Electrical Engineering Program

2021-2022 Undergraduate Student Handbook

Juan C. Balda, Department Head (jbalda@uark.edu)

Robert F. Saunders, Assistant Department Head (rsaunder@uark.edu)

Phone: (479)575-3008 or (479)575-3005

Fax: (479) 575-7967

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

UNIVERSITY OF ARKANSAS

Welcome Note from the Department Head

The faculty and staff of the Department of Electrical Engineering (www.electrical-engineering.uark.edu) welcome you to the University of Arkansas. Our goal is offering a high-quality undergraduate educational program so our graduates will have a very successful professional career. A variety of small to large companies covering all disciplines of electrical engineering hire our graduates who often become leaders in the society.

The eight-semester undergraduate program has several laboratories providing ample opportunities for hands-on experiences; a competitive advantage when seeking employment. The lab experience culminates in the senior capstone design courses where students from several departments and/or colleges work on industry-sponsored or multidisciplinary projects.

The main areas of specialization in the Department are (1) communications, radio-frequency/microwaves and terahertz, (2) control systems, (3) integrated circuit design, power electronics and power engineering, and (4) microelectronics, nanotechnology and optoelectronics.

The University of Arkansas, College of Engineering, and Department of Electrical Engineering offer a number of scholarships for qualified candidates. Outstanding students with excellent academic records could be considered for many prestigious fellowships, offering competitive stipends and tuition.

The Bachelor of Science in Electrical Engineering (BSEE) degree first established in 1897 has been accredited by the Accreditation Board for Engineering and Technology (ABET) since 1936.

In addition, the department offers the master (M.S.E.E.) and Doctor of Philosophy (Ph.D.) degrees for students seeking to gain greater technical competency. Students can apply up to six credit hours of their BSEE technical electives towards the MSEE degree. Graduate students can apply for teaching or research assistantships. The M.S.E.E. degree has an online version for mainly those students who are working off campus.

Best wishes for success in achieving your academic and career goals. The faculty and staff are available to aid during your stay in the department, and if we can be of help in any way, please do not hesitate to contact us.

Sincerest regards,

Juan Carlos Balda
Department Head
University Professor
Email: jbalda@uark.edu
Phone: 479-575-3008

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ELECTRICAL ENGINEERING AT THE UNIVERSITY OF ARKANSAS

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 challenging 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; Advance quickly to management positions in research and development; 3. Provide financial support for graduate students and gifted undergraduate students; and
4. 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 in 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
2021 – 2022

Freshman Year

1	GNEG 1111	Intro to Engineering I	1	GNEG 1121	Intro to Engineering II
4	MATH 2554	Calculus I[1]	4	MATH 2564	Calculus II
3	CHEM 1103	University Chemistry I	4	PHYS 2054	University Physics I
3	HIST 2003, HIST 2013, or PLSC 2003		4	Sophomore Science Elective[a]	
3	ENGL 1013	Composition I	3	ENGL 1033	Technical Composition II
14	semester hours		16	semester hours	

Sophomore Year

4	ELEG 2104	Electric Circuits I w/ Lab	4	CSCE 2004	Programming Foundations I
3	Humanities Elective[b]		4	ELEG 2114	Electric Circuits II
4	MATH 2584	Differential Equations	4	MATH 2574	Calculus III
4	PHYS 2074	University Physics	4	ELEG 2904	Digital Design w/Lab
15	semester hours		16	semester hours	

Junior Year

4	ELEG 3124	Systems & Signals Analysis w/Lab	3	Math/Science/Technical Elective[h]	
4	ELEG 3214	Electronics I w/ Lab	4	ELEG 3224	Electronics II w/ Lab
4	ELEG 3704	Applied Electromagnetics w/ Lab	4	ELEG 3304	Energy Systems w/ Lab
4	ELEG 3924	Microprocessor System Design w/ Lab	3	ELEG 3143	Probability & Stochastic Processes
			3	Social Science Elective[c]	
16	semester hours		17	semester hours	

Senior Year

3	ELEG 4063	Electrical Engineering Design I	1	ELEG 4071	Electrical Engineering Design II
3	ELEG Technical Elective[e]		3	ELEG Technical Elective[e]	
3	ELEG Technical Elective[e]		3	Technical Elective[i]	
3	Engineering Science/Technical Elective[d]		3	Technical Elective[i]	
3	ECON 2013, ECON 2023, or ECON 2143		3	Social Science Elective[g]	
			3	Fine Arts Elective[f]	
15	semester hours		16	semester hours	

TOTAL: 125 semester hours

[1] Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 2554.

