MAJOR IN COMPUTER ENGINEERING, EMBEDDED AND IOT SYSTEMS CONCENTRATION

Approaching innovation from a holistic perspective is key to advancing our hyper-connected world. The interdisciplinary embedded and IoT computing concentration takes a bird's eye view of computer engineering to help students understand how electronic devices, software, and networks function together to enable end-to-end solutions. Take a smart home, for example. Rather than designing one aspect of the solution, such as the temperature sensors on a thermostat, this concentration will help students design and optimize software and hardware technologies across the entire spectrum to enable an integrated, smart system. Centering on the science and design of both hardware and software for computing systems across applications ranging from medical imaging tools to wearable electronic devices, students will work on complex engineering problems such as improving energy-efficiency in mobile devices, integrating artificial intelligence into computing platforms, and developing solutions for reliability and security in safety critical applications. Course work focuses on applications of key computer engineering principles in the areas of computer architecture, embedded systems, internet-of-things (IoT), machine learning, computer security, software algorithms, and more.

Requirements Effective Fall 2025

In order to maintain professional standards required of practicing engineers, the Department of Electrical and Computer Engineering requires a cumulative grade point average of at least 2.000 in Electrical Engineering courses as a graduation requirement. It is the responsibility of any student who fails to maintain a 2.000 average to work with their advisor to correct grade point deficiencies. ECE courses required for the major at the 100, 200, and 300 level must be passed with a minimum grade of C (2.000); grades below a C will require the student to retake the course. ECE courses designated as an elective are exempt from the C or higher minimum grade requirement.

Freshman

		AUCC	Credits
CHEM 111	General Chemistry I (GT-SC2)	3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	3A	1
CO 150	College Composition (GT-CO2)	1A	3
ENGR 111	Fundamentals of Engineering		3
ENGR 114	Engineering for Grand Challenges		3
MATH 160	Calculus for Physical Scientists I (GT-MA1)	1B	4
MATH 161	Calculus for Physical Scientists II (GT-MA1)	1B	4
Select one group from the following:[1]			7
Group A			
CS 150B	Culture and Coding: Python (GT-AH3)	3B	
CS 164	CS1--Computational Thinking with Java		
Group B			
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	
CS 152	Python for STEM		
CS 162	CS1--Introduction to Java Programming		
Group C			
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	
CS 163	CS1---No Prior Programming Experience		
	Total Credits		**29**

Sophomore

CS 165	CS2--Data Structures	4
ECE 205	Analog Circuits I	2
ECE 206	Analog Circuits II	3
ECE 232	Introduction to Project Practices	1
ECE 252	Introduction to Digital Circuits	3
ECE 253	Microcontrollers and C for Internet-of-Things	3
ECE 303/STAT 303	Introduction to Communications Principles	3

MATH 261	Calculus for Physical Scientists III		4
MATH 340	Intro to Ordinary Differential Equations		4
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	5
	Total Credits		**32**
Junior			
CS 214	Software Development		3
CS 220	Discrete Structures and the Applications		4
CT 301	C++ Fundamentals		2
ECE 311	Linear System Analysis I		3
ECE 450	Digital System Design Laboratory		1
ECE 451	Digital System Design		3
ECE 452	Computer Organization and Architecture		3
ECON 202	Principles of Microeconomics (GT-SS1)	3C	3
JTC 300 or CO 301B	Strategic Writing and Communication (GT-CO3) Writing in the Disciplines: Sciences (GT-CO3)	2	3
Select a minimum of three credits from the following:			3
DSCI 369	Linear Algebra for Data Science		
MATH 369	Linear Algebra I		
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
	Total Credits		**31**
Senior			
CS 320	Algorithms--Theory and Practice		3
ECE 401	Senior Design Project I	4A,4B	3
ECE 402	Senior Design Project II	4C	3
Select one course from the following:			4
ECE 456	Computer Networks		
ECE 528/CS 528	Embedded Systems and Machine Learning		
Computer Engineering Electives and Technical Electives (see list below)			15
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	3
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
	Total Credits		**34**
	Program Total Credits:		**126**

Computer Engineering Electives 0-3 credits

Code	Title	Credits
Select 0-3 credits from the following courses:		
ECE 395A	Independent Study [2]	1-3
ECE 395B	Independent Study: Open Option Project [2]	1
ECE 395C	Independent Study : Vertically Integrated Project [2]	1
IDEA 310L	Design Thinking Toolbox : Creating Things That Think	2

Technical Electives 12-15 credits

Code	Title	Credits
CS 314	Software Engineering	3
CS 345	Machine Learning Foundations and Practice	3
CS 356	Systems Security	3
CS 370	Operating Systems	3
CS 4XX Any CS course numbered 400-479, excluding CS457 and CS470		4
CS 545	Machine Learning	4
CS 553	Algorithmic Language Compilers	4
CS 559	Quantitative Security	4
CS 575	Parallel Processing	4
CT 307	High Performance Programming in Rust	2

