

MAJOR IN ELECTRICAL ENGINEERING, ROBOTICS AND AUTOMATION CONCENTRATION

The Robotics and Automation concentration within the Electrical Engineering major provides students with a foundation in circuits, sensing, signal processing, and control systems, while offering specialized coursework in robotics, electromechanical actuation, and automation technologies.

This concentration prepares students to architect and control robotic and automated systems by integrating electrical engineering fundamentals with actuators, power electronics, sensor interfaces, embedded control, and feedback systems. Students gain extensive hands-on experience through design, control implementation, and project-based work involving robotic and automated systems.

Graduates will be ready for careers in industrial robotics, smart manufacturing, autonomous systems, aerospace and defense automation, and related fields requiring deep expertise in control, sensing, and intelligent electromechanical integration.

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 ECE 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. In addition, 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
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	5
Choose one group from the following: ¹			3
Group A			
CS 150B	Culture and Coding: Python	3B	
Group B			
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	
Group C			
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	
Total Credits			30

Sophomore

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 142	Physics for Scientists and Engineers II (GT-SC1)	3A	5
Select one group from the following: ¹			4
Group A			
CS 164	CS1--Computational Thinking with Java		
Group B			
CS 164 or 163	CS1--Computational Thinking with Java CS1--No Prior Programming Experience		
Group C			
CS 152	Python for STEM		
CS 162	CS1--Introduction to Java Programming		
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
Total Credits			33
Junior			
ECE 303/STAT 303	Introduction to Communications Principles		3
ECE 311	Linear System Analysis I		3
ECE 312	Linear System Analysis II		3
ECE 331	Electronics Principles I		4
ECE 332	Electronics Principles II	4A	4
ECE 341	Electromagnetic Fields and Devices I		3
ECE 342	Electromagnetic Fields and Devices II		3
JTC 300 or CO 301B	Strategic Writing and Communication (GT-CO3) Writing in the Disciplines: Sciences (GT-CO3)	2	3
Electives ²			7
Total Credits			33
Senior			
ECE 401	Senior Design Project I	4A,4B	3
ECE 402	Senior Design Project II	4C	3
ECE 411	Control Systems		3
Technical Electives (See list below)			12
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			30
Program Total Credits:			126

Technical Electives

Code	Title	Credits		
CS 345	Machine Learning Foundations and Practice ³	3	ECE 452	Computer Organization and Architecture 3
CS 445	Introduction to Machine Learning ³	4	ECE 455	Introduction to Robot Programming/ Simulation 3
ECE 412	Digital Control and Digital Filters	3	ECE 456	Computer Networks 4
ECE 450	Digital System Design Laboratory	1	ECE 463	Electrical Motors and Generators 4
ECE 451	Digital System Design	3	ECE 528/CS 528	Embedded Systems and Machine Learning 4
			ECE 529	Signal Processing & Artificial Intelligence 3

ECE 561/CS 561	Hardware/Software Design of Embedded Systems	4
MECH 414	Machine Learning-Mechanical Engr Automation ³	3
MECH 415	Rotorcraft Modeling and Control	3
MECH 416	Introduction to Robotic Manipulators	3
MECH 564	Fundamentals of Robot Mechanics and Controls	3
Select up to one course from the following:		3-4
MECH 424	Advanced Dynamics ³	
MECH 425	Mechanical Engineering Vibrations ³	
MECH 529	Advanced Mechanical Systems ³	

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

² Select enough elective credits to bring the program total to a minimum of 126 credits, of which at least 42 credits must be upper-division (300-level or higher).

³ Additional prerequisite coursework beyond degree requirements may be required to access some MECH/CS courses.

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.

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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
Course(s) 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
PH 141	Physics for Scientists and Engineers I (GT-SC1)	X		3A	5
Total Credits					15

Sophomore

Semester 3		Critical	Recommended	AUCC	Credits
ECE 205	Analog Circuits I	X			3
ECE 252	Introduction to Digital Circuits	X			3
MATH 261	Calculus for Physical Scientists III	X			4
Course(s) from Group A, B, or C (See options in Program Requirements Tab)		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 142	Physics for Scientists and Engineers II (GT-SC1)	X		3A	5
Total Credits					16

Junior

Semester 5		Critical	Recommended	AUCC	Credits
ECE 303/STAT 303	Introduction to Communications Principles	X			3

ECE 311	Linear System Analysis I	X			3
ECE 331	Electronics Principles I	X			4
ECE 341	Electromagnetic Fields and Devices I	X			3
Electives			X		3
Total Credits					16
Semester 6		Critical	Recommended	AUCC	Credits
ECE 312	Linear System Analysis II	X			3
ECE 332	Electronics Principles II	X		4A	4
ECE 342	Electromagnetic Fields and Devices II	X			3
JTC 300 or CO 301B	Strategic Writing and Communication (GT-CO3)		X	2	3
	Writing in the Disciplines: Sciences (GT-CO3)				
Electives			X		4
Total Credits					17
Senior					
Semester 7		Critical	Recommended	AUCC	Credits
ECE 401	Senior Design Project I	X		4A,4B	3
ECE 411	Control Systems	X			3
Technical Electives (See List on Concentration Requirements Tab)		X			6
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)			X	3B	3
Total Credits					15
Semester 8		Critical	Recommended	AUCC	Credits
ECE 402	Senior Design Project II	X		4C	3
Technical Electives (See List on Concentration Requirements Tab)		X			6
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		X		3D	3
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		X		3C	3
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.		X			
Total Credits					15
Program Total Credits:					126