[a] Sophomore Science Elective – CHEM 1123/CHEM 1121L or BIOL 1543/BIOL 1541L or BIOL 2213/BIOL 2211L, or PHYS 2094 or GEOS 1113/GEOS 1111L

[b] The Humanities Elective courses that satisfy General Education Outcomes 3.2 and 5.1 include: CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[c] The Social Sciences Electives courses that satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[d] Engineering Science/Technical Elective: **Any Engineering/Science/Math Technical Elective** or one of these 2000 level courses: MEEG 2013, MEEG 2303, MEEG 2403, CHEG 2313, or INEG 2413

[e] ELEG TECHNICAL ELECTIVES are defined as ELEG 4000 or ELEG 5000 level courses. CSCE 4114, CSCE 4613, or CSCE 4233 are approved ELEG Technical Electives for students pursuing a dual ELEG/CSCE undergraduate degree. Not more than 6 hours may be ELEG 488V or ELEG 400VH courses.

[f] Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

[g] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 281 3H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, SOCI 2033. Note, courses cannot be counted twice in degree requirements.

[h] MATH SCIENCE/TECHNICAL ELECTIVES: **Any Engineering/Science/Math Technical Elective**, suggested classes BIOL 1543/BIOL 1541L, CHEM 1123/CHEM 1121L, CHEM 3504, CHEM 3603, MATH 3083, MATH 4443, PHYS 3113, PHYS 3544, PHYS 3613, MEEG 2703 or STAT 3003.

[i] TECHNICAL ELECTIVES are 3000 or above level courses in Math, Engineering, or the sciences after the approval by ELEG advisor. CSCE 2014, Programming 2, and CSCE 2214, Computer Organization, are allowable non-ELEG technical electives. **Courses not eligible** for technical elective credit include ELEG 3903, ELEG 3933 and any history courses in math and the sciences (e.g., MATH 3133).

2021 -2022 Curriculum: List of Required Courses with Pre- and Co-Requisites for ELEG

Year/Semester	Number	Course Title	Pre-Requisites	Co-Requisites [g]
First Year				
Freshman 1	GNEG 1111	Introduction to Engineering 1	First Year Engineering	
Freshman 1	MATH 2554	Calculus I[1]	As Indicated in Catalog	
Freshman 1	CHEM 1103	University Chemistry 1		
Freshman 1	History Political Science Elective	As indicated in Catalog		
Freshman 1	ENGL 1013	Composition I		
Freshman 2	GNEG 1121	Introduction to Engineering II	GNEG 1111	
Freshman 2	MATH 2564	Calculus II	MATH 2554	
Freshman 2	PHYS 2054	University Physics I	MATH 2554	
Freshman 2	XXXX	Sophomore Science Elective[a]	As Indicated in Catalog	
Freshman 2	ENGL 1033	Technical Composition II	ENGL 1013	
Sophomore Year				
Sophomore 1	PHYS 2074	University Physics II	PHYS 2054	
Sophomore 1	ELEG 2104	Electric Circuits I w/Lab		MATH 2564
Sophomore 1	MATH 2584	Differential Equations	MATH 2564	
Sophomore 1	XXXX	Humanities Elective[b]	As Indicated in Catalog	
Sophomore 2	ELEG 2904	Digital Design w/Lab		
Sophomore 2	CSCE 2004	Programming Foundations I	MATH 2554	

Sophomore 2	ELEG 2114	Electric Circuits II	ELEG 2104	MATH 2584
Sophomore 2	MATH 2574	Calculus III	MATH 2564	

