

ELECTRICAL ENGINEERING (BS)

Offered at: San Luis Obispo Campus

The Electrical Engineering Department offers a Bachelor of Science degree and a Master of Science degree in Electrical Engineering. The undergraduate degree is accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org>).

The mission of the Electrical Engineering Department is to educate students to achieve excellence in the discipline of electrical engineering and to teach them to apply their education to solve practical problems in a socially responsible way. Students are prepared for careers of service, leadership, and distinction in a wide range of engineering and other related fields using a participatory, learn-by-doing, and "hands-on" laboratory, project, and design centered approach. Students are encouraged to participate in lifelong learning as essential in the presence of the ever-increasing pace of technological change.

Diversity in the students, faculty and staff is embraced and enhances the quality and creativity of the campus experience and environment.

The primary educational objectives of the Electrical Engineering program (May 2023 revision) are to prepare graduates to:

1. Excel in the electrical engineering profession, demonstrating technical agility, personal integrity, a collaborative spirit, articulate communication skills, and a global perspective in the design and commercialization of new products and the solution of engineering problems
2. Achieve personal career satisfaction while making a positive contribution to their employer and to society.
3. Demonstrate understanding of the broad social, economic, and ethical implications of their work.
4. Embrace lifelong learning as necessary to remain current and to further develop in their profession; being prepared to pursue graduate degrees for enhanced skills and opportunities.

The Electrical Engineering degree programs prepare graduates for distinguished practice in professional engineering; equipping students for pursuing engineering solutions to urgent problems while being responsibly aware of all implications. To that end, the curriculum provides a sound theoretical background along with current, practical engineering knowledge. Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum in numerous design-centered laboratories that provide students with hands-on experiences in design synthesis, analysis, characterization, and verification.

The student begins the major in the first quarter with an orientation class and laboratory; and generally has one or more major courses each quarter until graduation. The many laboratory courses provide practical experience and lead logically from demonstration of theory into design applications.

During their junior and senior years, students choose technical electives to gain additional expertise in one or more areas of specialization within electrical engineering. These courses deal with the development, design and application of circuits, electronic devices, computers, and systems for communication, controls, information processing and display, and system instrumentation. Senior courses in this area provide specialized preparation in a selected area such as active and passive network synthesis, advanced communications systems, software and hardware aspects of computer system design, microelectronic circuit engineering, microprocessor systems applications, rf and microwave engineering, photonics, biomedical engineering, integrated circuits, and solid-state devices.

Other courses deal with industrial process control systems, power electronics, and with generation, distribution, control, and utilization of electric power. Senior elective courses in this area provide specialized preparation in a selected area such as advanced control systems, energy conversion, power system analysis, protection and stability, and solid-state motor control.

Employers recognize that students who have completed such specialized technical courses are early contributors in the workforce. Students wishing to pursue graduate work may select appropriate senior courses in keeping with this goal.

In the required senior design project, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to solve practical problems.

Involvement in faculty research is possible for graduate students and outstanding undergraduate students. Research areas include computer-aided education, autonomous systems, signal and image processing, electric vehicles, computer architecture and software systems, photonics, polymer electronics, power systems, power electronics, radio frequency electronics, communication systems, biomedical electronics, renewable energy systems, and electric power microgrid systems.

Our Electrical Engineering curriculum prepares students to take the examinations required to become a licensed professional Engineers. The examinations include the Fundamentals of Engineering (F.E.) exam and the professional engineering exam (P.E.) administered by the national council of Examiners for Engineering (NCEES).

Students are encouraged to participate in professional organizations and clubs such as: Institute of Electrical and Electronics Engineers (IEEE), IEEE Computer Society (IEEE-CS), IEEE Consumer Electronics Society (IEEE-CES), IEEE Power and Energy Society (IEEE-PES), Audio Engineering Society (AES), Cal Poly Robotics, Electric Vehicle Club, Renewable Energy Club, Society of Automotive Engineers (SAE) and the Formula Electric challenge,

Society of Women Engineers (SWE), Women involved in Software & Hardware (WISH), Eta Kappa Nu (HKN), Society of Photo-Optical Instrumentation Engineers (SPIE), Student Electrical Engineering Council (SEEC), and the Amateur Radio Club. The Electric Power Institute, sponsored by the university and underwritten by major utility companies and electrical equipment manufacturers, offers advanced seminars and lectures in the electrical power field and facilitates student and faculty interaction with industry.

Concentrations

General Curriculum in Electrical Engineering

Offered at: San Luis Obispo Campus

The coursework in the non-concentration option provides the broad Electrical Engineering background necessary to pass the Electrical Engineering Fundamentals of Engineering examination that is the first step towards Electrical Engineering Professional Engineering Licensure. Students can choose from the largest list of electives in the non-concentration option.

