MAJOR IN COMPUTER ENGINEERING, ROBOTICS AND AUTOMATION CONCENTRATION

The Robotics and Automation concentration within the Computer Engineering major equips students with foundational knowledge in embedded computing, digital system design, and communication architectures, while offering specialized coursework in robotics, autonomy, and intelligent control.

This concentration prepares students to design and implement robotic and automated systems by integrating computing fundamentals with sensing, actuation, embedded AI, and control algorithms. Students gain extensive hands-on experience through programming, edge-AI deployment, and system-integration projects involving automation and cyber-physical systems.

Graduates will be well prepared for careers in autonomous systems, industrial automation, robotics software and controls, aerospace and defense systems, and emerging sectors at the intersection of computing, sensing, and autonomy.

Learning Objectives

Upon successful completion, students will be able to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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. Communicate effectively with a range of audiences.
4. 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. Function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements Effective Fall 2026

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	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 164 or 163	CS1--Computational Thinking with Java CS1---No Prior Programming Experience		
Group C			
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		
	Total Credits		**29**

Sophomore

CS 165	CS2--Data Structures		4
ECE 205	Analog Circuits I		3
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
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
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
	Total Credits		**33**

Junior

CS 214	Software Development		3
CS 220	Discrete Structures		4
CT 301	C++ Fundamentals		2
ECE 303/STAT 303	Introduction to Communications Principles		3
ECE 311	Linear System Analysis I		3
ECE 312	Linear System Analysis II		3
ECE 450	Digital System Design Laboratory		1
ECE 451	Digital System Design		3
ECE 452	Computer Organization and Architecture		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 3 credits from the following:			3
DSCI 369	Linear Algebra for Data Science		
MATH 369	Linear Algebra I		
	Total Credits		**31**

Senior

ECE 401	Senior Design Project I	4A,4B	3
ECE 402	Senior Design Project II	4C	3
ECE 411	Control Systems		3
Select one course from the following:			4
ECE 456	Computer Networks		
ECE 528/CS 528	Embedded Systems and Machine Learning		
Technical Electives (see list below)			11
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
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		3C	3
	Total Credits		**33**
	Program Total Credits:		**126**

Technical Electives

Code	Title	Credits
CS 345	Machine Learning Foundations and Practice	3
CS 356	Systems Security	3
CS 445	Introduction to Machine Learning	4
ECE 412	Digital Control and Digital Filters	3
ECE 455	Introduction to Robot Programming/ Simulation	3
ECE 456	Computer Networks [2]	4

ECE 463	Electrical Motors and Generators	4
ECE 528/CS 528	Embedded Systems and Machine Learning [2]	4
ECE 529	Signal Processing & Artificial Intelligence	3
ECE 561/CS 561	Hardware/Software Design of Embedded Systems	4
MECH 415	Rotorcraft Modeling and Control	3
MECH 416	Introduction to Robotic Manipulators	3
MECH 564	Fundamentals of Robot Mechanics and Controls	3

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

[2] 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; 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			3
ECE 252	Introduction to Digital Circuits	X			3
MATH 261	Calculus for Physical Scientists III	X			4
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)			X	1C	3
	Total Credits				**17**
Semester 4		**Critical**	**Recommended**	**AUCC**	**Credits**
ECE 206	Analog Circuits II	X			3
ECE 232	Introduction to Project Practices	X			1
ECE 253	Microcontrollers and C for Internet-of-Things	X			3
MATH 340	Intro to Ordinary Differential Equations	X			4
PH 141	Physics for Scientists and Engineers I (GT-SC1)	X		3A	5
	Total Credits				**16**

Junior

Semester 5		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 214	Software Development	X			3
ECE 303/ STAT 303	Introduction to Communications Principles	X			3

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				**16**
Semester 6		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 220	Discrete Structures	X			4
CT 301	C++ Fundamentals	X			2
ECE 312	Linear System Analysis II	X			3
ECE 452	Computer Organization and Architecture	X			3
Select a minimum of 3 credits from the following:			X		3
DSCI 369	Linear Algebra for Data Science				
MATH 369	Linear Algebra I				
	Total Credits				**15**
Senior					
Semester 7		**Critical**	**Recommended**	**AUCC**	**Credits**
ECE 401	Senior Design Project I	X		4A,4B	3
ECE 411	Control Systems	X			3
Select one course from the following:		X			4
ECE 456	Computer Networks				
ECE 528/ CS 528	Embedded Systems and Machine Learning				
Technical Electives (See Lists on Program Requirements Tab)		X			4
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)			X	3C	3
	Total Credits				**17**
Semester 8		**Critical**	**Recommended**	**AUCC**	**Credits**
ECE 402	Senior Design Project II	X		4C	3
Technical Electives (See Lists on Program Requirements Tab)		X			7
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		X		3B	3
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		X		3D	3
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.		X			
	Total Credits				**16**
	Program Total Credits:				**126**