ECE 340	Electromagnetics for Computer Engineering	3
ECE 445	Digital Logic Synthesis	3
ECE 455	Introduction to Robot Programming/ Simulation	3
ECE 456	Computer Networks [3]	4
ECE 495A	Independent Study [2]	1-3
ECE 495B	Independent Study: Open Option Project [2]	1
ECE 495C	Independent Study: Vertically Integrated Projects [2]	1
ECE 519	Network Centric Systems	3
ECE 528/CS 528	Embedded Systems and Machine Learning [3]	4
ECE 544	Silicon Photonics for Computing Systems	3
ECE 545	FPGA Signal Processing/Software-Defined Radio	3
ECE 554	Computer Architecture	3
ECE 561/CS 561	Hardware/Software Design of Embedded Systems	4
ECE 564	Semiconductor Memory	3
ECE 571	VLSI System Design	4
ENGR 430	Engineering With Drones	3
MATH 360	Mathematics of Information Security	3
MATH 450	Introduction to Numerical Analysis I	3
MATH 451	Introduction to Numerical Analysis II	3
MATH 460	Information and Coding Theory	3
MATH 463	Post-Quantum Cryptography	3
STAT 421	Introduction to Stochastic Processes	3

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

[2] A total of 6 credits of Independent Study may apply toward total degree requirements. This includes credit awarded for ECE 395A, ECE 395B, ECE 395C, ECE 495A, ECE 495B, and ECE 495C combined.

[3] Course may count as a Technical Elective ONLY when not taken as part of the major requirements. The course cannot count as credit toward both major and technical elective requirements.

Major Completion Map

Distinctive Requirements for Degree Program:

TO PREPARE FOR FIRST SEMESTER: The curriculum for this major assumes students enter college prepared to take calculus.

In order to maintain professional standards required of practicing engineers, the Department of Electrical and Computer Engineering requires a cumulative grade point average of at least 2.000 in Electrical Engineering courses as a graduation requirement. It is the responsibility of any student who fails to maintain a 2.000 average to work with their advisor to correct grade point deficiencies. ECE courses required for the major at the 100, 200, and 300 level must be passed with a minimum grade of C (2.000); grades below a C will require the student to retake the course. ECE courses designated as an elective are exempt from the C or higher minimum grade requirement.

Freshman

Semester 1		**Critical**	**Recommended**	**AUCC**	**Credits**
CHEM 111	General Chemistry I (GT-SC2)		X	3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)		X	3A	1
ENGR 111	Fundamentals of Engineering	X			3
MATH 160	Calculus for Physical Scientists I (GT-MA1)	X		1B	4
First course from Group A, B, or C (See options in Program Requirements Tab)		X		3B	3
	Total Credits				**15**
Semester 2		**Critical**	**Recommended**	**AUCC**	**Credits**
CO 150	College Composition (GT-CO2)		X	1A	3
ENGR 114	Engineering for Grand Challenges	X			3
MATH 161	Calculus for Physical Scientists II (GT-MA1)	X		1B	4
Remaining course(s) from Group A, B, or C (See options in Program Requirements Tab)		X			4
	Total Credits				**14**

Sophomore

Semester 3		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 165	CS2--Data Structures	X			4
ECE 205	Analog Circuits I	X			2
ECE 252	Introduction to Digital Circuits	X			3
MATH 261	Calculus for Physical Scientists III	X			4
PH 141	Physics for Scientists and Engineers I (GT-SC1)	X		3A	5
	Total Credits				**18**
Semester 4		**Critical**	**Recommended**	**AUCC**	**Credits**
ECE 206	Analog Circuits II				3
ECE 232	Introduction to Project Practices	X			1

ECE 253	Microcontrollers and C for Internet-of-Things				3
ECE 303/ STAT 303	Introduction to Communications Principles	X			3
MATH 340	Intro to Ordinary Differential Equations	X			4
	Total Credits				**14**
Junior					
Semester 5		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 214	Software Development	X			3
CS 220	Discrete Structures and the Applications	X			4
ECE 311	Linear System Analysis I	X			3
ECE 450	Digital System Design Laboratory	X			1
ECE 451	Digital System Design	X			3
JTC 300 or CO 301B	Strategic Writing and Communication (GT-CO3) Writing in the Disciplines: Sciences (GT-CO3)		X	2	3
	Total Credits				**17**
Semester 6		**Critical**	**Recommended**	**AUCC**	**Credits**
CT 301	C++ Fundamentals				2
ECE 452	Computer Organization and Architecture	X			3
ECON 202	Principles of Microeconomics (GT-SS1)		X	3C	3
Select a minimum of three credits from the following:			X		3
DSCI 369	Linear Algebra for Data Science				
MATH 369	Linear Algebra I				
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)			X	1C	3
	Total Credits				**14**
Senior					
Semester 7		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 320	Algorithms--Theory and Practice		X		3
ECE 401	Senior Design Project I	X		4A,4B	3
Choose one of the following:		X			4
ECE 456	Computer Networks				
ECE 528/ CS 528	Embedded Systems and Machine Learning				
Computer Engineering Electives and Technical Electives (See Lists on Program Requirements Tab)		X			4
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)			X	3D	3
	Total Credits				**17**
Semester 8		**Critical**	**Recommended**	**AUCC**	**Credits**
ECE 402	Senior Design Project II	X		4C	3
Computer Engineering Electives and Technical Electives (See Lists on Program Requirements Tab)		X			11
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		X		3B	3
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.		X			
	Total Credits				**17**
	Program Total Credits:				**126**