Junior Year				
Junior 1	ELEG 3124	System and Signal Analysis w/ Lab	ELEG 2104	MATH 2584
Junior 1	ELEG 3214	Electronics I w/ Lab		MATH 2574 and ELEG 2114
Junior 1	ELEG 3704	Applied Electromagnetics w/ Lab	ELEG 2114	PHYS 2074 and MATH 2574
Junior 1	ELEG 3924	Microprocessor System Design w/ Lab		ELEG 2904
Junior 2	ELEG 3224	Electronics II w/ Lab	ELEG 3214, ELEG 2114, MATH 2584	
Junior 2	ELEG 3304	Energy Systems w/ Lab	ELEG 2114	
Junior 2	ELEG 3143	Probability and Stochastic Processes		ELEG 3124
Junior 2	XXXX	Social Science Elective[c]	As Indicated in Catalog	
Junior 2	XXXX	Math/Science/Technical Elective[h]	As Indicated in Catalog	

Senior Year				
Senior 1	ELEG 4063	EE Design I	ELEG 3224, ELEG 3924	
Senior 1	ELEG	ELEG Technical Elective[e]	As Indicated in Catalog	
Senior 1	ELEG	ELEG Technical Elective[e]	As Indicated in Catalog	
Senior 1	XXXX XXX3	Engineering Science/Technical Elective[d]	As Indicated in Catalog	
Senior 1	ECON XXX3	ECON 2013, ECON 2023, or ECON 2143	As Indicated in Catalog	
Senior 2	ELEG 4071	EE Design II	ELEG 4063	
Senior 2	ELEG	ELEG Technical Elective[e]	As Indicated in Catalog	
Senior 2	XXXX XXX3	Technical Elective[i]	As Indicated in Catalog	
Senior 2	XXXX XXX3	Technical Elective[i]	As Indicated in Catalog	
Senior 2	XXXX	Social Science Elective[g]	As Indicated in Catalog	
Senior 2	XXXX XXX3	Fine Arts Elective[f]	As Indicated in Catalog	

[1] Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 2554.

[a] Sophomore Science Elective – CHEM 1123/CHEM 1121L or BIOL 1543/BIOL 1541L or BIOL 2213/BIOL 2211L, or PHYS 2094 or GEOS 1113/GEOS 1111L

[b] The Humanities Elective courses that satisfy General Education Outcomes 3.2 and 5.1 include: CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[c] The Social Sciences Electives courses that satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[d] Engineering Science/Technical Elective: **Any Engineering/Science/Math Technical Elective** or one of these 2000 level courses: MEEG 2013, MEEG 2303, MEEG 2403, CHEG 2313, or INEG 2413

[e] ELEG TECHNICAL ELECTIVES are defined as ELEG 4000 or ELEG 5000 level courses. CSCE 4114, CSCE 4613, or CSCE 4233 are approved ELEG Technical Electives for students pursuing a dual ELEG/CSCE undergraduate degree. Not more than 6 hours may be ELEG 488V or ELEG 400VH courses.

[f] Fine Arts Elective courses which satify General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

[g] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2013, INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 281 3H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, SOCI 2033. Note, courses cannot be counted twice in degree requirements.

[h] MATH SCIENCE/TECHNICAL ELECTIVES: **Any Engineering/Science/Math Technical Elective**, suggested classes BIOL 1543/BIOL 1541L, CHEM 1123/CHEM 1121L, CHEM 3504, CHEM 3603, MATH 3083, MATH 4443, PHYS 3113, PHYS 3544, PHYS 3613, MEEG 2703 or STAT 3003.

[i] TECHNICAL ELECTIVES are 3000 or above level courses in Math, Engineering, or the sciences after the approval by ELEG advisor. CSCE 2014, Programming 2, and CSCE 2214, Computer Organization, are allowable non-ELEG technical electives. **Courses not eligible** for technical elective credit include ELEG 3903, ELEG 3933 and any history courses in math and the sciences (e.g., MATH 3133).

