ELECTRICAL ENGINEERING

For the undergraduate curriculum in Electrical Engineering leading to the degree Bachelor of Science. The Electrical Engineering Program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org (https://www.abet.org/), under the commission's General Criteria and Program Criteria for Electrical, Computer, Communications, Telecommunication(s) and Similarly Named Engineering Programs.

The Department of Electrical and Computer Engineering (ECPE) at Iowa State University provides undergraduate students with the opportunity to learn electrical and computer engineering fundamentals, study applications of the most recent advances in state-of-the-art technologies and prepare for the practice of electrical engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment that is motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research and outreach programs.

The electrical engineering curriculum offers a number of emphasis areas at the undergraduate level, including control systems, electromagnetics and nondestructive evaluation, microelectronics and photonics, VLSI, electric power and energy systems, and communications and signal processing. Students are required to choose at least one course sequence that focuses on one of these areas; therefore, graduates have substantial depth in specific areas to complement the breadth obtained in the required curriculum. Students also may take elective courses in computer networking, security, computer architecture, digital systems, and software.

Student Learning Outcomes: Graduates of the Electrical Engineering curriculum should have at the time of graduation:

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.

Program Educational Objectives: The program objectives for the electrical engineering program describe accomplishments that graduates are expected to attain within five years after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives for expertise, engagement, learning, leadership and teamwork are defined below for each program.

The objectives of the electrical engineering program at ISU are:

- Graduates, within five years of graduation, should demonstrate peer-recognized **expertise** together with the ability to articulate that expertise and use it for contemporary problem solving in the analysis, design, and evaluation of electrical and electronic devices and systems.
- Graduates, within five years of graduation, should demonstrate **engagement** in the engineering profession, locally and globally, by contributing to the ethical, competent, and creative practice of engineering or other professional careers.
- Graduates, within five years of graduation, should demonstrate sustained **learning** and adapting to a constantly changing field through graduate work, professional development, and self-study.
- Graduates, within five years of graduation, should demonstrate **leadership** and initiative to ethically advance professional and organizational goals, facilitate the achievements of others, and obtain substantive results.
- Graduates, within five years of graduation, should demonstrate a commitment to **teamwork** while working with others of diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the ECPE department provides opportunities for each student to have experience with broadening activities. Through the cooperative education and internship program, students have the opportunity to gain practical industry experience.

Students have the opportunity to participate in advanced research activities, and through international exchange programs, students learn about engineering practices in other parts of the world. Well-qualified juniors and seniors in electrical engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science, the Bachelor of Science and Master of Business

Administration, or the Bachelor of Science and Master of Engineering degrees.

Courses for students who are not in the electrical engineering program: EE 4420 Introduction to Circuits and Instruments, EE 4480 Introduction to AC Circuits and Motors. Credit in these courses may not be counted toward a degree in either electrical engineering or computer engineering.

Curriculum in Electrical Engineering

Administered by the Department of Electrical and Computer Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 128.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.
Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
ENGL 3140	Technical Communication (C or better in this course)	
ENGL 3090	Proposal and Report Writing (C or better in this course)	

General Education Electives: 18 cr.

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course.)	3
ENGL 3140	Technical Communication (Must have a C or better in this course.)	3
or ENGL 3090	Proposal and Report Writing	
Complete minimum of 3 cr. from Approved General Education Component 3000 level and above. [2]		3
Complete additional 9cr. from Approved General Education Component. [2]		9
Total Credits		**18**

Basic Program: 24 cr.
A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770	General Chemistry I	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	
EE 1850	Introduction to Electrical Engineering and Problem-Solving I [3]	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		**24**

Math and Physical Science: 16 cr.

MATH 2070	Matrices and Linear Algebra	3
MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
PHYS 2320	Introduction to Classical Physics II	4
Total Credits		**15**

Electrical Engineering Core: 44 cr.
(A minimum GPA of 2.00 required for this set of courses, including any transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

CPRE 2810	Digital Logic	4
CPRE 2880	Embedded Systems I: Introduction	4
EE 2010	Electric Circuits	4
EE 2240	Signals and Systems I	4
EE 2300	Electronic Circuits and Systems	4
EE 2320	Professional and Ethical Issues in Electrical and Computer Engineering	3
EE 2850	Problem Solving Methods and Tools for Electrical Engineering	4
EE 3030	Energy Systems and Power Electronics	3
EE 3110	Electromagnetic Fields and Waves	4
EE 3220	Probabilistic Methods for Electrical Engineers	3
Core Elective: one of the following:		7
EE 3210	Communication Systems I	
EE 3240	Signals and Systems II	
Core Elective: one of the following:		

EE 3300	Integrated Electronics	
EE 3320	Semiconductor Materials and Devices	
Total Credits		**44**

Note: EE 3210 and EE 3320 are 3-credit courses, whereas EE 3240 and EE 3300 are 4-credit courses. The core credit requirement (44 credits) assumes 7 credits taken for these options. Any core credit surplus or deficiency can be used as credits for EE technical electives.

Other Remaining Courses: 26 cr.

