

SOFTWARE ENGINEERING

Administered by the College of Engineering and the College of Liberal Arts and Sciences.

For the undergraduate curriculum in Software Engineering (<http://www.se.iastate.edu>) leading to the degree Bachelor of Science. The Software Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

A software engineer uses their expertise to design, develop, and evaluate software, configure and install computer systems, and build and maintain software systems throughout their lifecycle. Specific tasks software engineers perform evolve quickly, reflecting changes in technology, as well as the needs of employers. Software engineers work as members of teams that may include experts in engineering, marketing, manufacturing, accounting, training, and design.

The Software Engineering Program provides undergraduate students with the opportunity to learn Software Engineering fundamentals, to study applications of state-of-the-art software technologies, and to prepare for the practice of Software Engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment 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 Software 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

Within five years of graduation, the graduates should:

1. attain a **productive career** in Software Engineering or related fields;
2. attain **leadership** roles and become **effective collaborators** to advance professional and organizational goals;
3. engage in **lifelong learning** and professional development;
4. encourage and support **diversity** and **inclusiveness** in their workplace.

We expect that these objectives will be manifested in our graduates through the following five key attributes: (a) *peer-recognized expertise*, (b) *engagement in professional practice*, (c) *sustained learning*, (d) *leadership* and (e) *teamwork*.

Demonstration of expertise involves applying state-of-the-art practices for solving problems in the design, development, validation, evolution and sustainment of (software) products. Demonstration of professional engagement involves contributing locally and globally to the use of ethical, competent, and creative practices in industry, academia or the public sector. Demonstration of sustained learning involves the ability to adapt to rapid technological, environmental, and organizational changes through self-study and group study and through opportunities of professional development or graduate study. Demonstration of leadership involves the ability to take initiative, and to facilitate the advancements of individuals and the community by influencing others and by having a widespread, positive impact on critical issues and projects. Finally, demonstration of teamwork involves the ability to work with collaborators who have varied expertise, and with diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the College of Engineering and the College of Liberal Arts and Sciences provide opportunities for each student to have experience with broadening activities. Students have the opportunity to gain practical industry experience in the cooperative education and internship program. Students have the opportunity to participate in advanced research activities. Through international exchange programs, students learn about engineering practices in other parts of the world.

Curriculum in Software Engineering

Degree requirements leading to the degree Bachelor of Science in Software Engineering.

Total credits required: 125 cr. 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, Engineering Basic Program GPA, or Software Engineering Core GPA). See also Engineering Basic Program and Special Programs. Note: Pass/Not Pass credits cannot 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 (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Introduction to College Level Research	1
Choose one of the following:		3
ENGL 309	Proposal and Report Writing (C or better in this course)	
ENGL 314	Technical Communication (C or better in this course)	
Total Credits		10

General Education Requirements: 24 cr. ²

Choose 1 course from the following:		3
ECON 101	Principles of Microeconomics	
ECON 102	Principles of Macroeconomics	
I E 305	Engineering Economic Analysis	
Approved Arts and Humanities or Social Sciences courses		12
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
Choose one of the following ENGL courses (C or better in this course)		3
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		24

Engineering Basic Program: 24 cr.

A minimum GPA of 2.00 is required for this set of courses (please note that transfer course grades will not be calculated into the Engineering 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 (C or better in this course)	3
S E 101	Software Engineering Orientation ³	R
S E 185	Problem Solving in Software Engineering 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 (C- or better in this course)	4
COM S 228	Introduction to Data Structures (C- or better in this course)	3
MATH 267	Elementary Differential Equations and Laplace Transforms	4
Math Elective: Choose one of the following:		3
MATH 207	Matrices and Linear Algebra	
MATH 265	Calculus III	
MATH 304	Combinatorics	
MATH 314	Graph Theory	
MATH 317	Theory of Linear Algebra	
STAT 330	Probability and Statistics for Computer Science	3
Total Credits		17

Software Engineering Core: 37 cr.

