

CYBER SECURITY ENGINEERING

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Administered by the Department of Electrical and Computer Engineering

For the undergraduate curriculum in cyber security engineering leading to the degree Bachelor of Science.

The Department of Electrical and Computer Engineering (ECpE) at Iowa State University provides undergraduate students with the opportunity to learn computer engineering fundamentals, study applications of the most recent advances in state-of-the-art technologies, and to prepare for the practice of cyber security 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.

Student Learning Outcomes: Graduates of the Cyber Security 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 cyber security 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 the program.

The objectives of the cyber security engineering program at Iowa State University are:

- Graduates, within five years of graduation, should demonstrate peer-recognized **expertise** in computer security principles together with the ability to articulate that expertise and use it for contemporary problem solving in the analysis, design, and operation of the physical, software and human components of a system, 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 cyber security 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.

Curriculum in Cyber Security Engineering

Administered by the Department of Electrical and Computer Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 125

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. ³

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 6 cr. from Approved General Education Component 300 level and above. ³		6
Complete additional 9cr. from Approved General Education Component. ³		9
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 ²	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
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Total Credits		24
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Math and Physical Science: 17 cr.

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

Cyber Security Engineering Core: 37 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).

CYB E 230	Cyber Security Fundamentals	3
CYB E 231	Cyber Security Concepts and Tools	3
CYB E 234	Legal, Professional, and Ethical Issues in Cyber Systems	3
CYB E 331	Application of Cryptographic Concepts to Cyber Security	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

Total Credits		37
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Other Remaining Courses: 26 cr.

CPR E 491	Senior Design Project I and Professionalism	3
CPR E 492	Senior Design Project II	2
Cyber Security Technical Electives ³		12
Computer Engineering Technical Electives ³		3
Technical Electives ³		6

Total Credits		26
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Seminar/Co-op/Internships ⁴:

CPR E 166	Professional Programs Orientation	R
CPR E 294	Program Discovery	R
CPR E 494	Portfolio Assessment	R

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. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.
3. From department approved lists. (<http://www.ece.iastate.edu/academics/bachelors-degree-requirements/>)
4. Co-op / Internships are optional

See also: A 4-year plan of study grid showing course template by semester. (<http://catalog.iastate.edu/previouscatalogs/2022-2023/collegeofengineering/cybersecurityengineering/#fouryearplantext>)

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

Cyber Security Engineering, B.S.

First Year

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

Second Year

Fall	Credits Spring	Credits
CPR E 281	4 CPR E 288	4
COM S 228	3 ENGL 250	3
CPR E 294	R Math Elective	3
MATH 267	4 CYB E 231	3

CYB E 230	3 CYB E 234	3
	14	16

Third Year

Fall	Credits Spring	Credits
CPR E 381	4 CPR E 308	4
CPR E 310	3 COM S 311	3
COM S 309	3 ENGL 314 or ENGL 309	3
CYB E 331	3 General Education Elective	3
General Education Elective	3 Cyber Security Elective	3
	16	16

Fourth Year

Fall	Credits Spring	Credits
CPR E 491	3 CPR E 492	2
CPR E 494	R Tech Elective	6
STAT 330	3 General Education Elective	3
Cyber Security Elective	6 Cyber Security Elective	3
CPR E Elective	3	
General Education Elective	3	
	18	14

Cyber Security Engineering Minor

The cyber security engineering minor (<http://catalog.iastate.edu/previouscatalogs/2022-2023/collegeofengineering/cybersecurityminor/>) is intended for students studying computer engineering, computer science, software engineering, or management information systems with the goal of enabling them to work in cyber security. The minor consists of a series of lab based courses that are designed to provide students with both the technical background and the hands-on experiences along with the theoretical background to allow them to compete for jobs in cyber security.

Cyber Security 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 ELECTRICAL ENGINEERING

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

Cyber Security Engineering students have the opportunity to begin their coursework towards their masters degree in computer engineering, cyber security during, or electrical engineering 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/>).

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

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 cyber security.

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