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 engineering problems in lasers and optical systems by applying principles of electrical engineering, science, and mathematics.
2. Apply the engineering design process to develop electrical engineering solutions for lasers and optical systems, balancing technical objectives with broader considerations including 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 lasers and optical systems and make informed judgments, considering their impact in global, economic, environmental, and societal contexts.
5. Function effectively on teams, collaborating on tasks related to lasers and optical systems, to establish goals, task plans, and to meet task objectives.
6. Develop and conduct appropriate experimentation, analyze results, and use principles of electrical engineering to draw conclusions.
7. Acquire and apply new knowledge in advancing lasers and optical systems, leveraging appropriate electrical engineering learning strategies.

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
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	5
Select one group from the following:[1]			3
Group A:			
CS 150B	Culture and Coding: Python (GT-AH3)	3B	
Group B or 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		2
ECE 206	Analog Circuits II		3
ECE 232	Introduction to Project Practices		1
ECE 252	Introduction to Digital Circuits		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 142	Physics for Scientists and Engineers II (GT-SC1)	3A	5
PH 314	Introduction to Modern Physics		4
Select one group from the following:[1]			4
Group A			
CS 164	CS1--Computational Thinking with Java		
Group B			
CS 152	Python for STEM		
CS 162	CS1--Introduction to Java Programming		
Group C			
CS 163	CS1---No Prior Programming Experience		
	Total Credits		**33**
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
JTC 300 or CO 301B	Strategic Writing and Communication (GT-CO3) Writing in the Disciplines: Sciences (GT-CO3)	2	3
PH 353	Optics and Waves		4
Science/Math/Engineering Elective (see list below)			2
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
	Total Credits		**32**
Senior			
ECE 401[2]	Senior Design Project I	4A,4B	3
ECE 402[2]	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)			8
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		**31**
	Program Total Credits:		**126**

Science/Math/Engineering Electives

Code	Title	AUCC	Credits
BC 351	Principles of Biochemistry		4
BIOM 200	Fundamentals of Biomedical Engineering		2
BIOM 350A	Study Abroad--Ecuador: Prosthetics		1-3
BIOM 350C	Study Abroad--Ireland: Biomedical Engineering and Healthcare		1
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
CHEM 245	Fundamentals of Organic Chemistry		4
CHEM 246	Fundamentals of Organic Chemistry Laboratory		1
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 214	Software Development		3
CS 220	Discrete Structures and the Applications		4
CS 310H/IDEA 310H	Design Thinking Toolbox: Mixed Reality Design		3
CT 301	C++ Fundamentals		2
or CS 253	Software Development with C++		
DSCI 320/MATH 320	Optimization Methods in Data Science		3
ECE 395A	Independent Study [2,3]		1-3
ECE 395B	Independent Study: Open Option Project [2,3]		1
ECE 395C	Independent Study : Vertically Integrated Project [2,3]		1
ENGR 300	3D Printing Lab for Engineers		1
ENGR 422	Technology Entrepreneurship		3
ENGR 478	Applied Engineering Data Analytics		3
HES 307	Biomechanical Principles of Human Movement		3
IDEA 310L	Design Thinking Toolbox : Creating Things That Think		2
IDEA 310O	Design Thinking Toolbox: Digital Interaction and Game Design		3
LIFE 103	Biology of Organisms-Animals and Plants (GT-SC1)	3A	4
MATH 151	Mathematical Algorithms in Matlab I		1
MATH 229	Matrices and Linear Equations		2
MATH 235	Introduction to Mathematical Reasoning		2
MATH 301	Introduction to Combinatorial Theory		3
MATH 317	Advanced Calculus of One Variable		3
MATH 331	Introduction to Mathematical Modeling		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 200A	Introduction to Manufacturing Processes: Lecture	3
MECH 200B	Introduction to Manufacturing Processes : Laboratory	1
MECH 201	Engineering Design I	2
MECH 202	Engineering Design II	3
Choose one course from the following:		3-4
MECH 237	Introduction to Thermal Sciences	
MECH 337	Thermodynamics	
MECH 339	Thermodynamics I for Mechanical Engineers	
MIP 300	General Microbiology	3
PH 341	Mechanics	4
PSY 253	Human Factors and Engineering Psychology	3
STAT 158	Introduction to R Programming	1
SYSE 501	Foundations of Systems Engineering	3

Technical Electives

Code	Title	Credits
ECE 312	Linear System Analysis II	3
ECE 403/BIOM 403	Intro to Optical Techniques in Biomedical Eng	3
ECE 415	Semiconductor Physics and Junctions	2
ECE 430/MATH 430	Fourier and Wavelet Analysis with Apps	3
ECE 495A	Independent Study [2,3]	1-3
ECE 495B	Independent Study: Open Option Project [2,3]	1
ECE 495C	Independent Study: Vertically Integrated Projects [2,3]	1
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 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 544	Silicon Photonics for Computing Systems	3
ECE 546	Laser Fundamentals and Devices	3
ECE 559/BIOM 559	Machine Learning in Imaging and Spectroscopy	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, ECE 495A, ECE 495B, and ECE 495C combined.

Major Completion Map

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)				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			2
ECE 252	Introduction to Digital Circuits	X			3
MATH 261	Calculus for Physical Scientists III	X			4
PH 142	Physics for Scientists and Engineers II (GT-SC1)	X		3A	5
Course(s) from Group A, B, or C (See options in Program Requirements Tab)		X			4
	Total Credits				**18**
Semester 4		**Critical**	**Recommended**	**AUCC**	**Credits**
ECE 206	Analog Circuits II	X			3
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				**15**

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
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)			X	1C	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
ECON 202	Principles of Microeconomics (GT-SS1)		X	3C	3
JTC 300 or CO 301B	Strategic Writing and Communication (GT-CO3) Writing in the Disciplines: Sciences (GT-CO3)		X	2	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			2
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				**14**
	Program Total Credits:				**126**