Electrical Engineering, B.S.E.E.

Degree Offered

- Bachelor of Science in Electrical Engineering (B.S.E.E.)

Nature of the Program

Electrical engineers design, develop, test, and oversee the manufacture and maintenance of equipment that uses electricity, including subsystems for power generation and transmission, sensors, electronics, instrumentation, controls, communications and signal processing. The Bachelor of Science in Electrical Engineering program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org.

In the first two years of electrical engineering, coursework is limited to those subjects that are essential as preparatory courses for more technical courses in the third and fourth years. Fundamental courses in electrical engineering are introduced in the second year. In the third and fourth years, the curriculum provides advanced instruction through required courses and electives. These electives are included in the curriculum to allow the student to acquire additional depth in the student's selected field of electrical engineering.

Program Educational Objectives

The Program Educational Objectives (PEO) of the Electrical Engineering (EE) program at West Virginia University is to produce graduates who will apply their knowledge and skills to achieve success in their careers in industry, research, government service or graduate study. It is expected that in the first five years after graduation our graduates will achieve success and proficiency in their profession, be recognized as leaders, and contribute to the well-being of society.

Concentration Areas

Students can choose from six concentration areas that are listed below.

1. Power Systems: The cost and reliability of electricity plays a critical role in the quality of life and price of all manufactured goods. Advances in power electronics devices and computers are improving the efficiency of electromechanical devices. Electric deregulation in many states is offering retail customers an opportunity to select their electricity supplier and reduce cost. Improvements in technologies such as fuel cells, micro-turbines, wind turbines and photovoltaic systems offer new choices for power generation. Siting of distributed generation sources near the loads and operating power system under deregulation offer new challenges for power engineers.
2. Control Systems: Control theory is fundamental to any system that is required to behave in a desired manner. Such systems include all engineering systems such as mechanical, chemical, electrical and computer systems as well as many other dynamical systems such as economic markets. Control theory therefore has a broad range of applications. This track interests those students who wish to apply technology to control dynamical systems. Signals from sensors, usually processed by a computer, are necessary for proper control of a system.
3. Electronics: Electronics spans a number of large technical specialties within LCSEE including electronic device design and fabrication, analog electronic circuit design and applications, and optical device design and applications. A solid understanding of device operation and their limitations is key to good electronic design, be it the design of individual devices or the design of complex electronic systems. Several programming tools will be introduced to the students during their training in this area to support the development of this understanding. Students will model devices using pSpice and layout electronic circuits using VLSI design rules.
4. Communications and Signal Processing: Communications and signal processing are interrelated fields that play an important role in today's information driven economy. Signal processing involves the use of programmable computer architectures to operate on physical-world signals. Signal processors are found within modern control systems, biomedical applications, and communication devices. Communications is the conveyance of information from one location to another. The capacity of a communications system is limited by the random noise in the channel. The communication channel may be a fiber optic cable, a local or wide area computer network, or the radio frequency spectrum.
5. Bioengineering and Biometrics: Bioengineering is the multidisciplinary application of engineering to medicine and biology, including such areas as biomedical signal and image processing, medical informatics, and biomedical instrumentation. Bioengineering work can include the development of new technologies for use in medicine and biology or the use of engineering techniques to study issues in biology and medicine. Biometrics is a specific area of bioengineering in which biological signatures (fingerprint, voice, face, DNA) is used for identification or authentication in criminal justice, e-commerce, and medical applications. Specific LCSEE projects in these areas include signal processing for prediction of sudden cardiac death in an animal model of heart failure, development of algorithms for arrhythmia detection in implanted medical devices, telemedicine for rural health care delivery in West Virginia, analysis of temporal fingerprint images for determination of vitality, CMOS fingerprint sensor design and modeling, neural net fingerprint matching, and 3-D craniofacial reconstruction. At the undergraduate level, these projects impact courses and create opportunities for senior design projects and undergraduate research experiences.
6. Computers: Computers have become an important part of the technology used by engineers and a very important part of many technological systems and products. Electrical engineering students will gain a basic understanding of how to use computers and microprocessors and be able to develop, program, and use systems with embedded microcomputers.

