

MAJOR IN COMPUTER ENGINEERING, NETWORKS AND DATA CONCENTRATION

Networking is a rapidly evolving field that focuses on the ubiquitous connectivity of people, machines, and things. Whether shopping online, using GPS navigation, or connecting with friends on social media, our online activities are on the rise – and we are straining our technology infrastructure with the mind-boggling amounts of data we generate every day. Combining topics from electrical engineering, computer science, and mathematics, this concentration will teach students how to optimize and bolster network systems that process the ever-growing volume of data we produce through our high-tech gadgets and applications. Experiencing first-hand the innovative technologies that fuel the digital information revolution, students will work on complex engineering problems, such as emerging 5G/6G networks, deep-space communication, Internet of Things, and social networks. The concentration offers an electrical

and computer engineering foundation with specialized training in the networks field. Coursework focuses on applications of key engineering principles in the areas of digital systems, communication systems, robotics, embedded systems, cybersecurity and more.

Requirements Effective Fall 2022

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
CS 163 or 164	CS1—No Prior Programming Experience CS1—Computational Thinking with Java		4
CS 165	CS2—Data Structures		4
ECE 102	Digital Circuit Logic		4
ECE 251	Introduction to Microcontrollers and IoT		4
MATH 160	Calculus for Physical Scientists I (GT-MA1)	1B	4
MATH 161	Calculus for Physical Scientists II (GT-MA1)	1B	4
Diversity, Equity, and Inclusion (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion)		1C	3
Career Development Seminar ¹			
Total Credits			30

Sophomore

CS 220	Discrete Structures and their Applications		4
ECE 103	DC Circuit Analysis		3
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 141	Physics for Scientists and Engineers I (GT-SC1)	3A	5
Select at least one course totaling a minimum of 3 credits from the following:			3
AA 100	Introduction to Astronomy (GT-SC2)	3A	
AA 101	Astronomy Laboratory (GT-SC1)	3A	
ANTH 120	Human Origins and Variation (GT-SC2)	3A	
ANTH 121	Human Origins and Variation Laboratory (GT-SC1)	3A	
BZ 110	Principles of Animal Biology (GT-SC2)	3A	
BZ 111	Animal Biology Laboratory (GT-SC1)	3A	
BZ 120	Principles of Plant Biology (GT-SC1)	3A	
CHEM 103	Chemistry in Context (GT-SC2)	3A	
CHEM 104	Chemistry in Context Laboratory (GT-SC1)	3A	

2 Major in Computer Engineering, Networks and Data Concentration

CHEM 107	Fundamentals of Chemistry (GT-SC2)	3A	
CHEM 108	Fundamentals of Chemistry Laboratory (GT-SC1)	3A	
CHEM 111	General Chemistry I (GT-SC2)	3A	
CHEM 112	General Chemistry Lab I (GT-SC1)	3A	
CHEM 120	Foundations of Modern Chemistry (GT-SC2)	3A	
CHEM 121	Foundations of Modern Chemistry Laboratory (GT-SC1)	3A	
GEOL 120	Exploring Earth - Physical Geology (GT-SC2)	3A	
GEOL 121	Introductory Geology Laboratory (GT-SC1)	3A	
GEOL 122	The Blue Planet - Geology of Our Environment (GT-SC2)	3A	
GEOL 124	Geology of Natural Resources (GT-SC2)	3A	
GEOL 150	Physical Geology for Scientists and Engineers	3A	
HONR 292A	Honors Seminar: Knowing in the Sciences	3A	
LIFE 102	Attributes of Living Systems (GT-SC1)	3A	
LIFE 103	Biology of Organisms-Animals and Plants (GT-SC1)	3A	
LIFE 201A	Introductory Genetics: Applied/Population/Conservation/Ecological (GT-SC2)	3A	
LIFE 201B	Introductory Genetics: Molecular/Immunological/Developmental (GT-SC2)	3A	
LIFE 220/LAND 220	Fundamentals of Ecology (GT-SC2)	3A	
MIP 101	Introduction to Human Disease (GT-SC2)	3A	
NR 150	Oceanography (GT-SC2)	3A	
PH 110	Physics of Everyday Phenomena (GT-SC2)	3A	
PH 111	Physics of Everyday Phenomena Laboratory (GT-SC1)	3A	
PH 122	General Physics II (GT-SC1)	3A	
PH 142	Physics for Scientists and Engineers II (GT-SC1)	3A	
Career Development Seminar ¹			
Total Credits			31
Junior			
CS 253	Software Development with C++		4
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
ECON 202	Principles of Microeconomics (GT-SS1)	3C	3
Select a minimum of three credits from the following:			3
DSCI 369	Linear Algebra for Data Science		
MATH 369	Linear Algebra I		
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	
Computer Engineering Electives (see list below) and Technical Electives (see list below)			3
Historical Perspectives (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)			3D
Career Development Seminar ¹			
Total Credits			32
Senior			
CS 320	Algorithms--Theory and Practice		3
CS 356	Systems Security		3
ECE 401	Senior Design Project I	4A,4B	3
ECE 402	Senior Design Project II	4C	3

ECE 421	Telecommunications I	3
ECE 456	Computer Networks	4
Technical Electives (see list below)		8
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		6
Career Development Seminar ¹		

