

MAJOR IN ELECTRICAL ENGINEERING, LASERS AND OPTICAL ENGINEERING CONCENTRATION

The Electrical and Computer Engineering (ECE) department is the premier place to prepare for a successful career in lasers and optics – a field that advances the science of light. Lasers hold the potential for generating a limitless form of clean energy, and they are used for everything from improving cancer detection to creating powerful computer chips. Plans are underway to build a new \$150 million laser facility at CSU. That means you will gain skills and knowledge from professors who are driving innovation at one of the most powerful laser facilities in the world.

Electrical and Computer Engineering (ECE) courses and research span a range of disciplines that include:

- Biomedical Engineering
- Communications and Signal Processing
- Computer Engineering
- Controls and Robotics
- Electromagnetics and Remote Sensing
- Lasers and Photonics

Career Opportunities

A field of endless possibilities, electrical engineering career paths are largely dependent on personal interests. Electrical engineering alumni hold positions ranging from a designer at a start-up company to a research scientist for the U.S. Naval Research Laboratory. In addition to being one of the most lucrative college majors, for the past decade electrical engineering has ranked among the top 10 majors in demand for bachelor's, master's, and doctoral degrees, according to the National Association of Colleges and Employers. Almost every industry recruits electrical engineering graduates, such as aerospace, biomedical, energy, robotics, manufacturing, and automotive.

Learning Objectives

The ECE program educational objectives are designed and implemented around the following three principal attributes: mastery, innovation, and leadership.

Graduates of the ECE program 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 and inclusive 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 2023

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
CO 150	College Composition (GT-CO2)	1A	3
ECE 102	Digital Circuit Logic		4
ECE 103	DC Circuit Analysis		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
Select one group from the following: ¹			
Group A:			
CS 150B	Culture and Coding: Python (GT-AH3)	3B	
CS 164	CS1–Computational Thinking with Java		
Group B:			
CS 152	Python for STEM		
CS 162	CS1–Introduction to Java Programming		
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	

Group C:			
CS 163	CS1—No Prior Programming Experience		
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	
Total Credits			30
Sophomore			
CHEM 111	General Chemistry I (GT-SC2)	3A	4
ECE 202	Circuit Theory Applications		4
ECE 232	Introduction to Project Practices		1
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 142	Physics for Scientists and Engineers II (GT-SC1)	3A	5
PH 314	Introduction to Modern Physics		4
Diversity, Equity, and Inclusion (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion)		1C	3
Total Credits			32
Junior			
ECE 311	Linear System Analysis I		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
ECON 202	Principles of Microeconomics (GT-SS1)	3C	3
PH 353	Optics and Waves		4
Select one course from the following:			3
CO 301B	Writing in the Disciplines: Sciences (GT-CO3)	2	
JTC 300	Strategic Writing and Communication (GT-CO3)	2	
Science/Engineering Elective (see list below)			2
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	3
Total Credits			32
Senior			
ECE 401 ²	Senior Design Project I	4A,4B	3
ECE 402	Senior Design Project II	4C	3
ECE 404	Experiments in Optical Electronics		2
ECE 441	Optical Electronics		3
ECE 457	Fourier Optics		3
PH 451	Introductory Quantum Mechanics I		3
Technical Electives (see list below)			12
Historical Perspectives (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
Total Credits			32
Program Total Credits:			126

Science/Math/Engineering Electives

Code	Title	Credits		
BC 351	Principles of Biochemistry	4		
BIOM 100	Overview of Biomedical Engineering	1		
	BIOM 200		Fundamentals of Biomedical Engineering	2
	BMS 300		Principles of Human Physiology	4
	BMS 301		Human Gross Anatomy	5
	BMS 325		Cellular Neurobiology	3
	BMS 345		Functional Neuroanatomy	4

BZ 310	Cell Biology	4
CBE 101	Introduction to Chemical and Biological Engr	3
CBE 101A	Introduction to Chemical and Biological Engr: Lecture	2
CBE 101B	Introduction to Chemical and Biological Engr: Laboratory	1
CHEM 112	General Chemistry Lab I (GT-SC1)	1
CHEM 245	Fundamentals of Organic Chemistry	4
CHEM 246	Fundamentals of Organic Chemistry Laboratory	1
CIVE 102	Introduction to Civil and Environmental Engr	3
CIVE 260	Engineering Mechanics-Statics	3
CIVE 371	Study Abroad--Peru: Grand Challenges in Engineering in Peru	3
CS 165	CS2--Data Structures	4
CS 220	Discrete Structures and their Applications	4
CS 253	Software Development with C++	4
CS 310H/IDEA 310H	Design Thinking Toolbox: Mixed Reality Design	3
DSCI 320	Optimization Methods in Data Science	3
ECE 101	Foundations in ECE	1
May select any course from the following: ³		Var.
ECE 395A	Independent Study	
ECE 395B	Independent Study: Open Option Project	
ECE 395C	Independent Study : Vertically Integrated Project	
ENGR 300	3D Printing Lab for Engineers	1
ENGR 478	Applied Engineering Data Analytics	3
HES 307	Biomechanical Principles of Human Movement	3
LIFE 103	Biology of Organisms-Animals and Plants (GT-SC1)	4
MATH 151	Mathematical Algorithms in Matlab I	1
MATH 229	Matrices and Linear Equations	2
MATH 235	Introduction to Mathematical Reasoning	2
MATH 317	Advanced Calculus of One Variable	3
MATH 332	Partial Differential Equations	3
MATH 360	Mathematics of Information Security	3
MATH 366	Introduction to Abstract Algebra	3
MATH 369	Linear Algebra I	3
or DSCI 369	Linear Algebra for Data Science	
MECH 103	Introduction to Mechanical Engineering	3
MECH 104A	Study Abroad--Germany: Introduction to Mechanical Engineering	3
MECH 200	Introduction to Manufacturing Processes	3
MECH 201	Engineering Design I	2
MECH 237	Introduction to Thermal Sciences	3-4
or MECH 337	Thermodynamics	
MIP 300	General Microbiology	3
PH 341	Mechanics	4

