Recommended Courses by ECE Topic Area
Graduate Students

The courses listed under each heading represent appropriate courses to take if you are seeking content within a topic area. The course recommendations below do not represent full plans of study. Graduate students must meet the graduation requirements for their degree. Please see the *ECE Graduate Handbook* for degree requirement information.

ECE course descriptions and additional course information can be found on the ECE Courses page.

ECE Topic Areas

CTRL-Click on the topic of interest to jump to the recommended courses within that topic area

AEROSPACE

Aerospace – Electrical Engineering

Course Number	Course Name	Semester Offered*	Credits	Online
ATS 550	Atmospheric Radiation and Remote Sensing	F	3	X
ECE 404	Experiments in Optical Electronics	F	2	
ECE 411	Control Systems	F	3	X
ECE 412	Digital Control and Digital Filters	S	3	X
ECE 415	Semiconductor Physics and Junctions	S	2	
ECE 421	Telecommunications I	F	3	X
ECE 441	Optical Electronics	F	3	
ECE 444	Antennas & Radiation	F, 2025	3	
ECE 452	Computer Organization and Architecture	S	3	X
ECE 455	Intro to Robot Programming/Simulation	F, 2025	3	X
ECE 456	Computer Networks	S	4	X
ECE 461	Power Systems	F	4	
ECE 512	Digital Signal Processing	F	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 516	Information Theory	F	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE 521	Satellite Communication	S	3	X
ECE/CS 528	Embedded Systems and Machine Learning	F	4	X
ECE 536	RF Integrated Circuit Design	F, Even years	3	
ECE 540	Computational Electromagnetics	F, Odd years	3	
ECE 541	Applied Electromagnetics	F, Even years	3	
ECE 545	FPGA Signal Processing/Software-Defined Radio	As needed	3	X
ECE 548	Microwave Theory & Component Design	S, Odd years	3	
ECE 549	Radar Systems and Design	S, Odd years	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, 2026	3	
ECE 556	AI for Radar and Remote Sensing	S	3	X
ECE/CS 561	Hardware/Software Design of Embedded Systems	S, Odd years	4	X
ECE 562	Power Electronics I	S, Even years	3	X
ECE/ENGR 565	Electrical Power Engineering	F, Odd years	3	X
ECE 572	Semiconductor Transistors	S	1	
ECE 578	Satellite Data Analysis	S	3	X
ECE 579	Global Navigation Satellite Systems	S	3	
ENGR 570	Coupled Electromechanical Systems	F, Even years	3	X
ECE 611	Nonlinear Control Systems	F, Even years	3	X
ECE 612	Robust Control Systems	S, Even years	3	X
ECE 614	Principles of Digital Communications	S, Even years	3	X
ECE 652	Estimation and Filtering Theory	S, Odd years	3	X
MECH 518	Orbital Mechanics	F	3	X
MECH 519	Aerospace Vehicles Trajectory and Performance	S	3	X
SYSE 580A6	AI – Augmented Systems Engineering	S, Even years	3	X

Avionics and Power Systems

Course Number	Course Name
ECE 404	Experiments in Optical Electronics
ECE 441	Optical Electronics
ECE 461	Power Systems
ECE 562	Power Electronics I
ECE/ENGR 565	Electrical Power Engineering
ENGR 570	Coupled Electromechanical Systems

Central Aerospace Principles

Course Number	Course Name
ECE 411	Control Systems
ECE 444	Antennas & Radiation
ECE 521	Satellite Communication
ECE 549	Radar Systems and Design
ECE 578	Satellite Data Analysis
ECE 579	Global Navigation Satellite Systems
MECH 518	Orbital Mechanics
MECH 519	Aerospace Vehicles Trajectory and Performance