Advising Form for 2021-2022 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	#	Sem	GR	Pre-Req	Co-Req	Spring Semester	#	Sem	GR
First Year Engineering		GNEG 1111 Intro to Engineering I	1			GNEG 1111		GNEG 1121 Intro to Engineering II	1		
		MATH 2554 Calculus I	4			MATH 2554		MATH 2564 Calculus II	4		
		CHEM 1103 University Chemistry I	3					Sophomore Science Elective	4		
		History Political Science Elective	3			MATH 2554		PHYS 2054 University Physics I	4		
		ENGL 1013 Composition I	3			ENGL 1013		ENGL 1033 Technical Composition II	3		
		University Credits	0					University Credits	0		
		Transfer and Credit Hours	0					Transfer and Credit Hours	0		
		Number of "D" Hours	0					Number of "D" Hours	0		

SOPHOMORE YEAR

Pre-Req	Co-Req	Fall Semester	#	Sem	GR	Pre-Req	Co-Req	Spring Semester	#	Sem	GR
PHYS 2054		PHYS 2074 University Physics II	4					ELEG 2904 Digital Design w/Lab	4		
	MATH 2564	ELEG 2104 Electric Circuits I (With Lab)	4			MATH 2554		CSCE 2004 Programming Foundations I	4		
MATH 2564		MATH 2584 Differential Equations	4			ELEG 2104	MATH 2584	ELEG 2114 Electric Circuits II	4		
		Humanities Elective	3			MATH 2564		MATH 2574 Calculus III	4		
								University Credits	0		
		University Credits	0					Transfer and Credit Hours	0		
		Transfer and Credit Hours	0					Number of "D" Hours	0		
		Number of "D" Hours	0								

JUNIOR YEAR

Pre-Req	Co-Req	Fall Semester	#	Sem	GR	Pre-Req	Co-Req	Spring Semester	#	Sem	GR
ELEG 2104	MATH 2584	ELEG 3124 System & Signal Analysis (With Lab)	4					Math/Science/Technical Elective	3		
	ELEG 2114 MATH 2574	ELEG 3214 Electronics I (With Lab)	4			ELEG 3214, ELEG 2114, MATH 2584		ELEG 3224 Electronics II (With Lab)	4		
ELEG 2114	PHYS 2074 MATH 2574	ELEG 3704 Applied Electromagnetics (With Lab)	4			ELEG 2114		ELEG 3304 Energy Systems (With Lab)	4		
	ELEG 2904	ELEG 3924 Microprocessor System Design (With Lab)	4				ELEG 3124	ELEG 3143 Probability & Stochastic Processes	3		
		University Credits	0					Social Science 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		

SENIOR YEAR

Pre-Req	Co-Req	Fall Semester	#	Sem	GR	Pre-Req	Co-Req	Spring Semester	#	Sem	GR
ELEG 3224, ELEG 3924		ELEG 4063 Electrical Engineering Design I	3			ELEG 4063		ELEG 4071 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					Universtiy 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: _____

*3000 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 3133) are not eligible for technical elective