EE 4910	Senior Design Project I and Professionalism	3
EE 4920	Senior Design Project II	2
Econ Elective (ECON 1010, 1020 or IE 3050)		3
EE/CPRE Technical Electives including one approved sequence [2]		13
Technical Electives [2]		6
Total Credits		**27**

Seminar/Co-op/Internships:

EE 1660	Professional Programs Orientation
EE 4940	Portfolio Assessment

Co-op or internship is optional

Outcomes Assessment - Students are required to prepare and to maintain a portfolio of their technical and non-technical skills. This portfolio is evaluated for student preparation during the student's curriculum planning process. Results of the evaluation are used to advise students of core strengths and weaknesses.

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 3000-level or above in professional and technical courses earned at ISU in order to receive a B.S. in electrical engineering. These 30 credits must include EE 4910 Senior Design Project I and Professionalism, EE 4920 Senior Design Project II, and credits in the core professional curriculum and/or in technical electives. The Electrical and Computer Engineering Department requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. From department approved lists (http://www.ece.iastate.edu/academics/bachelors-degree-requirements/).
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Note: International perspectives and U.S. diversity courses are used to meet the general education electives.

Electrical Engineering, B.S.

First Year

Fall	Credits	Spring	Credits
ENGR 1010	R	MATH 1660	4
EE 1850	3	EE 2850	4
MATH 1650	4	PHYS 2310	4
CHEM 1670	4	PHYS 2310L	1
ENGL 1500	3	EE 1660	R
LIB 1600	1	General Education Elective	3
	15		**16**

Second Year

Fall	Credits	Spring	Credits
EE 2010	4	CPRE 2810	4
PHYS 2320	4	EE 2300	4
MATH 2670	4	EE 2240	4
ENGL 2500	3	MATH 2650	4
	15		**16**

Third Year

Fall	Credits	Spring	Credits
CPRE 2880	4	EE 3300 or EE 3320	3-4
EE 2320	3	EE 3210 or EE 3240	3-4
EE 3030	3	EE 3220	3
EE 3110	4	ENGL 3140 or ENGL 3090	3
MATH 2070	3	General Education Elective	3
	17		**15-17**

Fourth Year

Fall	Credits	Spring	Credits
EE 4910	3	EE 4920	2
EE 4940	R	Technical Electives	10
Technical Electives	9	General Education Electives	6
Econ Elective (ECON 1010, 1020 or IE 3050)	3		
	15		**18**

Actual Total Credits: 128

Electrical Engineering students have the opportunity to become a concurrent undergraduate/graduate student in a few programs.

CONCURRENT B.S./M.ENG OR M.S. IN COMPUTER ENGINEERING

CONCURRENT B.S./M.ENG OR M.S. IN CYBER SECURITY

CONCURRENT B.S./M.ENG OR M.S. IN ELECTRICAL ENGINEERING

Electrical engineering students have the opportunity to begin their coursework towards their master's degree in computer, cyber security or electrical engineering during their final semester(s) of undergraduate coursework. In order to be eligible, student must have a 3.0 cumulative GPA or higher to begin a Master of Engineering ("M.ENG") degree or a 3.3 cumulative GPA to begin a Master of Science ("M.S.") degree. Students should meet with their academic advisor to discuss this option.

CONCURRENT B.S./MBA

Juniors and Seniors have the opportunity to continue their undergraduate coursework while also pursuing a Master of Business Administration (MBA) degree. For additional information please visit the concurrent MBA website www.ivybusiness.iastate.edu/full-time-concurrent-mba (https://www.ivybusiness.iastate.edu/full-time-concurrent-mba/).

Graduate Study

The department offers work for the degrees Master of Engineering, Master of Science, and Doctor of Philosophy with a major in electrical engineering and minor work to students with other majors. Minor work for electrical engineering majors is usually selected from a wide range of courses outside electrical engineering.

Master of Engineering degree is coursework only. It is recommended for off-campus students.

The degree Master of Science with thesis is recommended for students who intend to continue toward the Doctor of Philosophy degree or to undertake a career in research and development. The non-thesis Master of Science degree requires a creative component.

The department also offers a graduate certificate program in power systems engineering.

The normal prerequisite to major in graduate work in electrical engineering is the completion of undergraduate work substantially equivalent to that required of electrical engineering students at this university. Because of the diversification in the electrical engineering graduate program, however, it is possible for a student to qualify for graduate study in certain areas of electrical engineering even though the student's undergraduate or prior graduate training has been in a discipline other than electrical engineering. Supporting work, if required, will depend on the student's background and area of research interest.

Prospective students from a discipline other than electrical engineering are required to submit, with the application for admission, a statement of the proposed area of graduate study.

The department requires submission of GRE General test scores by applicants. All students whose first language is not English and who have no U.S. degree must submit TOEFL examination scores. Students pursuing the Doctor of Philosophy must complete the department qualifying process.

The Department of Electrical and Computer Engineering is a participating department in the interdepartmental Master of Science and Doctor of Philosophy degree programs in bioinformatics and computational biology. Students interested in these programs may earn their degrees while working under an advisor in electrical and computer engineering.

Well-qualified juniors or seniors in electrical engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science degrees, the Bachelor of Science and Master of Business Administration, or the Bachelor of Science and Master of Engineering degrees. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate courses. Details are available in the Student Services Office and on the department's website.