Click here to view the Suggested Plan of Study (p. 6)

Curriculum in Electrical Engineering

General Education Foundations

Please use this link to view a list of courses that meet each GEF requirement. **(**http://registrar.wvu.edu/gef/**)**

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

Code	Title	Hours
General Education Foundations		
F1 - Composition & Rhetoric		3-6
ENGL 101 & ENGL 102	Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research	
or ENGL 103	Accelerated Academic Writing	
F2A/F2B - Science & Technology		4-6
F3 - Math & Quantitative Reasoning		3-4
F4 - Society & Connections		3
F5 - Human Inquiry & the Past		3
F6 - The Arts & Creativity		3
F7 - Global Studies & Diversity		3
F8 - Focus (may be satisfied by completion of a minor, double major, or dual degree)		9
Total Hours		31-37

Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.

Degree Requirements

Students must meet the following criteria to qualify for a Bachelor of Science in Electrical Engineering degree:

- Complete a minimum of 127 credit hours
- Satisfy WVU's undergraduate degree requirements
- Satisfy Statler College's undergraduate degree requirements (http://catalog.wvu.edu/undergraduate/collegeofengineeringandmineralresources/#policiestext)
- Complete all courses listed in the curriculum requirements with the required minimum grades
- Attain an overall grade point average of 2.00 or better
- Attain a WVU grade point average of 2.00 or better
- Attain a Statler grade point average of 2.00 or better
- A maximum of one math or science courses with a grade of D+, D, or D- may apply towards a Statler College degree
- Complete a survey regarding their academic and professional experiences at WVU, as well as post-graduation job placement or continuing education plans.

The Statler GPA is computed based on all work taken at WVU with a subject code within Statler College (BIOM, BMEG, CE, CHE, CPE, CS, CSEE, CYBE, EE, ENGR, ENVE, ETEC, IENG, IH&S, MAE, MINE, PDA, PNGE, SAFM, SENG) excluding ENGR 140, ENGR 150, and CS 101. The WVU GPA is computed based on all work taken at WVU. The Overall GPA is computed based on all work taken at WVU and transfer work.

Curriculum Requirements

Code	Title	Hours
University Requirements		16
Fundamentals of Engineering Requirements		5
Math and Science Requirements		34
Electrical Engineering Program Requirements		72
Total Hours		127

University Requirements

Code	Title	Hours
General Education Foundations (GEF) 1, 2, 3, 4, 5, 6, 7, and 8 (31-37 Credits)		
Outstanding GEF Requirements 1, 5, 6, and 7		15
ENGR 191	First-Year Seminar	1
Total Hours		16

Fundamentals of Engineering Requirements

Code	Title	Hours
A minimum grade of C- is required in all Fundamentals of Engineering courses.		
ENGR 101	Engineering Problem Solving 1	2
Engineering Problem Solving (Select one of the following):		3
CHE 102	Introduction to Chemical Engineering	
ENGR 102	Engineering Problem-Solving 2	
ENGR 103	Introduction to Nanotechnology Design	
MAE 102	Introduction to Mechanical and Aerospace Engineering Design	
Total Hours		5

Math and Science Requirements

Code	Title	Hours
A minimum grade of C- is required in all Math and Science courses.		
CHEM 115 & 115L	Fundamentals of Chemistry 1 and Fundamentals of Chemistry 1 Laboratory (GEF 2B)	4
Calculus I (GEF 3):		4
MATH 155	Calculus 1	
MATH 153 & MATH 154	Calculus 1a with Precalculus and Calculus 1b with Precalculus	
MATH 156	Calculus 2	4
MATH 251	Multivariable Calculus	4
MATH 261	Elementary Differential Equations	4
PHYS 111 & 111L	General Physics 1 and General Physics 1 Laboratory (GEF 8)	4
PHYS 112 & 112L	General Physics 2 and General Physics 2 Laboratory (GEF 8)	4
STAT 215	Introduction to Probability and Statistics	3
Math/Science Elective (Select one of the following):		3
BIOL 115 & 115L	Principles of Biology and Principles of Biology Laboratory	
CHEM 116 & 116L	Fundamentals of Chemistry 2 and Fundamentals of Chemistry 2 Laboratory	
MATH 343	Introduction to Linear Algebra	
MATH 375	Applied Modern Algebra	
MATH 420	Numerical Analysis 1	
MATH 441	Applied Linear Algebra	
MATH 456	Complex Variables	
MATH 465	Partial Differential Equations	
PHYS 211	Introduction to Mathematical Physics	
PHYS 314	Introductory Modern Physics	
PHYS 321	Optics	
PHYS 331	Theoretical Mechanics 1	
PSIO 241	Elementary Physiology	
PSIO 441	Mechanisms of Body Function	