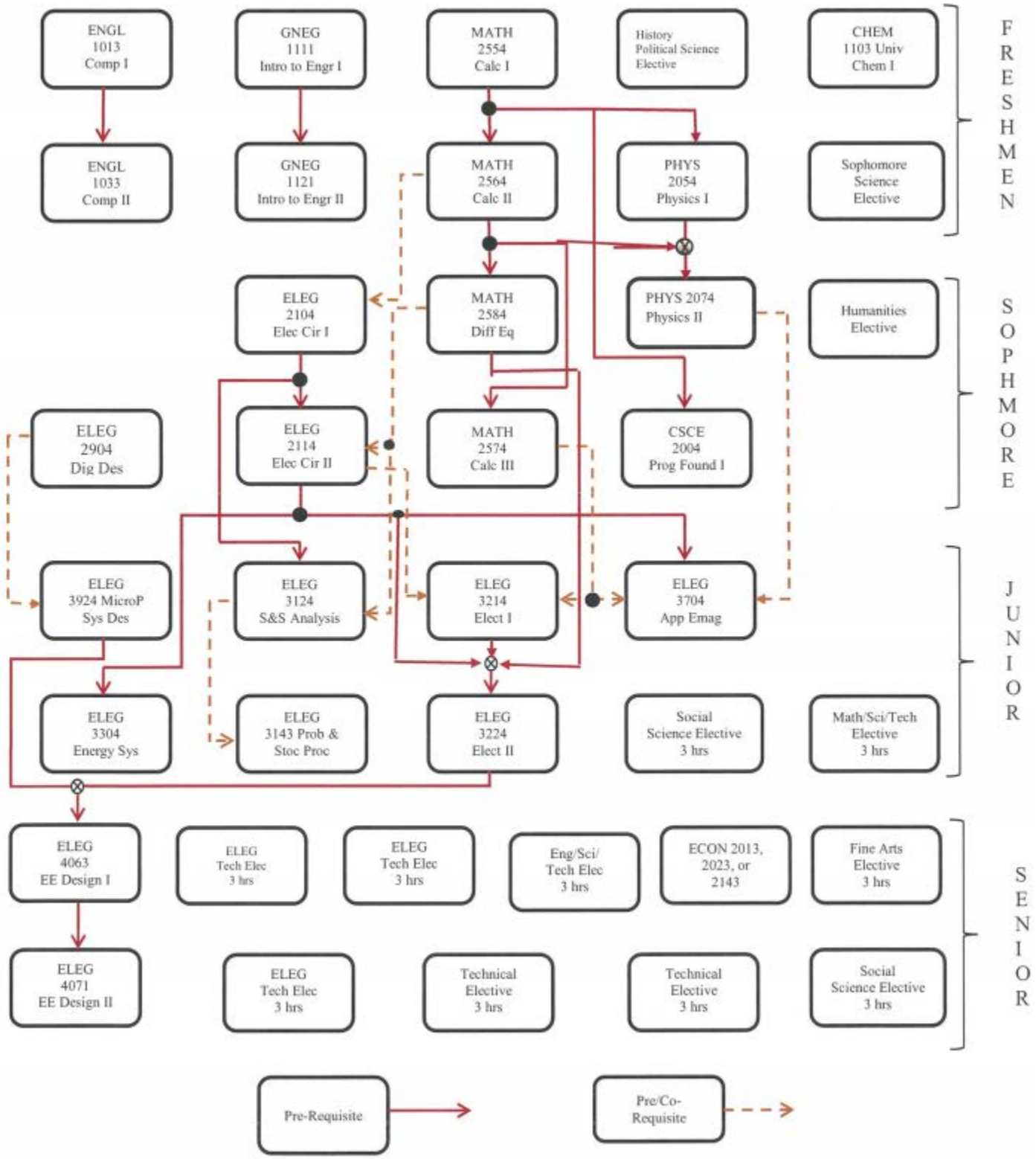
*CSCE 2014 Programming II and CSCE 2214 Computer Organization are allowable non-ELEG technical electives

*Students who have (1) Talked to the departmental co-op coordinator, Robert Saunders, about the intention of taking three GNEG 3811 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 3903 or ELEG 3933 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.

Electrical Engineering 2021-2022
Curriculum Flowchart


ENGL 1013 Comp I
GNEG 1111 Intro to Engr I
MATH 2554 Calc I
History Political Science Elective
CHEM 1103 Univ Chem I
ENGL 1033 Comp II
GNEG 1121 Intro to Engr II
MATH 2564 Calc II
PHYS 2054 Physics I
Sophomore Science Elective
FRESHMEN
ELEG 2104 Elec Cir I
MATH 2584 Diff Eq
PHYS 2074 Physics II
Humanities Elective
ELEG 2904 Dig Des
ELEG 2114 Elec Cir II
MATH 2574 Calc III
CSCE 2004 Prog Found I
SOPHMORE
ELEG 3924 MicroP Sys Des
ELEG 3124 S&S Analysis
ELEG 3214 Elect I
ELEG 3704 App Emag
ELEG 3304 Energy Sys
ELEG 3143 Prob & Stoc Proc
ELEG 3224 Elect II
Social Science Elective 3 hrs
Math/Sci/Tech Elective 3 hrs
JUNIOR
ELEG 4063 EE Design I
ELEG Tech Elec 3 hrs
ELEG Tech Elec 3 hrs
Eng/Sci/ Tech Elec 3 hrs
ECON 2013, 2023, or 2143
Fine Arts Elective 3 hrs
ELEG 4071 EE Design II
ELEG Tech Elec 3 hrs
Technical Elective 3 hrs
Technical Elective 3 hrs
Social Science Elective 3 hrs
SENIOR
Pre-Requisite
Pre/Co-Requisite