Electronics, Controls, and Communications

Offered at: San Luis Obispo Campus

The coursework in the Electronics, Controls and Communications Concentration provides the background necessary to pass the corresponding Electrical Engineering Professional Engineering License examination.

Power

Offered at: San Luis Obispo Campus

The coursework in the Power Concentration provides the background necessary to pass the corresponding Electrical Engineering Professional Engineering License examination.

Program Learning Objectives

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.

Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<https://catalog.calpoly.edu/academic-standards-policies/general-requirements-bachelors-degree/>) section of this catalog, including:

- 40 units of upper-division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No Major or Support courses may be selected as credit/no credit. In addition, no more than 12 units of cooperative or internship courses can count towards your degree requirements.

Code	Title	Units
MAJOR COURSES		
EE 1111 & 1111L	Introduction to Electrical Engineering and Introduction to Electrical Engineering Laboratory	2
EE 2211	Electric Circuit Analysis I	3
EE 2241	Electric Circuit Analysis Laboratory I	1
EE 2212	Electric Circuit Analysis II	3
EE 2328	Signals and Systems	4

EE 3302 & 3302L	Classical Control Systems and Classical Control Systems Laboratory	4
EE 3306 & 3306L	Electronics I and Electronics Laboratory I	4
EE 3308 & 3308L	Electronics II and Electronics Laboratory II	4
EE 3255 & 3255L	Electric Machines and Power Systems and Electric Machines and Power Systems Laboratory	4
EE 3335 & 3335L	Electromagnetic Fields and Transmission and Electromagnetic Fields and Transmission Laboratory	4
EE 3329	Cyber-Physical Systems	4
EE 4314 & 4314L	Communication Systems and Communication Systems Laboratory	4
EE 4461	Senior Project I	1
EE 4462	Senior Project II	1
EE 4463 or EE 4465	Senior Project Design Laboratory I Senior Design: Individual Project I	1
EE 4464 or EE 4466	Senior Project Design Laboratory II Senior Design: Individual Project II	1
EE 4459	Electrical Engineering Fundamentals of Engineering Exam	1
Concentration or General Curriculum in Electrical Engineering		
(See list of Concentrations and General Curriculum in Electrical Engineering)		15
SUPPORT COURSES		
BIO 2213	Life Science for Engineers (5B) ¹	3
CSC 1001 & 1001L	Fundamentals of Computer Science and Fundamentals of Computer Science Laboratory	4
CPE 2300	Introduction to Computer Systems	3
CPE 2301	Introduction to HDL and Digital Design Laboratory	1
MATH 1261	Calculus I (2) ¹	4
MATH 1262	Calculus II	4
MATH 2263	Calculus III	3
MATH 2341	Linear Analysis	4
PHYS 1141	General Physics I (5A & 5C) ¹	4
PHYS 1143	General Physics II	4
STAT 3310	Probability and Random Processes for Engineers (Upper-Division 2/5) ¹	3
GENERAL EDUCATION (GE)		
(See GE program requirements below)		30
FREE ELECTIVES		
Free Electives		0
Total Units		128

¹ Required in Major or Support; also satisfies General Education (GE) requirement.

Concentrations

General Curriculum in Electrical Engineering

Code	Title	Units
REQUIRED COURSES		
Approved Electrical Engineering Electives		
Select from the following:		15
EE Technical Electives ¹		
EE 4406	Power System Analysis I	
EE 4407	Power System Analysis II	