STAT 312	Intermediate Statistical Methods	
STAT 331	Sampling Methods	
STAT 461	Introduction to Probability Theory	
Total Hours		34

Electrical Engineering Program Requirements

Code	Title	Hours
ECON 201	Principles of Microeconomics (GEF 4)	3
CPE 271	Introduction to Digital Logic Design	3
CPE 271L	Digital Logic Laboratory	1
CPE 310	Microprocessor Systems	3
CPE 310L	Microprocessor Systems Laboratory	1
CS 110 & 110L	Introduction to Computer Science and Introduction to Computer Science Laboratory	4
EE 221	Introduction to Electrical Engineering	3
EE 221L	Introduction to Electrical Engineering Laboratory	1
EE 223	Electrical Circuits	3
EE 223L	Electrical Circuits Laboratory	1
EE 327	Signals and Systems 1	3
EE 329	Signals and Systems 2	3
EE 329L	Signals and Systems Laboratory	1
EE 335	Electromechanical Energy Conversion and Systems	3
EE 335L	Electromechanical Energy Conversion and Systems Laboratory	1
EE 345	Engineering Electromagnetics	3
EE 251	Digital Electronics	3
EE 251L	Digital Electronics Laboratory	1
EE 355	Analog Electronics	3
EE 355L	Analog Electronics Laboratory	1
CSEE 380	Engineering Professionalism Seminar	1
CSEE 480	Capstone Project - Design	2
or CSEE 480S	Capstone Project - Design	
or EE 480	Capstone Project - Design	
CSEE 481	Capstone Project - Implementation	3
or CSEE 481S	Capstone Project - Implementation	
or EE 481	Capstone Project - Implementation	
Engineering Science Elective (Select one of the following):		3
CE 443	Environmental Science and Technology	
CHE 366	Materials Science	
CHE 221	Material and Energy Balance	
IENG 316	Industrial Quality Control	
IENG 377	Engineering Economy	
MAE 241	Statics	
MAE 320	Thermodynamics	
Technical Electives (300 level or higher in BIOM, BMEG, CE, CHE, CPE, CS, CYBE, EE, IENG, MAE, MINE, PNGE, BIOL, CHEM, PHYS, STAT, OR MATH courses) *		9
Concentration Area (CA) Technical Electives (Selected from one of the CAs below)		9
CA1: Power Systems		
EE 435	Introduction to Power Electronics	
Select one of the following:		
EE 431	Electrical Power Distribution Systems	
EE 436	Power Systems Analysis	
Select one of the following:		

