

# Bachelor of Engineering, Engineering: Electrical Engineering

The Bachelor of Engineering, Engineering: Electrical Engineering program focuses on the theories, practices, competencies, tools, and technologies associated with electrical engineering. You will get both online classroom instruction and hands-on lab experience to help prepare you to excel as an electrical engineer. The U.S. Bureau of Labor Statistics predicts a 4% job growth by 2022 for electrical and electronics engineers due to the engineer's versatility in developing and applying emerging technologies. Because this program fills a market-driven educational need, earning your Bachelor of Engineering, Engineering: Electrical Engineering could give you a step up in starting a career in aerospace, telecommunications, defense, automotive, medical, construction, chemical, and more.

For professional licensure information, please see State Requirements listed on the AMU (<https://www.amu.apus.edu/academic/schools/science-technology-engineering-and-math/bachelors/electrical-engineering.html>) or APU (<https://www.apu.apus.edu/academic/schools/science-technology-engineering-and-math/bachelors/electrical-engineering.html>) program page.

For admission to the Bachelor of Engineering, Engineering: Electrical Engineering program applicants must have completed preparation in mathematics equivalent to pre-calculus or higher.

The goal of the Bachelor of Engineering, Engineering: Electrical Engineering program is to provide our students with a sound Engineering education which they can apply in a variety of contexts. Specifically, in three to seven years after graduation, we expect that graduates of our program will demonstrate the following:

## Program Educational Objectives

1. Utilize the critical and systemic thinking skills, and technical and professional competencies, acquired through their education to advance in a career related to their profession as evidenced by achievements or promotions to positions of increasing responsibility.
2. Create value for society through the ethical practice of their professional abilities in developing solutions to technical and societal challenges.
3. Continue to increase their knowledge and competence through self-development or formal schooling.

Courses in the Bachelor of Engineering, Engineering: Electrical Engineering include foundations in math, computer science, and physical sciences. Course topics include:

- Essential elements of analog circuit design
- Fundamentals of circuit analysis - Ohm's law, Kirchhoff's law, etc.
- International System of Units
- Digital and logic circuit analysis and design in 6 main parts
- Energy conversion and transport
- Electromagnetic field theory
- Passive microwave circuit analysis and design
- Radar and RF signal propagation, transmission, and reception

**Note:** The technology fee for the engineering courses (those with the ENGR and ELEN prefix) is \$100/per course (covered by grants for military students). In addition, at-home lab exercises require you to purchase additional course materials which are estimated to be up to \$8,000. These materials are not covered by the university undergraduate book grant.

## Degree Program Objectives

In addition to the institutional and degree level learning objectives, graduates of this program are expected to achieve these student outcomes:

### Student Outcomes

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- an ability to communicate effectively with a range of audiences
- 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
- 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
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

## Programmatic Admission Requirements

For admission to the Bachelor of Engineering, Engineering: Electrical Engineering program, applicants must have completed preparation in mathematics equivalent to pre-calculus or higher. A review of high school or college transcripts showing completion of this requirement will be conducted during the admission process.

Please visit our AMU (<https://www.amu.apus.edu/admissions/undergraduate-requirements.html>) or APU (<https://www.apu.apus.edu/admissions/undergraduate-requirements.html>) undergraduate admission page for more information on institutional admission requirements.

### Need help?

If you have questions regarding a program's admission requirements, please contact an admissions representative at 877-755-2787 or [info@apus.edu](mailto:info@apus.edu).

## Degree at a Glance

Code	Title	Semester Hours
	General Education Requirements	30
	Major Required	78
	Select one of the following concentrations:	14
	General Concentration	
	Communications	
	Mechatronic Systems	
	Final Program Requirements	6
	<b>Total Semester Hours</b>	<b>128</b>

## Degree Program Requirements

### General Education Requirements (30 semester hours)

Code	Title	Semester Hours
<b>Arts and Humanities (6 semester hours)<sup>1</sup></b>		
PHIL200	Introduction to Ethics	3
STEM270	Thinking and Acting Ethically	3
<b>Civics, Political and Social Sciences (6 semester hours)<sup>1</sup></b>		
STEM280	Exploring Society and Cultures via Science Fiction	3

Select 1 course from the following:		3
ANTH100	Introduction to Anthropology	
ANTH202	Introduction to Cultural Anthropology	
CHFD220	Human Sexuality	
COMM211	Social Media and Society	
COMM240	Intercultural Communication	
ECON101	Microeconomics	
ECON102	Macroeconomics	
EDUC200	Humane Education: A Global Interdisciplinary Perspective	
GEOG101	Introduction to Geography	
HOSP110	Practical Food Safety and Awareness	
IRLS210	International Relations I	
LITR212	Forgotten America--Under Represented Cultures in American Literature	
LITR235	Four Points of the Compass: Culture and Society Around the World	
POLS101	Introduction to Political Science	
POLS210	American Government I	
PSYC101	Introduction to Psychology	
SOCI111	Introduction to Sociology	
SOCI212	Social Problems	
SOCI220	American Popular Culture	

### Communication: Writing, Oral, and Multimedia (9 semester hours)

COMM120	Information and Digital Literacy	3
ENGL110	Making Writing Relevant	3
ENGL220	Technical Writing	3

### History (3 semester hours)

STEM185	The History and Context of STEM	3
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### Mathematics and Applied Reasoning (3 semester hours)

MATH225	Calculus	3
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### Natural Sciences (3 semester hours)

STEM100	Introduction to STEM Disciplines	3
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Total Semester Hours		30
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<sup>1</sup> All literature courses require successful completion of ENGL101 (<https://catalog.apus.edu/search/?P=ENGL101>) - Proficiency in Writing or ENGL110 (<https://catalog.apus.edu/search/?P=ENGL110>) - Making Writing Relevant.

