

ELECTRICAL ENGINEERING, B.S. (ENGINEERING)

Begin Campus: Any Penn State Campus

End Campus: University Park

Program Description

Electrical Engineering (EE) is one of the broadest of all engineering majors and is much more than just building electrical circuits. Electrical engineering is the application of electronics, electrical science and technology, and computer systems to the needs of society. An electrical engineer is responsible for designing and integrating electronic/electrical systems in diverse industries such as defense, communications, transportation, manufacturing, health care, construction, and entertainment.

The mission of our undergraduate program is to provide a high-quality education in electrical engineering for our students and to instill in them the attitudes, values, and vision that will prepare them for lifetimes of success, continued learning, and leadership in their chosen careers. A combination of required and elective courses ensures that students acquire a broad knowledge base in electrical circuits, digital systems, electronic devices, electromagnetics, and linear systems, as well as expertise in one or more areas of specialization. Additional problem-solving skills and practical experience are developed through design projects and laboratory assignments, which also provide opportunities for developing team-building and technical communication skills.

What is Electrical Engineering?

Electrical engineering is a broad discipline of study that includes circuit design, analog and digital electronics, electromagnetics, electro-optics, control systems, power systems, communications, and signal/image processing. Electrical engineers study and apply physics and mathematics to design electrical and electronic systems and their components for a wide range of applications such as mobile phones, wireless communications, consumer electronics, computers, computer networks, power generation, machine learning, robotics, nanoelectronics, nanophotonics, bioelectronics, autonomous transportation, wearable electronics, and metamaterials.

You Might Like This Program If...

- You are good in math, physics and computer programming and want to use technical skills in these areas to solve real-world problems.
- You are intrigued by the many applications of electronics and electrical systems in our world.
- You want a degree that is very broad and can be applied to a wide range of career opportunities.

Entrance to Major

In order to be eligible for entrance to this major, students must satisfy the following requirements:

- 29-55 cumulative credits (excludes transfer and AP credits)
- completed with a grade of C or better: CMPSC 121 or CMPSC 131 or EDSGN 100; CHEM 110, MATH 140, MATH 141, PHYS 211
- earned a minimum cumulative grade-point average (GPA) of 2.60

* In the event that the major is under enrollment control, a higher minimum cumulative grade-point average is likely to be needed and students must be enrolled in the College of Engineering or Division of Undergraduate Studies at the time of confirming their major choice.

Degree Requirements

For the Bachelor of Science degree in Electrical Engineering, a minimum of 127 credits is required:

Requirement	Credits
General Education	45
Requirements for the Major	109-111

27 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 9 credits of GWS courses.

Requirements for the Major

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44>).

Code	Title	Credits
Prescribed Courses		
EE 200	Design Tools	3
EE 300W	Design Process	3
EE 403W	Capstone Design	3
MATH 220	Matrices	2-3
PHYS 214	General Physics: Wave Motion and Quantum Physics	2
<i>Prescribed Courses: Require a grade of C or better</i>		
CHEM 110	Chemical Principles I	3
EDSGN 100	Cornerstone Engineering Design	3
EE 210	Circuits and Devices	4
EE 310	Electronic Circuit Design I	4
EE 330	Engineering Electromagnetics	4
EE 340	Introduction to Nanoelectronics	4
EE 350	Continuous-Time Linear Systems	4
ENGL 202C	Effective Writing: Technical Writing	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4
Additional Courses		
Select 1 credit of First-Year Seminar		1
CMPSC 122	Intermediate Programming	3
or CMPSC 132 Programming and Computation II: Data Structures		
ECON 102	Introductory Microeconomic Analysis and Policy	3
or ECON 104 Introductory Macroeconomic Analysis and Policy		
MATH 231 & MATH 232	Calculus of Several Variables and Integral Vector Calculus	4
or MATH 230 Calculus and Vector Analysis		
Select 3 credits of the following:		3

IE 424	Process Quality Engineering	
STAT 401	Experimental Methods	
STAT/MATH 414	Introduction to Probability Theory	
STAT/MATH 418	Introduction to Probability and Stochastic Processes for Engineering	
<i>Additional Courses: Require a grade of C or better</i>		
CAS 100A	Effective Speech	3
or CAS 100B	Effective Speech	
or ENGL 138T	Rhetoric and Civic Life II	
CMPEN 271 & CMPEN 275	Introduction to Digital Systems and Digital Design Laboratory ¹	4
or CMPEN 270	Digital Design: Theory and Practice	
CMPSC 121	Introduction to Programming Techniques	3
or CMPSC 131	Programming and Computation I: Fundamentals	
ENGL 15	Rhetoric and Composition	3
or ENGL 30H	Honors Rhetoric and Composition	
or ENGL 137H	Rhetoric and Civic Life I	
MATH 250	Ordinary Differential Equations	3-4
or MATH 251	Ordinary and Partial Differential Equations	