Communications and Sensing

Course Number	Course Name
ATS 550	Atmospheric Radiation and Remote Sensing
ECE 421	Telecommunications I
ECE 444	Antennas & Radiation
ECE 512	Digital Signal Processing
ECE 514	Applications of Random Processes
ECE 516	Information Theory
ECE 521	Satellite Communication
ECE 536	RF Integrated Circuit Design
ECE 540	Computational Electromagnetics
ECE 541	Applied Electromagnetics
ECE 545	FPGA Signal Processing/Software-Defined Radio
ECE 548	Microwave Theory & Component Design
ECE 549	Radar Systems and Design
ECE 556	AI for Radar and Remote Sensing
ECE 578	Satellite Data Analysis
ECE 579	Global Navigation Satellite Systems
ECE 614	Principles of Digital Communications
ECE 652	Estimation and Filtering Theory

Robotics and Controls

Course Number	Course Name
ECE 411	Control Systems
ECE 412	Digital Control and Digital Filters
ECE 452	Computer Organization and Architecture
ECE 455	Intro to Robot Programming/Simulation
ECE 456	Computer Networks
ECE 520	Optimization Methods for Control & Communications
ECE/CS 528	Embedded Systems and Machine Learning
ECE 555	Advanced Robotics: Redundancy & Optimization
ECE/CS 561	Hardware/Software Design of Embedded Systems
ECE 611	Nonlinear Control Systems
ECE 612	Robust Control Systems

Aerospace - Computer Engineering

Course Number	Course Name	Semester Offered*	Credits	Online
ATS 550	Atmospheric Radiation and Remote Sensing	F	3	X
CS 415	Software Testing	S	4	X
CS 420	Introduction to Analysis of Algorithms	F	4	X
CS 430	Database Systems	S	4	X
CS 435	Introduction to Big Data	F	4	X
CS 440	Introduction to Artificial Intelligence	F	4	X
CS 445	Introduction to Machine Learning	S	4	X
CS 455	Introduction to Distributed Systems	S	4	X
CS 456	Modern Cybersecurity	F	4	X
CS 464	Principles of Human-Computer Interaction	S	4	X
CS 475	Parallel Programming	F	4	X
CS 545	Machine Learning	F	4	X
CS 553	Algorithmic Language Compilers	As needed	4	
CS 559	Quantitative Security	F	4	X
CS 575	Parallel Processing	As needed	4	X
ECE 411	Control Systems	F	3	X
ECE 412	Digital Control and Digital Filters	S	3	X
ECE 421	Telecommunications I	F	3	X
ECE 444	Antennas & Radiation	F, 2025	3	
ECE 455	Intro to Robot Programming/Simulation	F, 2025	3	X
ECE 456	Computer Networks	S	4	X
ECE 512	Digital Signal Processing	F	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 516	Information Theory	F	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE 521	Satellite Communication	S	3	X
ECE/CS 528	Embedded Systems and Machine Learning	F	4	X
ECE 545	FPGA Signal Processing/Software-Defined Radio	As needed	3	X
ECE 549	Radar Systems and Design	S, Odd years	3	X
ECE 554	Computer Architecture	S, Even years	3	X
ECE 556	AI for Radar and Remote Sensing	S	3	X
ECE/CS 561	Hardware/Software Design of Embedded Systems	S, Odd years	4	X
ECE 571	VLSI System Design	S	4	
ECE 578	Satellite Data Analysis	S	3	X
ECE 579	Global Navigation Satellite Systems	S	3	
ECE 580C6	Storage System--Device to System Perspective	S	3	X
ECE 611	Nonlinear Control Systems	F, Even years	3	X
ECE 612	Robust Control Systems	S, Even years	3	X
ECE 656	Machine Learning and Adaptive Systems	S, Even years	3	X
ECE 661	Advanced Topics in Embedded	As needed	4	X
ENGR 570	Coupled Electromechanical Systems	F, Even years	3	X
MECH 518	Orbital Mechanics	F	3	X
MECH 519	Aerospace Vehicles Trajectory and Performance	S	3	X
SYSE 580A6	AI – Augmented Systems Engineering	S, Even years	3	X