Total Credits	33
----------------------	-----------

Program Total Credits:	126
-------------------------------	------------

Computer Engineering Electives 0-3 credits

Code	Title	Credits
DSCI 320	Optimization Methods in Data Science	3
ECE 101	Foundations in ECE	1
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

ECE 545	FPGA Signal Processing/Software-Defined Radio	3
ECE 554	Computer Architecture	3
ECE 558	Manycore System Design Using Machine Learning	3
ECE 561/CS 561	Hardware/Software Design of Embedded Systems	4
MATH 360	Mathematics of Information Security	3
MATH 460	Information and Coding Theory	3
MECH 564	Fundamentals of Robot Mechanics and Controls	3
STAT 421	Introduction to Stochastic Processes	3

Technical Electives 7-11 credits

Code	Title	Credits
CS 314	Software Engineering	3
CS 345	Machine Learning Foundations and Practice	3
CS 370	Operating Systems	3
CS 420	Introduction to Analysis of Algorithms	4
CS 422	Automata, Logic, and Computation	4
CS 435	Introduction to Big Data	4
CS 440	Introduction to Artificial Intelligence	4
CS 445	Introduction to Machine Learning	4
CS 455	Introduction to Distributed Systems	4
CS 456	Modern CyberSecurity	4
CS 458	Blockchain Principles and Applications	4
CS 462	Engaging in Virtual Worlds	4
CS 464	Principles of Human-Computer Interaction	4
CS 530	Fault-Tolerant Computing	4
CS 545	Machine Learning	4
CS 559	Quantitative Security	4
ECE 340	Electromagnetics for Computer Engineering	3

Select any course from the following:² 1-3

ECE 495A	Independent Study	
ECE 495B	Independent Study: Open Option Project	
ECE 495C	Independent Study: Vertically Integrated Projects	
ECE 514	Applications of Random Processes	3
ECE 519	Network Centric Systems	3
ECE 528/CS 528	Embedded Systems and Machine Learning	4
ECE 544	Silicon Photonics for Computing Systems	3

¹ Students are required to complete three Career Development Seminars: 1) Resume Writing; 2) Behavior Based Interviewing; and 3) Using LinkedIn™. Completion of the required workshops may be spread over the student's four-year program.

² A total 6 credits of Independent Study may apply toward 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

Distinctive Requirements for Degree Program:

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

The ECE curriculum has been modified as part of the Revolutionizing Engineering Departments initiative (RED). Three threads run through the new curriculum: Foundations, Creativity and Professional Formation of Engineers. This new curriculum incorporates skills that engineers need beyond technical expertise, in areas like communication, ethics, social impact and interaction in large, diverse groups. The ECE department requires that students also complete the following three Career Development Seminars: 1) Resume Writing; 2) Behavior Based Interviewing; and 3) Using LinkedIn™.

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

		Critical	Recommended	AUCC	Credits
CO 150	College Composition (GT-CO2)		X	1A	3
CS 163 or 164	CS1--No Prior Programming Experience CS1--Computational Thinking with Java	X			4
ECE 102	Digital Circuit Logic	X			4
MATH 160	Calculus for Physical Scientists I (GT-MA1)	X		1B	4
Career Development Seminar(s)			X		
Total Credits					15

		Critical	Recommended	AUCC	Credits
CS 165	CS2--Data Structures	X			4
ECE 251	Introduction to Microcontrollers and IoT	X			4
MATH 161	Calculus for Physical Scientists II (GT-MA1)	X		1B	4
Diversity, Equity, and Inclusion (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion)		X		1C	3
Career Development Seminar(s)			X		
Total Credits					15

Sophomore

		Critical	Recommended	AUCC	Credits
CS 220	Discrete Structures and their Applications	X			4
ECE 103	DC Circuit Analysis	X			3
MATH 261	Calculus for Physical Scientists III	X			4
PH 141	Physics for Scientists and Engineers I (GT-SC1)	X		3A	5
Career Development Seminar(s)			X		
Total Credits					16

		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
Department Approved Science (See List on Requirements Tab)			X	3A	3
Career Development Seminar(s)			X		
Total Credits					15

Junior

		Critical	Recommended	AUCC	Credits
CS 253	Software Development with C++	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
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	
Computer Engineering Electives (See list on Requirements Tab) or Technical Electives (See List on Requirements Tab)		X			3
Career Development Seminar(s)			X		
Total Credits					17

		Critical	Recommended	AUCC	Credits
ECE 312	Linear System Analysis II	X			3
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: 3

DSCI 369 Linear Algebra for Data Science X

MATH 369 Linear Algebra I X

Historical Perspectives (<http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives>) X 3D 3

Career Development Seminar(s) X

Total Credits 15

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

ECE 421 Telecommunications I X 3

Technical Electives (See List on Requirements Tab) X 4

Arts and Humanities (<http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities>) 3B 3

Career Development Seminar(s) X

Total Credits 16

Semester 8 **Critical** **Recommended** **AUCC** **Credits**

CS 356 Systems Security X 3

ECE 402 Senior Design Project II X 4C 3

ECE 456 Computer Networks X 4

Technical Electives (See List on Requirements Tab) X 4

Arts and Humanities (<http://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