MAJOR IN COMPUTER SCIENCE, SOFTWARE ENGINEERING CONCENTRATION

Software engineering involves designing, implementing, and maintaining computer programs. Developing modern software systems requires more than programming skills and core computer science concepts. It requires software engineering skills, which are in high demand in the software industry.

The Software Engineering concentration focuses on the concepts, techniques, and tools necessary for software analysis, design, testing, maintenance, and teamwork. Courses will include hands-on work with the software engineering tools used in industry.

This concentration combines a rigorous computer science degree with courses in software design, software testing, project management, and system analysis and design.

Learning Outcomes

Upon completing this program, students will be able to:

- Work effectively in teams to develop computational solutions to complex problems.
- Communicate technical ideas effectively in writing and verbally.
- Confidently pursue graduate studies or professional employment in software engineering and computer science.

Potential Occupations

In addition to the career opportunities open to all computer science graduates, the software engineering concentration opens career paths that include:

Software developer, software architect, full-stack developer, software project manager, database programmer, computer systems analyst, web developer, computer and information systems manager, UX designer, cloud engineer, and mobile application developer.

Requirements Effective Fall 2023

A minimum grade of C (2.000) is required in CO 150 and in all CS, CIS, DSCI, MATH, and STAT courses which are required for graduation.

Freshman

		AUCC	Credits
CO 150	College Composition (GT-CO2)	1A	3
MATH 156 or 160[1]	Mathematics for Computational Science I (GT-MA1) Calculus for Physical Scientists I (GT-MA1)	1B	4
Select one group from the following:[2]			5-9
Group A:			
CS 150A or 150B	Culture and Coding: Java (GT-AH3) Culture and Coding: Python (GT-AH3)	3B	
CS 162 or 164	CS1--Introduction to Java Programming CS1--Computational Thinking with Java		
Group B:			
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-and-humanities)		3B	
CS 152	Python for STEM		
CS 162 or 164	CS1--Introduction to Java Programming CS1--Computational Thinking with Java		
Group C:			
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-and-humanities)		3B	
CS 163	CS1---No Prior Programming Experience		
CS 201/PHIL 201	Ethical Computing Systems (GT-AH3)	3B	3
Select at least two courses totaling a minimum of 7 credits from the following (one course must be or include the sequenced laboratory):			7
AA 100 & AA 101	Introduction to Astronomy (GT-SC2)	3A	
ANTH 120 & ANTH 121	Human Origins and Variation (GT-SC2)	3A	
BZ 110 & BZ 111	Principles of Animal Biology (GT-SC2)	3A	

BZ 120	Principles of Plant Biology (GT-SC1)	3A	
CHEM 107 & CHEM 108	Fundamentals of Chemistry (GT-SC2)	3A	
CHEM 111 & CHEM 112	General Chemistry I (GT-SC2)	3A	
GEOL 120 & GEOL 121	Exploring Earth - Physical Geology (GT-SC2)	3A	
GEOL 122 & GEOL 121	The Blue Planet - Geology of Our Environment (GT-SC2)	3A	
GEOL 124 & GEOL 121	Geology of Natural Resources (GT-SC2)	3A	
GEOL 150	Physical Geology for Scientists and Engineers	3A	
HONR 292A	Honors Seminar: Knowing in the Sciences	3A	
LIFE 102	Attributes of Living Systems (GT-SC1)	3A	
LIFE 103	Biology of Organisms-Animals and Plants (GT-SC1)	3A	
LIFE 201A	Introductory Genetics: Applied/Population/Conservation/Ecological (GT-SC2)	3A	
LIFE 201B	Introductory Genetics: Molecular/Immunological/Developmental (GT-SC2)	3A	
LIFE 220/LAND 220	Fundamentals of Ecology (GT-SC2)	3A	
NR 150	Oceanography (GT-SC2)	3A	
PH 121	General Physics I (GT-SC1)	3A	
PH 122	General Physics II (GT-SC1)	3A	
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	
PH 142	Physics for Scientists and Engineers II (GT-SC1)	3A	
Diversity, Equity, and Inclusion (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion)		1C	3
Elective[3]			1-5
	Total Credits		**30**

Sophomore

CS 165	CS2--Data Structures		4
CS 220	Discrete Structures and their Applications		4
Select one group from the following:			4-5
Group A			
CS 214	Software Development		
CT 301	C++ Fundamentals		
Group B			
CS 253	Software Development with C++		
Select one course from the following:			4
CS 250	Computer Systems Foundations		
CS 270	Computer Organization		
Select one course from the following:			3-4
DSCI 369	Linear Algebra for Data Science		
MATH 369	Linear Algebra I		
Select one course from the following:			1-3
STAT 301	Introduction to Applied Statistical Methods		
STAT 302A	Statistics Supplement: General Applications		
STAT 307	Introduction to Biostatistics		
STAT 315	Intro to Theory and Practice of Statistics		
Historical Perspectives (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
Social and Behavioral Sciences (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		3C	3