CS 453	Data and Computer Communications
CS 465	Cybersecurity Principles and Practice
EE 411	Fundamentals of Control Systems
EE 413	Introduction to Digital Control
EE 431	Electrical Power Distribution Systems
EE 436	Power Systems Analysis
EE 461	Introduction to Communications Systems
CA2: Control Systems	
Select one of the following:	
EE 411	Fundamentals of Control Systems
EE 413	Introduction to Digital Control
Select two of the following:	
EE 411	Fundamentals of Control Systems
EE 413	Introduction to Digital Control
EE 435	Introduction to Power Electronics
EE 461	Introduction to Communications Systems
EE 463	Digital Signal Processing Fundamentals
CA3: Electronics	
EE 450	Device Design and Integration
Select two of the following:	
EE 435	Introduction to Power Electronics
EE 437	Fiber Optics Communications
EE 445	Introduction to Antennas
EE 455	Introduction to Microfabrication
BIOM 457	Fundamentals of Photonics
PHYS 321	Optics
PHYS 471	Solid State Physics
CA4: Communications & Signal Processing	
Choose one of the following:	
EE 437	Fiber Optics Communications
EE 461	Introduction to Communications Systems
EE 463	Digital Signal Processing Fundamentals
Select two of the following:	
BIOM 426	Biometric Systems
CPE 442	Introduction to Digital Computer Architecture
CPE 462	Wireless Networking
CS 453	Data and Computer Communications
EE 411	Fundamentals of Control Systems
EE 413	Introduction to Digital Control
EE 437	Fiber Optics Communications
EE 445	Introduction to Antennas
EE 461	Introduction to Communications Systems
EE 463	Digital Signal Processing Fundamentals
EE 465	Introduction to Digital Image Processing
EE 467	Digital Speech Processing
CA5: Bioengineering and Biometrics	
BIOM 425	Bioengineering
Select one of the following:	
BIOM 426	Biometric Systems
EE 463	Digital Signal Processing Fundamentals
EE 465	Introduction to Digital Image Processing
Select one of the following:	

BIOM 426	Biometric Systems
CHEM 231 & 231L	Organic Chemistry: Brief Course and Organic Chemistry: Brief Course Laboratory
CHEM 233 & 233L	Organic Chemistry 1 and Organic Chemistry 1 Laboratory
CHEM 234 & 234L	Organic Chemistry 2 and Organic Chemistry 2 Laboratory
EE 463	Digital Signal Processing Fundamentals
EE 465	Introduction to Digital Image Processing
PSIO 241	Elementary Physiology
or PSIO 441	Mechanisms of Body Function
CA6: Computers	
Option 1	
CPE 312 & 312L	Microcomputer Structures and Interfacing and Microcomputer Structures and Interfacing Laboratory
Select two of the following:	
CPE 435	Computer Incident Response
CPE 442	Introduction to Digital Computer Architecture
CPE 484	Real-Time Systems Development
Option 2	
CPE 435	Computer Incident Response
CPE 442	Introduction to Digital Computer Architecture
CPE 484	Real-Time Systems Development
Total Hours	72

*

Excludes any 490, 491, 495, Non-LCSEE 493

Suggested Plan of Study

It is important for students to take courses in the order specified as closely as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.E.E. degree program that completes degree requirements in four years is as follows.

First Year

Fall	Hours	Spring	Hours
CHEM 115 & 115L (GEF 2)	4	ENGR 102	3
ENGL 101 (GEF 1)	3	MATH 156 (GEF 8)	4
ENGR 101	2	PHYS 111 & 111L (GEF 8)	4
ENGR 191	1	GEF 6	3
MATH 155 (GEF 3)	4	GEF 7	3
GEF 5	3		
	17		17

Second Year

Fall	Hours	Spring	Hours
CPE 271	3	CS 110 & 110L	4
CPE 271L	1	EE 223	3
EE 221	3	EE 223L	1
EE 221L	1	EE 251	3
MATH 251	4	EE 251L	1
PHYS 112 & 112L (GEF 8)	4	MATH 261	4
	16		16

Third Year

Fall	Hours	Spring	Hours
EE 327	3	CPE 310	3
EE 335	3	CPE 310L	1
EE 335L	1	EE 329	3
EE 355	3	EE 329L	1
EE 355L	1	EE 345	3
STAT 215	3	Math/Science Elective	3
ENGL 102 (GEF 1)	3	CSEE 380	1
	17		15

Fourth Year

Fall	Hours	Spring	Hours
CSEE 480	2	CSEE 481	3
ECON 201 (GEF 4)	3	CA Technical Elective	3
CA Technical Elective	3	Technical Elective	3
CA Technical Elective	3	Technical Elective	3
Engineering Science Elective	3	Technical Elective	3
	14		15

Total credit hours: 127

Student Outcomes

Upon graduation, all Bachelor of Science in Electrical Engineering students will have:

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 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.