EE 4410	Fundamentals of Power Electronics
EE 4412	Advanced Analog and Mixed-Signal Electronics
EE 4452	Advanced Analog and Mixed-Signal Electronics Laboratory
EE 4416	Digital Communication Systems
EE 4456	Modern Communication Systems Laboratory
EE 4417	Electric Machines
EE 4418 & 4418L	Photonic Component and System Engineering and Photonic Engineering Laboratory
EE 4419	Digital Signal Processing
EE 4420	Sustainable Energy Generation
EE 4422	Polymer Electronics Laboratory
EE 4425 & 4425L	Signal Integrity Electronics and Test Automation and Signal Integrity Electronics and Test Automation Laboratory
EE 4431	Computer-Aided Design of VLSI Devices
EE 4433	Magnetic Apparatus Design
EE 4434	Transportation Electrification and Energy Storage Systems
EE 4435	Industrial Power Control and Automation
EE 4440 & 4440L	Wireless Communications and Wireless Communications Laboratory
EE 4450	Solar Photovoltaic System Engineering I
EE 4470	Special Advanced Topics
EE 4471	Special Advanced Laboratory
EE 4528	Digital Image Processing
EE 5344	Phased Array Antennas
EE 5424	Principles of Remote Sensing and Radar
EE 5428	Computer Vision
EE 5500	Individual Study
EE 5502	Microwave and Millimeter Wave Device and System Electronics
EE 5504	Software Defined Radio
EE 5509	Computational Intelligence
EE 5510	Advanced Power Electronics
EE 5511	Advanced Electric Machines and Design
EE 5512	Advanced Control Techniques in Modern Power Systems
EE 5513	Modern Control Systems
EE 5514	Advanced Modern Control Systems
EE 5515	Advanced Digital Signal Processing
EE 5517	Data Analytics for Cyber-Physical Systems
EE 5518	Power System Protection
EE 5519	Electric Power Distribution and Microgrids
EE 5520	Advanced Solar-Photovoltaic Systems Design
EE 5524	Solid State Electronics
EE 5525	Stochastic Processes
EE 5526	Advanced Digital Communications
EE 5530	Advanced Photonic Systems
EE 5531	Advanced VLSI Design and Validation
EE 5532	VLSI Test Laboratory
EE 5533	Antennas
EE 5535	Utility Applications of Power Electronics and Power Quality
EE 5541	Advanced Microwave and Millimeter-Wave Laboratory
EE 5544	Solid-state Electronics Laboratory
EE 5563	Graduate Seminar
EE 5570	Special Advanced Topics
EE 5571	Special Advanced Laboratory

EE 5594	Professional Engineer Examination
Non-EE Electives ²	
BMED 4434	Micro/Nano Fabrication
BMED 4435	Micro/Nano Fabrication Laboratory
CPE 3300	Computer Architecture
CPE 4180	Advanced Microcontrollers and Embedded Applications
CPE 4300	Advanced Computer Architecture
CPE 4390	Introduction to Real-Time Operating Systems
CPE 4420	High-Performance Embedded Systems
CPE 4455	Design of Fault-Tolerant Systems
CPE 5350	Digital Systems Design
ME 4305	Mechatronics II
Lower-Division Electives ²	
CHEM 1120	Fundamentals of Chemical Structure and Properties
CSC 2001 & 2001L	Data Structures and Data Structures Laboratory
EE 2261	Introduction to C Programming with a Hardware Emphasis
EE 2262	Object-Oriented Programming with a Hardware Emphasis
IME 1140	Technical Graphics Communication for Design and Manufacturing
IME 1143	Introduction to Design and Manufacturing
ME 2210	Engineering Statics
PHYS 2211	General Physics III: Modern Physics
Total Units	
15	

¹ A minimum of 8 units from the EE Technical Electives list is required.

² A maximum of 4 units may come from either the Non-EE Technical Electives or the Lower-Division Electives list, with a combined maximum of 7 units allowed across both lists.

Electronics, Controls, and Communications

Code	Title	Units
REQUIRED COURSES		
Approved Electrical Engineering Electives		
Select from the following: ¹		15
EE Technical Electives ¹		
BMED 4434	Micro/Nano Fabrication	
BMED 4435	Micro/Nano Fabrication Laboratory	
EE 4410	Fundamentals of Power Electronics	
EE 4412	Advanced Analog and Mixed-Signal Electronics	
EE 4452	Advanced Analog and Mixed-Signal Electronics Laboratory	
EE 4416	Digital Communication Systems	
EE 4456	Modern Communication Systems Laboratory	
EE 4418 & 4418L	Photonic Component and System Engineering and Photonic Engineering Laboratory	
EE 4419	Digital Signal Processing	
EE 4425 & 4425L	Signal Integrity Electronics and Test Automation and Signal Integrity Electronics and Test Automation Laboratory	
EE 4431	Computer-Aided Design of VLSI Devices	
EE 4440 & 4440L	Wireless Communications and Wireless Communications Laboratory	
EE 4470	Special Advanced Topics	
EE 4471	Special Advanced Laboratory	
EE 5344	Phased Array Antennas	
EE 5424	Principles of Remote Sensing and Radar	

