" and "Research" for additional information on:

- Humanities/Social Science/Economics/Fine Arts Electives
- Departmental Facilities
- Advising
- Registration
- Tutoring Services
- Activities and Organizations
- Career Services
- Electrical Engineering Faculty Research Specialty Areas ▪ Scholarships