BIOMEDICAL ENGINEERING

Biomedical Devices

Course Number	Course Name	Semester Offered*	Credits	Online
CS 464	Principles of Human-Computer Interaction	S	4	X
ECE/BIOM 403	Intro to Optical Techniques in Biomedical Engineering	F, Even years	3	X
ECE 404	Experiments in Optical Electronics	F	2	
ECE/BIOM 431	Biomedical Signal and Image Processing	S	3	X
ECE 441	Optical Electronics	F	3	
ECE 415	Semiconductor Physics and Junctions	S	2	
ECE 504	Physical Optics	F, Odd years	3	X
ECE 505	Nanostructures: Fundamentals and Applications	As needed	3	X
ECE/BIOM 517	Advanced Optical Imaging	F, Even years	3	X
ECE/BIOM 518	Biophotonics	F, Odd years	3	X
ECE/MATH 522	Random Walks	F, Even years	3	X
ECE/BIOM 526	Biosensors: Biological Physics	F, Odd years	3	X
ECE/BIOM 527A	Biosensors: Cells as Circuits	F, Odd years	1	
ECE/BIOM 527B	Biosensors: Signal and Noise in Biosensors	S, Even years	1	
ECE/BIOM 527C	Biosensors: Sensor Circuit Fundamentals	F, Odd years	1	
ECE/BIOM 527D	Biosensors: Electrochemical Sensors	F, Odd years	1	
ECE/BIOM 527E	Biosensors: Affinity Sensors	S, Even years	1	
ECE/BIOM 527F	Biosensors: Biophotonic Sensors Using Refractive Index	S, Even years	1	
ECE 541	Applied Electromagnetics	F, Even years	3	
ECE 546	Laser Fundamentals and Devices	S, Odd years	3	
ECE 572	Semiconductor Transistors	S	1	
ECE 574	Optical Materials and Devices	S, Even years	3	X
ECE 641	Electromagnetics	As needed	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 455	Mathematics in Biology and Medicine	F, Odd years	3	
MATH 560	Linear Algebra	F	3	X

Biomedical Signals and Systems

Course Number	Course Name	Semester Offered*	Credits	Online
CS 425	Introduction to Bioinformatics Algorithms	F	4	X
CS 525	Bioinformatics Algorithms	As needed	4	X
ECE/BIOM 403	Intro to Optical Techniques in Biomedical Engineering	F, Even years	3	X
ECE/BIOM 431	Biomedical Signal and Image Processing	S	3	X
ECE 457[a]	Fourier Optics	S	3	X
ECE 502[a]	Advanced Fourier Optics	S	4	X
ECE 503	Ultrafast Optics	S, Even years	3	
ECE 504	Physical Optics	F, Odd years	3	X
ECE 512	Digital Signal Processing	F	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE/BIOM 518	Biophotonics	F, Odd Years	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE/MATH 522	Random Walks	F, Even years	3	X
ECE/BIOM 526	Biological Physics	F, Odd years	3	X
ECE/BIOM 527A	Biosensors: Biological Physics	F, Odd years	1	
ECE/BIOM 527B	Biosensors: Cells as Circuits	S, Even years	1	
ECE/BIOM 527C	Biosensors: Signal and Noise in Biosensors	F, Odd years	1	
ECE/BIOM 527D	Biosensors: Sensor Circuit Fundamentals	F, Odd years	1	
ECE/BIOM 527E	Biosensors: Affinity Sensors	S, Even years	1	
ECE/BIOM 527F	Biosensors: Biophotonic Sensors Using Refractive Index	S, Even years	1	
ECE/BIOM 537	Biomedical Signal Processing	As needed	3	X
ECE 541	Applied Electromagnetics	F, Even years	3	
ECE 580C7	Machine Learning in Imaging and Spectroscopy	F, Even years	3	X
ECE 604	Nonlinear Optics	As needed	3	X
ECE 652	Estimation and Filtering Theory	S, Odd years	3	X
MATH 419	Introduction to Complex Variables	F	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 560	Linear Algebra	F	3	X
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	F, S	1	X
MATH 569B	Linear Algebra for Data Science: Geometric Data Reduction	F, S	1	X
MATH 569C	Linear Algebra for Data Science: Matrix Factorizations and Transformations	F, S	1	X

