COMPUTER ENGINEERING

www.ece.iastate.edu (http://www.ece.iastate.edu)

Administered by the Department of Electrical and Computer Engineering

For the undergraduate curriculum in computer engineering leading to the degree Bachelor of Science. The Computer Engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

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 to prepare for the practice of computer 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 computer engineering curriculum offers focus areas in software systems, embedded systems, networking, information security, computer architecture, and VLSI.

Students also may take elective courses in control systems, electromagnetics, microelectronics, VLSI, power systems, and communications and signal processing.

Student Learning Outcomes: Graduates of the Computer 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 computer engineering programs 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 computer engineering program at Iowa State University 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 computer and software systems, including system integration and implementation.
- 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 computer 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.

Curriculum in Computer Engineering

Administered by the Department of Electrical and Computer Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 127

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 150	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 160	Introduction to College Level Research	1
One of the following:		3
ENGL 314	Technical Communication (C or better in this course)	
ENGL 309	Proposal and Report Writing (C or better in this course)	

General Education Electives: 21 cr. [2]

ENGL 250	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course.)	3
ENGL 314	Technical Communication (Must have a C or better in this course.)	3
or ENGL 309	Proposal and Report Writing	
Complete minimum of 3 cr. from Approved General Education Component 300 level or higher. [3]		3
Complete additional 12 cr. from Approved General Education Component. [3]		12
Total Credits		**21**

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 167	General Chemistry for Engineering Students	4
or CHEM 177	General Chemistry I	
ENGL 150	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 101	Engineering Orientation	R
CPR E 185	Introduction to Computer Engineering and Problem Solving I [3]	3
LIB 160	Introduction to College Level Research	1

MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 231	Introduction to Classical Physics I	4
PHYS 231L	Introduction to Classical Physics I Laboratory	1
Total Credits		**24**

Math and Physical Science: 17 cr.

COM S 227	Object-oriented Programming	4
COM S 228	Introduction to Data Structures	3
MATH 207	Matrices and Linear Algebra	3
MATH 267	Elementary Differential Equations and Laplace Transforms	4
STAT 330	Probability and Statistics for Computer Science	3
Total Credits		**17**

Computer Engineering Core: 36 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).

CPR E 232	Professional and Ethical Issues in Electrical and Computer Engineering	3
CPR E 281	Digital Logic	4
CPR E 288	Embedded Systems I: Introduction	4
CPR E 308	Operating Systems: Principles and Practice	4
CPR E 310	Theoretical Foundations of Computer Engineering	3
CPR E 381	Computer Organization and Assembly Level Programming	4
COM S 309	Software Development Practices	3
COM S 311	Introduction to the Design and Analysis of Algorithms	3
E E 201	Electric Circuits	4
E E 230	Electronic Circuits and Systems	4
Total Credits		**36**

Other Remaining Courses: 29 cr.

CPR E 491	Senior Design Project I and Professionalism	3
CPR E 492	Senior Design Project II	2
Computational Thinking Technical Electives [2]		6
Computer Engineering Technical Electives [2]		9
Technical Electives [2]		9
Total Credits		**29**

Seminar/Co-op/Internships:

CPR E 166	Professional Programs Orientation	R
CPR E 494	Portfolio Assessment	R

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 300-level or above in professional and technical courses earned at ISU in order to receive a B.S. in computer engineering. These 30 credits must include CPR E 491 Senior Design Project I and Professionalism, CPR E 492 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, but are used to meet the general education electives.

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. (http://catalog.iastate.edu/previouscatalogs/2023-2024/collegeofengineering/computerengineering/#fouryearplantext)

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

Computer Engineering, B.S.

First Year

Fall	Credits	Spring	Credits
CHEM 167	4	COM S 227	4
CPR E 185	3	CPR E 166	R
ENGL 150	3	MATH 166	4
ENGR 101	R	ENGL 250	3
LIB 160	1	PHYS 231	4
MATH 165	4	PHYS 231L	1
	15		**16**

Second Year

Fall	Credits	Spring	Credits
CPR E 281	4	CPR E 288	4
COM S 228	3	E E 230	4
E E 201	4	CPR E 310	3
MATH 267	4	MATH 207	3
		Gen Ed Elective	3
	15		**17**

Third Year

Fall	Credits	Spring	Credits
CPR E 232	3	CPR E 308	4
CPR E 381	4	ENGL 314	3
COM S 311	3	COM S 309	3
General Education Elective	3	CPR E 494	0
Technical Electives	3	General Education Elective	3
		Computational Thinking Tech Elective	3
	16		**16**

Fourth Year

Fall	Credits	Spring	Credits
CPR E 491	3	CPR E 492	2
STAT 330	3	Computational Thinking Tech Elective	3
Technical Electives	3	General Education Elective	3
CPR E Elective	6	CPR E Electives	6
General Education Elective	3	Tech Elective	3
	18		**17**

Computer 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

Computer engineering students have the opportunity to begin their coursework towards their masters degree in computer engineering or cyber security 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 Masters of Engineering ("M.ENG") degree or a 3.3 cumulative GPA to begin a Masters 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 computer engineering and minor work to students with other majors. Minor work for computer engineering majors is usually selected from a wide range of courses outside computer engineering.

The Master of Engineering degree is course-work only. It is recommended for off-campus students.

The Master of Science degree 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 three graduate certificate programs in embedded systems, computer networking, and software systems.

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

The Department of Electrical and Computer Engineering also is a participating department in the interdepartmental certificate, Master of Engineering, and Master of Science in Cyber Security programs. Students interested in studying information assurance topics may earn a degree in computer engineering or in information assurance. (See catalog section on Cyber Security.)

Well-qualified juniors and seniors in computer engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both Bachelor of Science and Master of Science, or Bachelor of Science and Master of Business Administration, or 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 web site.