PSY 253	Human Factors and Engineering Psychology	3
STAT 158	Introduction to R Programming	1

Technical Electives

Code	Title	Credits
ECE 312	Linear System Analysis II	3
ECE 415	Semiconductor Physics and Junctions	2
ECE 430/MATH 430	Fourier and Wavelet Analysis with Apps	3
May select any course from the following: ³		Var.
ECE 495A	Independent Study	
ECE 495B	Independent Study: Open Option Project	
ECE 495C	Independent Study: Vertically Integrated Projects	
ECE 503	Ultrafast Optics	3
ECE 504	Physical Optics	3
ECE 505	Nanostructures: Fundamentals and Applications	3
ECE 506	Optical Interferometry and Laser Metrology	3
ECE 507	Plasma Physics and Applications	3
ECE 517/BIOM 517	Advanced Optical Imaging	3
ECE 518/BIOM 518	Biophotonics	3
ECE 526/BIOM 526	Biological Physics	3
ECE 527B/BIOM 527B	Biosensing: Signal and Noise in Biosensors	1
ECE 527F/BIOM 527F	Biosensing: Biophotonic Sensors Using Refractive Index	1
ECE 546	Laser Fundamentals and Devices	3
ECE 572	Semiconductor Transistors	1
ECE 573	Semiconductor Optoelectronics Laboratory	3
ECE 574	Optical Properties in Solids	3
MATH 419	Introduction to Complex Variables	3
PH 315	Modern Physics Laboratory	2
PH 425	Advanced Physics Laboratory	2
PH 452	Introductory Quantum Mechanics II	3
PH 462	Statistical Physics	3

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

² Project must be a laser and optical engineering topic.

³ A total of 3 credits of Independent Study may apply toward the total degree requirements. This includes credit awarded for ECE 395A, ECE 395B, ECE 395C and ECE 495A, ECE 495B, ECE 495C combined.

Major Completion Map

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
CO 150	College Composition (GT-CO2)		X	1A	3
ECE 102 or 103	Digital Circuit Logic DC Circuit Analysis	X			3-4
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					13

Semester 2		Critical	Recommended	AUCC	Credits
ECE 103 or 102	DC Circuit Analysis Digital Circuit Logic	X			3-4
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
Remaining course(s) from Group A, B, or C (See options in Program Requirements Tab)		X			4
Total Credits					17

Sophomore

Semester 3		Critical	Recommended	AUCC	Credits
CHEM 111	General Chemistry I (GT-SC2)		X	3A	4
MATH 261	Calculus for Physical Scientists III	X			4
PH 142	Physics for Scientists and Engineers II (GT-SC1)	X		3A	5
Diversity, Equity, and Inclusion (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion)			X	1C	3
Total Credits					16

Semester 4		Critical	Recommended	AUCC	Credits
ECE 202	Circuit Theory Applications	X			4
ECE 232	Introduction to Project Practices	X			1
ECE 303/ STAT 303	Introduction to Communications Principles	X			3
MATH 340	Intro to Ordinary Differential Equations	X			4
PH 314	Introduction to Modern Physics	X			4
Total Credits					16

Junior

Semester 5		Critical	Recommended	AUCC	Credits
ECE 311	Linear System Analysis I	X			3
ECE 331	Electronics Principles I	X			4
ECE 341	Electromagnetic Fields and Devices I	X			3
PH 353	Optics and Waves	X			4
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)			X	3B	3
Total Credits					17

Semester 6		Critical	Recommended	AUCC	Credits
ECE 332	Electronics Principles II	X		4A	4
ECE 342	Electromagnetic Fields and Devices II	X			3
Select one course from the following:					3
CO 301B	Writing in the Disciplines: Sciences (GT-CO3)		X	2	
JTC 300	Strategic Writing and Communication (GT-CO3)		X	2	
ECON 202	Principles of Microeconomics (GT-SS1)			3C	3

Science/Math/Engineering Electives (See List on Program Requirements Tab)			X		2
Total Credits					15
Senior					
Semester 7					
		Critical	Recommended	AUCC	Credits
ECE 401	Senior Design Project I	X		4A,4B	3
ECE 404	Experiments in Optical Electronics	X			2
ECE 441	Optical Electronics	X			3
PH 451	Introductory Quantum Mechanics I	X			3
Technical Electives (See List on Program Requirements Tab)			X		6
Total Credits					17
Semester 8					
		Critical	Recommended	AUCC	Credits
ECE 402	Senior Design Project II	X		4C	3
ECE 457	Fourier Optics	X			3
Technical Electives (See List on Program Requirements Tab)		X			6
Historical Perspectives (http://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					15
Program Total Credits:					126