[a] Students cannot get credit for both ECE457 and ECE502

COMMUNICATIONS

Course Number	Course Name	Semester Offered*	Credits	
ECE 421	Telecommunications I	F	3	X
ECE/MATH 430	Fourier and Wavelet Analysis with Apps.	S	3	
ECE 444	Antennas & Radiation	F, 2025	3	
ECE 456	Computer Networks	S	4	X
ECE 512	Digital Signal Processing	F	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 516	Information Theory	F	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE 521	Satellite Communication	S	3	
ECE 545	FPGA Signal Processing/Software-Defined Radio	As needed	3	X
ECE 549	Radar Systems and Design	F, Odd years	3	X
ECE 578	Satellite Data Analysis	S	3	X
ECE 579	Global Navigation Satellite Systems	S	3	
ECE 614	Principles of Digital Communications	S, Even years	3	X
ECE 652	Estimation and Filtering Theory	S, Odd years	3	X
ECE 653	Detection Theory	F, Odd years	3	
MATH 417	Advanced Calculus I	F	3	
MATH 466	Abstract Algebra I	F	3	
MATH 469	Linear Algebra II	S	3	
MATH 474	Introduction to Differential Geometry	F, Odd years	3	
MATH 517	Introduction to Real Analysis	F	3	
MATH 519	Complex Variables I	S	3	
MATH 560	Linear Algebra	F	3	X
MATH 566	Introduction to Abstract Algebra I	F	3	
MATH 570	Topology I	F, Odd years	3	
MATH 617	Integration and Measure Theory	S	4	
MATH 618	Advanced Real Analysis	F	3	
MATH 670	Introduction to Differential Manifolds	As needed	3	
STAT 525	Time Series Analysis I	F	3	
STAT 620	Introduction to Measure Theoretic Probability	S	3	
STAT 720[b]	Probability Theory	As needed	3	

[b]Course recommended for PhD level students only

COMPUTER ENGINEERING

Computer Architecture

Course Number	Course Name	Semester Offered*	Credits	Online
CS 414	Object Oriented Design	F	4	X
CS 415	Software Testing	S	4	X
CS 420	Introduction to Analysis of Algorithms	F	4	X
CS 422	Automata, Logic, and Computation	F	4	X
CS 425	Intro to Bioinformatics Algorithms	F	4	X
CS 435	Introduction to Big Data	F	4	X
CS 440	Introduction to Artificial Intelligence	F	4	X
CS 445	Introduction to Machine Learning	S	4	X
CS 453	Introduction to Compiler Construction	S	4	X
CS 455	Introduction to Distributed Systems	S	4	X
CS 456	Modern Cybersecurity	F	4	X
CS 458	Blockchain Principles and Applications	S	4	X
CS 464	Principles of Human-Computer Interaction	S	4	X
CS 475	Parallel Programming	F	4	X
CS 530	Fault-Tolerant Computing	S	4	X
CS 535	Big Data	F	4	X
CS 540	Artificial Intelligence	S	4	X
CS 542	Natural Language Processing	F	4	X
CS 545	Machine Learning	F	4	X
CS 553	Algorithmic Language Compilers	As needed	4	
CS 556	Computer Security	S	4	X
CS 557	Advanced Networking and the Internet	S	4	X
CS 559	Quantitative Security	F	4	X
CS 567	3D User Interfaces	F	4	X
CS 575	Parallel Processing	As needed	4	X
ECE 445	Digital Logic Synthesis	S, Even years	3	X
ECE 450/451	Digital System Design and Laboratory	F	4	
ECE 452	Computer Organization and Architecture	S	4	X
ECE480A6	Optical Computing	S	3	X
ECE480A7	Intro to Quantum Computing	F	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 519	Network Centric Systems	S, Even years	3	X
ECE/CS 528	Embedded Systems and Machine Learning	F	4	X
ECE 545	FPGA Signal Processing/Software-Defined Radio	As needed	3	X
ECE 554	Computer Architecture	S, Even years	3	X
ECE/CS 560	Foundations of Fine-Grain Parallelism	As needed	4	
ECE/CS 561	Hardware/Software Design of Embedded Systems	S, Odd years	4	X
ECE 571	VLSI System Design	S	4	
ECE 580C6	Storage System--Device to System Perspective	S	3	X
ECE 661	Advanced Topics in Embedded Systems	As needed	4	X
ECE/CS 670	Topics in Architecture/Systems	As needed	1-4	
GRAD 510	Fundamentals of High Performance Computing	F	3	