Supporting Courses and Related Areas

Select 6 credits from program-approved list of 300-level courses	6
Select 3 credits from program-approved lists of 300-level or 400-level courses	3
Select 6 credits from program-approved list of 400-level courses	6
Select 6 additional credits, which may include up to 6 credits of ROTC, up to 6 co-op credits, and others from a program-approved list	6

¹ CMPEN 275 does not require a grade of C or better.

General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (<https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/>) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required and Inter-Domain courses do not meet this requirement.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)

- **Arts (GA):** 3 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 3 credits

- **Social and Behavioral Sciences (GS):** 3 credits
- **Natural Sciences (GN):** 3 credits

Integrative Studies

- **Inter-Domain Courses (Inter-Domain):** 6 credits

Exploration

- **GN**, may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GS, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher: 6 credits

University Degree Requirements

First Year Engagement

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement

6 credits are required and may satisfy other requirements

- **United States Cultures:** 3 credits
- **International Cultures:** 3 credits

Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80>)). For more information, check the Suggested Academic Plan for your intended program.

Integrated B.S. in Electrical Engineering and M.I.A. in International Affairs

Requirements for the Integrated B.S. in Electrical Engineering and M.I.A. in International Affairs can be found in the Graduate Bulletin (<https://>

bulletins.psu.edu/graduate/programs/majors/international-affairs/#integratedundergradprogramstext).

Program Educational Objectives

The BSEE Program provides undergraduates with a broad technical education important for employment in the private or public sector, and it teaches them the fundamentals, current issues, and creative problem solving skills essential for future years of learning. At three to five years after graduation, we foresee our graduates able to accomplish the following:

1. Electrical engineering practice in technical assignments such as design, product development, research, manufacturing, consulting, testing, sales, and management;
2. Participation and leadership on teams comprised of individuals with diverse professional and cultural backgrounds;
3. Continued learning and professional development through such activities as graduate school, distance education, professional training, and membership in professional societies.

Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Electrical Engineering program is designed to enable students to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. 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. Communicate effectively with a range of audiences
4. 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. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and-out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy/>)

University Park

David Salvia
 Director of Academic Affairs
 114 EE East
 University Park, PA 16802
 814-865-7227
 dsalvia@psu.edu

Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2023-24 academic year. To access previous years' suggested academic plans, please visit the archive (<https://bulletins.psu.edu/undergraduate/archive/>) to view the appropriate Undergraduate Bulletin edition (*Note: the archive only contains suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin*).

Electrical Engineering, B.S. at University Park Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

If you are starting at a campus other than the one this plan is ending at, please refer to: <http://advising.engr.psu.edu/degree-requirements/academic-plans-by-major.aspx>

First Year

Fall	Credits Spring	Credits
CHEM 110 (GN) ^{*#†}	3 CMPSC 121 or 131 ¹	3
EE 8 or 9 (or First Year Seminar) [†]	1 ECON 102 or 104 (GS) [†]	3
ENGL 15, 30H, or ESL 15 (GWS) ^{††}	3 EDSGN 100 ^{*1}	3
MATH 140 or 140E (GQ) ^{*†#†}	4 MATH 141 or 141E (GQ) ^{*†#†}	4
PHYS 211 (PHYS 211L and PHYS 211R (GN)) ^{*#†}	4 PHYS 212 (PHYS 212L and PHYS 212R (GN)) ^{*†}	4
	15	17

Second Year

Fall	Credits Spring	Credits
CMPEN 270 or 271 and 275 [*]	4 CAS 100A or 100B (GWS) ^{††}	3
CMPSC 122 or 132	3 EE 200	3
EE 210 [*]	4 EE 310 [*]	4
MATH 220	2-3 MATH 230	4
MATH 250 [*]	3 PHYS 214	2
	16-17	16

Third Year

Fall	Credits Spring	Credits
EE 330 [*]	4 EE 300W (Writing Intensive) [†]	3
EE 340 [*]	4 ENGL 202C (GWS) ^{††}	3
EE 350 [*]	4 EE/CMPEN 300-Level Elective	3