NOTES FOR 2021-2022

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 3000 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 1123 and CHEM 1121L – University Chemistry II; BIOL 1543 and 1541L – Principles of Biology; BIOL 2213 and 2211L – Human Physiology; PHYS 2094 – University Physics III or GEOS 1113/GEOS 1111L

ELEG TECHNICAL ELECTIVES

- ELEG 4000 or ELEG 5000 level courses
- For students pursuing a dual degree in CSCE and ELEG: CSCE 4114, CSCE 4613, CSCE 4233.
- Not more than 6 hours may be ELEG 488V or ELEG 400VH courses are approved ELEG Technical Electives.

TECHNICAL ELECTIVES

*3000 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 3133) are not eligible technical elective credit. **CSCE 2014, Programming 2, and CSCE 2214, 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 3811 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 3801 cannot be used for technical elective credit.

**Students cannot use ELEG 3903 or ELEG 3933 to meet this requirement.

MATH/SCIENCE/TECHNICAL ELECTIVES

BIOL 1543 & 1541L Principles of Biology
CHEM 1123 & 1121L University Chemistry II
CHEM 3504 Physical Chemistry I
CHEM 3603 Organic Chemistry I
MATH 3083 Linear Algebra
MATH 3423 Advanced Applied Math
MATH 4443 Complex Variables
PHYS 3113 Analytical Mechanics
PHYS 3544 Optics
PHYS 3613 Modern Physics
MEEG 2703 Computer Methods in ME
STAT 3003 Statistical Methods
Or any other Technical Elective

ENGINEERING SCIENCE/TECHNICAL ELECTIVES

MEEG 2013 Dynamics

MEEG 2303 Introduction to Materials
MEEG 2403 Thermodynamics
CHEG 2313 Thermodynamics of Single-Component Systems
INEG 2413 Engineering Economics Analysis
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	SELECT ONE	SELECT ONE	SELECT TWO	SELECT ONE
U.S. HISTORY	**FINE ARTS**	**HUMANITIES**	**SOCIAL SCIENCES**	**ECONOMICS**

HIST 2003 HIST 2013 PLSC 2003	ARCH 1003 ARHS 1003 COMM 1003 DANC 1003 LARC 1003 MLIT 1003/1003H MLIT 1013/1013H MLIT 1333 THTR 1003 THTR 1013/1013H	CLST 1003/1003H CLST 1013 HUMN 1124H PHIL 2003/2003C PHIL 2003H PHIL 2103/2103C	AGEC 1103 AGEC 2103 ANTH 1023 COMM 1023 ECON 2013 ECON 2023 ECON 2143 EDST 2003 HDFS 1403 HDFS 2413 HDFS 2603 HIST 2093 HIST 1113/1113H HIST 1123/1123H HIST 2003 HIST 2013 HUMN 1114H HUMN 2114H INST 2013 INST 2813/2813H PLSC 2003 PLSC 2013 PLSC 2203 PLSC 2813/2813H PSYC 2003 RESM 2853 SOCI 2013/2013H SOCI 2033	ECON 2013 ECON 2023 ECON 2143

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 4233. 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 4233 and ELEG 5923. Prerequisite: ELEG 3214 or ELEG 3933 and ELEG 2904 or equivalent.

ELEG 4243. 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 3224.

ELEG 4293. Mixed-Signal Modeling & Simulation. 3 Hours.