Computer Architecture, continued

Course Number	Course Name	Semester Offered*	Credits	Online
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 460	Information and Coding Theory	S	3	
MATH 463	Post-Quantum Cryptography	S, Odd years	3	
MATH 510	Linear Programming and Network Flows	F	3	
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	F, S	1	X
MATH 569C	Linear Algebra for Data Science: Matrix Factorizations and Transformations	F, S	1	X
STAT 421	Introduction to Stochastic Processes	S	3	

Computer Engineering

Course Number	Course Name	Semester Offered*	Credits	Online
CS 414	Object Oriented Design	F	4	X
CS 415	Software Testing	S	4	X
CS 420	Introduction to Analysis of Algorithms	F	4	X
CS 422	Automata, Logic, and Computation	F	4	X
CS 425	Intro to Bioinformatics Algorithms	F	4	X
CS 435	Introduction to Big Data	S	4	X
CS 440	Introduction to Artificial Intelligence	F	4	X
CS 445	Introduction to Machine Learning	S	4	X
CS 453	Introduction to Compiler Construction	S	4	X
CS 455	Introduction to Distributed Systems	S	4	X
CS 456	Modern Cybersecurity	F	4	X
CS 458	Blockchain Principles and Applications	S	4	X
CS 462	Engaging in Virtual Worlds	F	4	X
CS 464	Principles of Human-Computer Interaction	S	4	X
CS 475	Parallel Programming	F	4	X
CS 530	Fault-Tolerant Computing	S	4	X
CS 535	Big Data	F	4	X
CS 540	Artificial Intelligence	S	4	X
CS 542	Natural Language Processing	F	4	X
CS 545	Machine Learning	F	4	X
CS 553	Algorithmic Language Compilers	As needed	4	
CS 556	Computer Security	S	4	X
CS 557	Advanced Networking and the Internet	S	4	X
CS 559	Quantitative Security	F	4	X
CS 567	3D User Interfaces	F	4	X
CS 575	Parallel Processing	As needed	4	X
CS 580A9	Perceptual Elements in Extended Reality	S	4	
ECE 445	Digital Logic Synthesis	S, Even years	3	X
ECE 450/451	Digital System Design and Laboratory	F	4	
ECE 452	Computer Organization and Architecture	S	3	X

Computer Engineering, continued

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 456	Computer Networks	S	4	X
ECE480A6	Optical Computing	S	3	X
ECE480A7	Intro to Quantum Computing	F	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 519	Network Centric Systems	S, Even years	3	X
ECE/CS 528	Embedded Systems and Machine Learning	F	4	X
ECE 544	Silicon Photonics for Computing Systems	F	3	X
ECE 545	FPGA Signal Processing/Software-Defined Radio	As needed	3	X
ECE 554	Computer Architecture	S, Even years	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, 2026	3	
ECE/CS 560	Foundations of Fine-Grain Parallelism	As needed	4	
ECE 556	AI for Radar and Remote Sensing	S	3	X
ECE/CS 561	Hardware/Software Design of Embedded Systems	S, Odd years	4	X
ECE 571	VLSI System Design	S	4	
ECE 578	Satellite Data Analysis	S	3	X
ECE 580C6	Storage System--Device to System Perspective	S	3	X
ECE 656	Machine Learning and Adaptive Systems	S, Even years	3	X
ECE/CS 658	Internet Engineering	F, Even years	4	X
ECE 661	Advanced Topics in Embedded	As needed	4	X
ECE/CS 670	Topics in Architecture/Systems	As needed	1-4	
GRAD 510	Fundamentals of High Performance Computing	F	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 460	Information and Coding Theory	S	3	
MATH 463	Post-Quantum Cryptography	S, Odd years	3	
MATH 510	Linear Programming and Network Flows	F	3	
MATH 532	Mathematical Modeling of Large Data Sets	S, Even years	3	
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	F, S	1	X
MATH 569C	Linear Algebra for Data Science: Matrix Factorizations and Transformations	F, S	1	X
MECH 564	Fundamentals of Robot Mechanics and Controls	S	3	X
STAT 421	Introduction to Stochastic Processes	S	3	
STAT 520	Introduction to Probability Theory	F	4	