### Major Required (78 semester hours)

Code	Title	Semester Hours
MATH220	Linear Algebra	3
Select 1 course from the following:		4

CHEM133	General Chemistry I with Lab	
BIOL133	General Biology I with Lab	
ELEN100	Introduction to Electrical Engineering	3
MATH210	Discrete Mathematics	3
SCIN233	Physics I with Lab	4
MATH226	Calculus II	3
ENGR200	Introduction to Engineering and Computing	3
SCIN234	Physics II with Lab	4
MATH240	Differential Equations	3
MATH227	Calculus III	3
ELEN201	Circuits I	3
ELEN210	Engineering Instrumentation and Measurements	3
ELEN202	Circuits II	3
MATH303	Probability and Statistics for Engineers and Scientists	3
ENGR300	Fundamentals of Mechanical Engineering	3
STEM380	Coevolution of Society, Culture, and Technology	3
ELEN310	Continuous and Discrete Signals and Systems	4
ELEN350	Electromagnetic Field Theory	3
ELEN306	Analog Circuit Theory	4
ELEN307	Digital Circuit Theory	4
ELEN315	Energy Conversion Processes and Power Systems	3
ELEN420	Communication Systems	3
ELEN416	Control Systems Theory and Design	3
Select 1 course from the following:		3
STEM470	Cybersecurity, Surveillance, Privacy and Ethics	
STEM471	Analytics, Algorithms, AI, and Humanity	
Total Semester Hours		78

Students must choose a concentration for this degree program and may select from the General Concentration, Concentration in Communication Systems, or a Concentration in Mechatronics.

Transfer students from an engineering program who select the General Concentration may apply up to 18 semester hours of STEM courses in place of the General Concentration courses

### General Concentration (14 semester hours)

This general concentration allows you to select from all concentration courses offered within this program, enabling you to create your own focused area of study.

Transfer students from an ABET accredited engineering program who select the General Concentration may apply up to 18 semester hours of upper-division engineering courses in place of the General Concentration courses with the Program Director's approval.

### Concentration Requirements (14 semester hours)

Code	Title	Semester Hours
Select 2 courses from the following:		6
ELEN421	RF/Microwave Engineering I	
ELEN426	Antennas-Theory and Applications	
ELEN430	Embedded Systems Design	
ELEN432	Microcontroller Based Systems	
Select 2 courses from the following:		8
ELEN422	RF/Microwave Engineering II	
ELEN423	Wireless Communications	
ELEN427	Radar Systems Theory	
ELEN435	Introduction to Power Electronics	
ELEN436	Advanced Power Electronics	
ELEN440	Mechatronics	
Total Semester Hours		14

### Concentration in Communications (14 semester hours)

Examines the fundamental concepts of passive microwave circuit analysis and design. Offers an understanding of the key concepts and basic theories associated with microwave circuits and systems, and the basic components of a wireless communication system. Has in-depth coverage of the basic properties of antenna theory, analysis, and design as well as radar and RF signal propagation, transmission, and reception.

### Concentration Requirements (14 semester hours)

Code	Title	Semester Hours
ELEN421	RF/Microwave Engineering I	3
ELEN426	Antennas-Theory and Applications	3
Select 2 courses from the following:		8
ELEN422	RF/Microwave Engineering II	
ELEN423	Wireless Communications	
ELEN427	Radar Systems Theory	
Total Semester Hours		14

### Concentration in Mechatronic Systems (14 semester hours)

Covers the fundamentals of embedded system hardware and firmware design. Includes a basic understanding of circuit analysis and the functionality, topography, and regulation of power electronic devices. Provides knowledge of advances in power electronics such as

modeling DC motor drives and machines, various modes of operation, multi-phase control converters, and choppers.

### Concentration Requirements (14 semester hours)

Code	Title	Semester Hours
ELEN430	Embedded Systems Design	3
ELEN432	Microcontroller Based Systems	3
Select 2 courses from the following:		8
ELEN435	Introduction to Power Electronics	
ELEN436	Advanced Power Electronics	
ELEN440	Mechatronics	
Total Semester Hours		14

### Final Program Requirements (6 semester hours)

Code	Title	Semester Hours
ELEN498	Senior Seminar Design	3
ELEN499	Senior Seminar Project (to be taken as the last course before graduation)	3
Total Semester Hours		6