Elective			0-4
	Total Credits		**30**
Junior			
CS 314	Software Engineering	4A,4B	3
CS 320	Algorithms--Theory and Practice		3
CS 356	Systems Security		3
CS 370	Operating Systems		3
Select one course from the following:			3-4
CS 312	Modern Web Applications		
CS 345	Machine Learning Foundations and Practice		
CS course numbered 400- or above, excluding 480-499			
CIS 320	Project Management for Information Systems		3
Advanced Writing (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing)		2	3
Electives			8-9
	Total Credits		**30**
Senior			
CS 414	Object-Oriented Design	4C	4
CS 415	Software Testing		4
CIS 360	Systems Analysis and Design		3
Depth course - select two courses from the following:			8
CS 430	Database Systems		
CS 435	Introduction to Big Data		
CS 440	Introduction to Artificial Intelligence		
CS 453	Introduction to Compiler Construction		
CS 455	Introduction to Distributed Systems		
CS 462	Engaging in Virtual Worlds		
CS 464	Principles of Human-Computer Interaction		
Electives[4]			11
	Total Credits		**30**
	Program Total Credits:		**120**

1 MATH 156 recommended for computer science majors who do not already have MATH 160 credit.

2 Recommended sequence for most incoming students is Group A: CS 150B to CS 164.

3 CS 192 or other seminar course is a recommended elective for incoming, first semester, students.

4 Select enough elective credits to bring the program total to a minimum of 120 credits, of which at least 42 must be upper-division (300- to 400-level).

Major Completion Map

Distinctive Requirements for Degree Program:

To prepare for first semester: The curriculum for the Computer Science major assumes students enter college prepared to take calculus. Entering students who are not prepared to take calculus will need to fulfill pre-calculus requirements in the first semester. All students must maintain a C (2.000) or better in CO 150 and in all CS, CIS, DSCI, MATH, and STAT courses which are required for graduation.

Freshman

Semester 1		**Critical**	**Recommended**	**AUCC**	**Credits**
CO 150	College Composition (GT-CO2)			1A	3
First course from Group A, B, or C (See options in Concentration Requirements Tab)					2-4
Department Approved Science (See list on Concentration Requirements Tab)				3A	3
Diversity, Equity, and Inclusion (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion)		X		1C	3

Electives					2-3
MATH 124 and MATH 126 may be necessary for some students to fulfill pre-calculus requirements.		X			
	Total Credits				**15**
Semester 2		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 201/PHIL 201	Ethical Computing Systems (GT-AH3)		X	3B	3
MATH 156 or 160	Mathematics for Computational Science I (GT-MA1) Calculus for Physical Scientists I (GT-MA1)		X	1B	4
Remaining course(s) from Group A, B, or C (See options in Concentration Requirements Tab)		X			2-4
Department Approved Science Course with Lab (See list on Concentration Requirements Tab)				3A	4
Electives					0-2
CO 150 must be completed by the end of Semester 2 with a grade of C or better.		X			
	Total Credits				**15**
Sophomore					
Semester 3		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 165	CS2--Data Structures				4
CS 220	Discrete Structures and their Applications		X		4
Select one course from the following:					1-3
STAT 301	Introduction to Applied Statistical Methods				
STAT 302A	Statistics Supplement: General Applications				
STAT 307	Introduction to Biostatistics				
STAT 315	Intro to Theory and Practice of Statistics				
Historical Perspectives (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)				3D	3
Electives					1-4
	Total Credits				**16**
Semester 4		**Critical**	**Recommended**	**AUCC**	**Credits**
Select one group from the following:					4-5
Group A					
CS 214	Software Development				
CT 301	C++ Fundamentals				
Group B					
CS 253	Software Development with C++				
Select one course from the following:					4
CS 250	Computer Systems Foundations	X			
CS 270	Computer Organization	X			
Select one course from the following:					3-4
DSCI 369	Linear Algebra for Data Science	X			
MATH 369	Linear Algebra I	X			
Social and Behavioral Sciences (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)				3C	3
CS 165 and CS 220 must be completed by the end of Semester 4.		X			
MATH 156 or MATH 160 and MATH 369 or DSCI 369 must be completed by the end of Semester 4.		X			
	Total Credits				**14**
Junior					
Semester 5		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 314	Software Engineering			4A,4B	3
CS 320	Algorithms--Theory and Practice		X		3

Advanced Writing (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing)				2	3
Electives					6
CS 253 must be completed by the end of Semester 5.		X			
	Total Credits				**15**
Semester 6		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 356	Systems Security				3
CS 370	Operating Systems				3
CIS 320	Project Management for Information Systems				3
Software Engineering Breadth Course (See list on Concentration Requirements Tab)			X		3-4
Electives					2-3
CS 314 and CS 320 and CS 370 must be completed by the end of Semester 6.		X			
	Total Credits				**15**
Senior					
Semester 7		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 414	Object-Oriented Design	X		4C	4
CIS 360	Systems Analysis and Design				3
Depth Course (See list on Concentration Requirements Tab)		X			4
Electives					4
At least two 300- to 400-level CS classes must be completed by the end of Semester 7.		X			
	Total Credits				**15**
Semester 8		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 415	Software Testing	X			4
Depth Course (See list on Concentration Requirements Tab)		X			4
Electives		X			7
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.		X			
	Total Credits				**15**
	Program Total Credits:				**120**