Computer Networking

Course Number	Course Name	Semester Offered*	Credits	Online
CS 420	Introduction to Analysis of Algorithms	F	4	X
CS 425	Intro to Bioinformatics Algorithms	F	4	X
CS 435	Introduction to Big Data	S	4	X
CS 440	Introduction to Artificial Intelligence	F	4	X
CS 445	Introduction to Machine Learning	S	4	X
CS 456	Modern Cybersecurity	F	4	X
CS 458	Blockchain Principles and Applications	S	4	X
CS 464	Principles of Human-Computer Interaction	S	4	X
CS 535	Big Data	F	4	X
CS 540	Artificial Intelligence	S	4	X
CS 542	Natural Language Processing	F	4	X
CS 545	Machine Learning	F	4	X
CS 556	Computer Security	S	4	X
CS 557	Advanced Networking and the Internet	S	4	X
CS 559	Quantitative Security	F	4	X
CS 567	3D User Interfaces	F	4	X
ECE 445	Digital Logic Synthesis	S, Even years	3	X
ECE 456	Computer Networks	S	4	X
ECE480A7	Intro to Quantum Computing	F	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 516	Information Theory	F	3	X
ECE 519	Network Centric Systems	S, Even years	3	X
ECE 521	Satellite Communication	S	3	X
ECE/CS 528	Embedded Systems and Machine Learning	F	4	X
ECE 544	Silicon Photonics in Computing Systems	F	3	X
ECE 554	Computer Architecture	S, Even years	3	X
ECE/CS 560	Reconfigurable Computing	As needed	4	
ECE/CS 561	Hardware/Software Design of Embedded Systems	S, Odd years	4	X
ECE 580C6	Storage System--Device to System Perspective	S	3	X
ECE/CS 658	Internet Engineering	F, Even years	4	X
MATH 460	Information and Coding Theory	S	3	
MATH 463	Post-Quantum Cryptography	S, Odd years	3	
MATH 532	Mathematical Modeling of Large Data Sets	S, Even years	3	
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	F, S	1	X
MATH 569C	Linear Algebra for Data Science: Matrix Factorizations and Transformations	F, S	1	X
STAT 421	Introduction to Stochastic Processes	S	3	
STAT 520	Introduction to Probability Theory	F	4	

Embedded Systems

Course Number	Course Name	Semester Offered*	Credits	Online
CS 414	Object Oriented Design	F	4	X
CS 415	Software Testing	S	4	X
CS 420	Introduction to Analysis of Algorithms	F	4	X
CS 422	Automata, Logic, and Computation	F	4	X
CS 425	Intro to Bioinformatics Algorithms	F	4	X
CS 435	Introduction to Big Data	S	4	X
CS 440	Introduction to Artificial Intelligence	F	4	X
CS 445	Introduction to Machine Learning	S	4	X
CS 453	Introduction to Compiler Construction	S	4	X
CS 455	Introduction to Distributed Systems	S	4	X
CS 456	Modern Cybersecurity	F	4	X
CS 458	Blockchain Principles and Applications	S	4	X
CS 464	Principles of Human-Computer Interaction	S	4	X
CS 475	Parallel Programming	F	4	X
CS 530	Fault-Tolerant Computing	S	4	X
CS 540	Artificial Intelligence	S	4	X
CS 542	Natural Language Processing	F	4	X
CS 545	Machine Learning	F	4	X
CS 557	Advanced Networking and the Internet	S	4	X
CS 559	Quantitative Security	F	4	X
CS 567	3D User Interfaces	F	4	X
CS 575	Parallel Processing	As needed	4	X
ECE 445	Digital Logic Synthesis	S, Even years	3	X
ECE 450/451	Digital System Design and Laboratory	F	4	
ECE 452	Computer Organization and Architecture	S	3	X
ECE 455	Intro to Robot Programming/Simulation	F, 2025	3	X
ECE 456	Computer Networks	S	4	X
ECE 514	Applications of Random Processes	F	3	X
ECE 519	Network Centric Systems	S, Even years	3	X
ECE/CS 528	Embedded Systems and Machine Learning	F	4	X
ECE 545	FPGA Signal Processing/Software-Defined Radio	As needed	3	X
ECE 554	Computer Architecture	S, Even years	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, 2026	3	
ECE/CS 560	Foundations of Fine-Grain Parallelism	As needed	4	
ECE/CS 561	Hardware/Software Design of Embedded Systems	S, Odd years	4	X
ECE 571	VLSI System Design	S	4	
ECE 580C6	Storage System--Device to System Perspective	S	3	X
ECE 661	Advanced Topics in Embedded Systems	As needed	4	X
GRAD 510	Fundamentals of High Performance Computing	F	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 460	Information and Coding Theory	S	3	
MATH 463	Post-Quantum Cryptography	S, Odd years	3	
MATH 510	Linear Programming and Network Flows	F	3	
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	F, S	1	X