Study of basic analog, digital & mixed signal simulation solution methods. Modeling with hardware description languages. Use of state-of-the-art simulators and HDLs. Students may not receive credit for both ELEG 4293 and ELEG 5993. Prerequisite: ELEG 3224.

ELEG 487V. 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 4533. 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 SiC MOSFETs, and an introduction to electric motor drives. Students may not receive credit for both ELEG 4533 and ELEG 5533. Prerequisite: ELEG 3304 and ELEG 3224.

ELEG 4543. 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 5543 and ELEG 4543. Prerequisite: ELEG 2114 and ELEG 3214.

ELEG 4553. Switch Mode Power Conversion. 3 Hours.

Basic switching converter topologies: buck, boost, buck-boost, Cuk, flyback, resonant; pulsewidth 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 3224 and ELEG 3124.

ELEG 487V. 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 Systems

ELEG 4403. 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 4403 and ELEG 5403. Prerequisite: ELEG 3124.

ELEG 4403H. 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 4403 and ELEG 5403. Prerequisite: ELEG 3124.

ELEG 4413. 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 4413 and ELEG 5413. Prerequisite: ELEG 4403 or equivalent course.

ELEG 4423. 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 4403.

ELEG 4463L. 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 3924 and ELEG 3124.

ELEG 4473. Power System Operation and Control. 3 Hours.

Study of the control and operation of electric power systems: Modeling, dynamics, and stability of three-phase power systems. Design and implementation of control systems related to generation and transmission. Overview of the related industry and government regulations for power system protection and reliability. Students may not receive credit for both ELEG 4473 and ELEG 5473. Prerequisite: ELEG 3124 and ELEG 3304.

ELEG 4503. 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 4503 and ELEG 5503. Prerequisite: ELEG 3304.

ELEG 4503H. Honors 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 4503H and ELEG 5503. Prerequisite: ELEG 3304. This course is equivalent to ELEG 4503.

ELEG 4513. 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 4513 and ELEG 5513. Prerequisite: ELEG 2114.

ELEG 4523. Quality of Electric Power. 3 Hours.
This course addresses concepts related to the quality of electric power (in particular wiring and grounding, voltage sags and interruptions, harmonics, and transients), distributed generation and power electronic systems, power quality benchmarking, as well as instrumentation and PQ analyzers. Students may not receive credit for both ELEG 4523 and ELEG 5523. Prerequisite: ELEG 3304.

ELEG 487V. 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.

RF and Antenna Engineering

ELEG 4623. 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 4623 and ELEG 5663. Pre- or Corequisite: ELEG 3143.

ELEG 4703. 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 3704.

ELEG 4783. 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 3704.

ELEG 4783H. 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 variety of antenna radiation patterns. Corequisite: Drill component. Prerequisite: ELEG 3704. This course is equivalent to ELEG 4783.

ELEG 487V. 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.

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 4063H – Honors Electrical Engineering Design I ELEG 4071H – Honors Electrical Engineering Design II ELEG 400VH – Senior Thesis

Electrical Engineering Honors Courses

ELEG 3XX3H: Honors section of ELEG required junior courses.

ELEG 4063H: Electrical Engineering Design I
Design and application in electrical engineering.

ELEG 4071H: Electrical Engineering Design II Design and application in electrical engineering.

ELEG 400VH: Honors Senior Thesis

ELEG 488VH: Honors Special Problem
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 4XX3H: ELEG technical elective (Honors section)
Several ELEG technical electives have an Honors section. Please check the offering of these Honors Sections for a particular semester.

ELEG 5XXX: 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:

http://www.uams.edu/com/comcat/COM_Admissions_Guide_Web_2013.pdf In 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 1103/1101L plus CHEM 1123/1121L can be taken as a Sophomore Science Elective or Math/Science Elective

- 2 semesters of Organic Chemistry: CHEM 3603 and CHEM 3613 can be taken as nonEE Technical Electives
- 2 semesters of Biological Sciences: BIOL 1543/1541L taken as a Sophomore Science Elective or Math/Science Elective plus BIOL 3xxx 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 come back 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 Programs. 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