EE 5502	Microwave and Millimeter Wave Device and System Electronics
EE 5504	Software Defined Radio
EE 5509	Computational Intelligence
EE 5513	Modern Control Systems
EE 5514	Advanced Modern Control Systems
EE 5515	Advanced Digital Signal Processing
EE 5524	Solid State Electronics
EE 5525	Stochastic Processes
EE 5526	Advanced Digital Communications
EE 5530	Advanced Photonic Systems
EE 5531	Advanced VLSI Design and Validation
EE 5532	VLSI Test Laboratory
EE 5533	Antennas
EE 5544	Solid-state Electronics Laboratory
Lower-Division Electives ²	
CHEM 1120	Fundamentals of Chemical Structure and Properties
CSC 2001 & 2001L	Data Structures and Data Structures Laboratory
EE 2261	Introduction to C Programming with a Hardware Emphasis
EE 2262	Object-Oriented Programming with a Hardware Emphasis
IME 1140	Technical Graphics Communication for Design and Manufacturing
IME 1143	Introduction to Design and Manufacturing
ME 2210	Engineering Statics
PHYS 2211	General Physics III: Modern Physics

Total Units
15
¹ A minimum of 11 units from the EE Technical Electives list is required.

² A maximum of 4 units may come from the Lower-Division Electives list.

Power

Code	Title	Units
REQUIRED COURSES		
EE 4406 or EE 4410	Power System Analysis I Fundamentals of Power Electronics	3
Approved Electrical Engineering Electives		
Select from the following:		12
EE Technical Electives ¹		
EE 4406	Power System Analysis I	
EE 4407	Power System Analysis II	
EE 4410	Fundamentals of Power Electronics	
EE 4417	Electric Machines	
EE 4420	Sustainable Energy Generation	
EE 4433	Magnetic Apparatus Design	
EE 4434	Transportation Electrification and Energy Storage Systems	
EE 4435	Industrial Power Control and Automation	
EE 4450	Solar Photovoltaic System Engineering I	
EE 4470	Special Advanced Topics	
EE 4471	Special Advanced Laboratory	
EE 5510	Advanced Power Electronics	
EE 5511	Advanced Electric Machines and Design	
EE 5512	Advanced Control Techniques in Modern Power Systems	
EE 5517	Data Analytics for Cyber-Physical Systems	

EE 5518	Power System Protection
EE 5519	Electric Power Distribution and Microgrids
EE 5520	Advanced Solar-Photovoltaic Systems Design
EE 5535	Utility Applications of Power Electronics and Power Quality
Lower-Division Electives ²	
CHEM 1120	Fundamentals of Chemical Structure and Properties
CSC 2001 & 2001L	Data Structures and Data Structures Laboratory
EE 2261	Introduction to C Programming with a Hardware Emphasis
EE 2262	Object-Oriented Programming with a Hardware Emphasis
IME 1140	Technical Graphics Communication for Design and Manufacturing
IME 1143	Introduction to Design and Manufacturing
ME 2210	Engineering Statics
Total Units	
15	

¹ A minimum of 8 units from the EE Technical Electives list is required.

² A maximum of 4 units may come from the Lower-Division Electives list.

General Education (GE) Requirements

- 43 units required, 13 of which are specified in Major and/or Support.
- If any of the remaining 30 Units is used to satisfy a Major or Support requirement, additional units of Free Electives may be needed to complete the total units required for the degree.
- See the complete GE course listing (<https://catalog.calpoly.edu/academic-standards-policies/general-requirements-bachelors-degree/#generaleducationtext>).
- A grade of C- or better is required in one course in each of the following GE Areas: 1A (English Composition), 1B (Critical Thinking), 1C (Oral Communication), and 2 (Mathematics and Quantitative Reasoning).

Lower-Division General Education

Area 1	English Communication and Critical Thinking	
1A	Written Communication	3
1B	Critical Thinking	3
1C	Oral Communication	3
Area 2	Mathematics and Quantitative Reasoning	
2	Mathematics and Quantitative Reasoning (3 units in Support) ¹	0
Area 3	Arts and Humanities	
3A	Arts	3
3B	Humanities: Literature, Philosophy, Languages other than English	3
Area 4	Social and Behavioral Sciences (Area 4 courses must come from at least two different course prefixes.)	
4A	American Institutions (Title 5, Section 40404 Requirement)	3
4B	Social and Behavioral Sciences	3
Area 5	Physical and Life Sciences	
5A	Physical Sciences (3 units in Support) ¹	0
5B	Life Sciences (3 units in Support) ¹	0
5C	Laboratory (may be embedded in a 5A or 5B course) (1 units in Support) ¹	0
Area 6	Ethnic Studies	
6	Ethnic Studies	3
Upper-Division General Education		
Upper-Division 2/5	Mathematics and Quantitative Reasoning or Physical and Life Sciences (3 units in Support) ¹	0
Upper-Division 3	Arts and Humanities	3

Upper-Division 4

Social and Behavioral Sciences (Area 4 courses must come from at least two different course prefixes.)

3

Total Units**30**

¹ Required in Major or Support; also satisfies General Education (GE) requirement.

Coming soon