General Education Course [†]	3 EE/CMPEN 300-Level Elective	3
General Education Course (GHW) [†]	1.5 General Education Course [†]	3
16.5		15
Fourth Year		
Fall	Credits Spring	Credits
EE 403W	3 EE/CMPEN 400-Level Elective	3
EE/CMPEN 300/400-Level Elective	3 EE/CMPEN 400-Level Elective	3
Related Elective	3 Related Elective	3
Statistics Elective	3 General Education Course [†]	3
General Education Course [†]	3 General Education Course [†]	3
	General Education Course (GHW) [†]	1.5
15		16.5

Total Credits 127-128

- * Course requires a grade of C or better for the major
- ‡ Course requires a grade of C or better for General Education
- # Course is an Entrance to Major requirement
- † Course satisfies General Education and degree requirement

¹ Completing one of EDSGN 100 or CMPSC 121 or CMPSC 131 is required for Entrance to Major.

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

All incoming Schreyer Honors College first-year students at University Park will take ENGL 137H/CAS 137H in the fall semester and ENGL 138T/CAS 138T in the spring semester. These courses carry the GWS designation and satisfy a portion of that General Education requirement. If the student's program prescribes GWS these courses will replace both ENGL 15/ENGL 30H and CAS 100A/CAS 100B/CAS 100C. Each course is 3 credits.

College Notes:

- **EE/CMPEN 300-Level Elective:** Select from department list.
- **EE/CMPEN 300/400-Level Elective:** Select from department list.
- **EE/CMPEN 400-Level Elective:** Select from department list.

- **Health and Physical Activity Elective:** Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement and 3 ROTC credits for a Related Elective.
- **Related Elective:** Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement and 3 ROTC credits for a Related Elective. Students who complete the Cooperative Education Program may substitute up to 6 co-op credits for the Related Electives.
- **Statistics Elective:** Select from department list.

Career Paths

CAREERS

An electrical engineer is responsible for designing and integrating electronic/electrical systems in diverse industries such as defense, communications, transportation, manufacturing, healthcare, construction, power/energy, and entertainment. Some graduates work as design engineers in research labs where they help design state-of-the-art electronic circuits, devices, and systems. Others work in a manufacturing environment where they help improve the manufacturing of existing products. Still others may work in post-production jobs where they deal with technical sales, field testing, or trouble shooting. Some graduates even serve as consultants who are hired by companies to help solve their technical problems.

Some examples of career opportunities include: circuit design for consumer electronics; design of power systems and industrial automation for manufacturing; design of communications systems; signal processing software and hardware development for audio and video applications; image processing and computer vision for medical imaging; software design and algorithm development for artificial intelligence, cyber security, and other big data analytics.

The average entry-level salary for electrical engineers is \$73,000.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE ELECTRICAL ENGINEERING PROGRAM (<http://www.eecs.psu.edu/students/undergraduate/EECS-Students-Undergrad-EE-Specialization.aspx>)

Opportunities for Graduate Studies

A graduate degree can broaden your educational credentials and improve your marketability in the global workplace. Students who graduate with a Bachelor of Science Degree in Electrical Engineering are well-prepared to continue their technical education with a Master's or PhD degree in electrical engineering or related fields such as physics or computer science and engineering. These technical graduate degrees prepare students for employment in research labs or higher education.

Penn State offers M.S. and Ph.D. degrees in Electrical Engineering and in Computer Science and Engineering. All of these graduate programs are highly recognized for producing graduates with strong academic credentials who can perform both theoretical and experimental research.

In addition to traditional technical degrees, some of our graduates opt to get professional degrees in medicine, law or business administration so that they can pursue careers in fields such as medical imaging, patent law, and engineering management.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (<http://www.eecs.psu.edu/students/graduate/EECS-How-to-apply-EE.aspx>)

Professional Resources

- Penn State IEEE (<http://sites.psu.edu/psuieee/>)
- Eta Kappa Nu (<http://sites.psu.edu/hkneecs/>)
- Association of Women in Computing (<http://awc.cse.psu.edu/>)
- Penn State SPIE/OSA (<http://spie.ee.psu.edu/about.html>)
- Association for Computing Machinery (<https://acm.psu.edu/>)

Accreditation

The Bachelor of Science in Electrical Engineering at University Park is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the General Criteria and the Electrical and Electronics Program Criteria.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

University Park

SCHOOL OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE
121 Electrical Engineering East
814-865-7667
gbr6@psu.edu

<http://eecs.psu.edu>