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

CPR E 281	Digital Logic	4
Choose one of the following:		3
COM S 327	Advanced Programming Techniques	
CPR E 288	Embedded Systems I: Introduction	
Choose one of the following:		3
COM S 321	Introduction to Computer Architecture and Machine-Level Programming	
CPR E 381	Computer Organization and Assembly Level Programming	
Choose one of the following:		3
COM S 352	Introduction to Operating Systems	
CPR E 308	Operating Systems: Principles and Practice	
Choose one of the following:		3
COM S 230	Discrete Computational Structures	
CPR E 310	Theoretical Foundations of Computer Engineering	
COM S 311	Introduction to the Design and Analysis of Algorithms	3
COM S 363	Introduction to Database Management Systems	3
S E 309	Software Development Practices	3

S E 317	Introduction to Software Testing	3
S E 319	Construction of User Interfaces	3
S E 339	Software Architecture and Design	3
S E 421	Software Analysis and Verification for Safety and Security	3

Note: CPR E 288, CPR E 381, and CPR E 308 are 4-credit courses. The Software Engineering Core credit requirement (37 credits) is given in terms of 3-credit courses. If the 4-credit courses are taken instead, then the extra credits will be used as credits for Supplemental Electives.

Total Credits **37**

Other Remaining Courses: 23 cr.

S E 166	Careers in Software Engineering	R
S E 491	Senior Design Project I and Professionalism	3
S E 492	Senior Design Project II	2
Software Engineering Elective ²		6
Supplemental Elective ²		9
Open Elective ²		3

Total Credits **23**

Optional Co-op/Internships

Co-op (S E 398) or internship (S E 396) is optional

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 Bachelor of Science in Software Engineering. These 30 credits must include S E 491 Senior Design Project I and Professionalism and S E 492 Senior Design Project II. The Software Engineering degree program 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. Choose from approved lists (<http://www.se.iastate.edu/academics/>).
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Engineering 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 (<http://www.se.iastate.edu/academics/>).

Software Engineering, B.S.

Freshman

Fall	Credits Spring	Credits
MATH 165	4 COM S 227	4
ENGL 150	3 MATH 166	4
S E 101	R S E 166	R
LIB 160	1 Economics Elective	3
CHEM 167 or 177	4 PHYS 231	4
S E 185	3 PHYS 231L	1

15 **16**

Sophomore

Fall	Credits Spring	Credits
CPR E 281 ¹	4 S E 319 ¹	3
ENGL 250	3 COM S 327 or CPR E 288 ^{1,2}	3
MATH 267	4 Math Elective	3
COM S 228	3 General Education Elective	3
SP CM 212	3	

17 **12**

Junior

Fall	Credits Spring	Credits
COM S 363 ¹	3 COM S 352 or CPR E 308 ^{1,2}	3
COM S 230 or CPR E 310 ¹	3 ENGL 314 or 309	3
COM S 321 or CPR E 381 ^{1,2}	3 COM S 311 ¹	3
S E 309 ¹	3 S E 317 ¹	3
General Education Elective	3 S E 339 ¹	3
	Open Elective	3

15 **18**

Senior

Fall	Credits Spring	Credits
S E 491	3 S E 492	2
STAT 330	3 Supplemental Electives	9
S E 421 ¹	3 Software Engineering Elective	3
General Education Elective	3 General Education Elective	3
Software Engineering Elective	3	

15 **17**

* Total credits required - 125 credits. 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, Engineering Basic Program GPA, or Software Engineering Core GPA). See also Basic Program and Special Programs.

Engineering Basic Program - A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Engineering Basic Program GPA)

Must receive a C or better grade in required English classes.

Must receive a C- or better grade in MATH 165, MATH 166, COM S 227, and COM S 228.

General Educational Elective courses to be selected in consultation with Software Engineering Academic Advisors from a list of approved courses. They must include courses that satisfy university and college general education requirements. These courses include courses or categories of courses such as International Perspectives and U.S. Diversity, World Language, Arts and Humanities, and Social Sciences. Pass/Not Pass credit is not accepted.

Software Engineering Electives and Supplemental Electives must be selected from the program-approved list (<http://www.se.iastate.edu/academics/>).

¹ Software Engineering Core (A minimum GPA of 2.00 is required for this set of courses, including any transfer courses but transfer course grades will not be calculated into the Software Engineering Core GPA)

² Students who take the 4-credit lab courses CPR E 288, CPR E 308, and CPR E 381 instead of the corresponding 3-credit alternatives can apply the additional credits toward Supplemental Electives. The total number of credits required in the Software Engineering Program remains the same for all students.

The Software Engineering Program has established concurrent undergraduate and graduate programs with the Department of Computer Science, the Department of Electrical and Computer Engineering, and the Ivy College of Business. Please visit <https://se.iastate.edu/academics/> for details.