Embedded Systems, continued

Course Number	Course Name	Semester Offered*	Credits	Online
MECH 564	Fundamentals of Robot Mechanics and Controls	S	3	X
STAT 421	Introduction to Stochastic Processes	S	3	
SYSE 580A6	AI – Augmented Systems Engineering	S, Even years	3	X

High Performance Computing

Course Number	Course Name	Semester Offered*	Credits	Online
CS 414	Object Oriented Design	F	4	X
CS 415	Software Testing	S	4	X
CS 420	Introduction to Analysis of Algorithms	F	4	X
CS 422	Automata, Logic, and Computation	F	4	X
CS 425	Intro to Bioinformatics Algorithms	F	4	X
CS 435	Introduction to Big Data	S	4	X
CS 440	Introduction to Artificial Intelligence	F	4	X
CS 445	Introduction to Machine Learning	S	4	X
CS 453	Introduction to Compiler Construction	S	4	X
CS 455	Introduction to Distributed Systems	S	4	X
CS 456	Modern Cybersecurity	F	4	X
CS 458	Blockchain Principles and Applications	S	4	X
CS 464	Principles of Human-Computer Interaction	S	4	X
CS 475	Parallel Programming	F	4	X
CS 530	Fault-Tolerant Computing	S	4	X
CS 540	Artificial Intelligence	S	4	X
CS 542	Natural Language Processing	F	4	X
CS 545	Machine Learning	F	4	X
CS 556	Computer Security	S	4	X
CS 557	Advanced Networking and the Internet	S	4	X
CS 559	Quantitative Security	F	4	X
CS 567	3D User Interfaces	F	4	X
CS 575	Parallel Processing	As needed	4	X
ECE 445	Digital Logic Synthesis	S, Even years	3	X
ECE 450/451	Digital System Design and Laboratory	F	4	
ECE 452	Computer Organization and Architecture	S	4	X
ECE 456	Computer Networks	S	4	X
ECE480A6	Optical Computing	S	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 519	Network Centric Systems	S, Even years	3	X
ECE/CS 528	Embedded Systems and Machine Learning	F	4	X
ECE 544	Silicon Photonics for Computing Systems	F	3	X
ECE 545	FPGA Signal Processing/Software-Defined Radio	As needed	3	X
ECE 554	Computer Architecture	S, Even years	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, 2026	3	

High Performance Computing, continued

Course Number	Course Name	Semester Offered*	Credits	
ECE 556	AI for Radar and Remote Sensing	S	3	X
ECE/CS 560	Foundations of Fine-Grain Parallelism	As needed	4	
ECE/CS 561	Hardware/Software Design of Embedded Systems	S, Odd years	4	X
ECE 578	Satellite Data Analysis	S	3	X
ECE 580C6	Storage System--Device to System Perspective	S	3	X
ECE 661	Advanced Topics in Embedded Systems	As needed	4	X
GRAD 510	Fundamentals of High Performance Computing	F	3	
GRAD 511	High Performance Computing and Visualization	S	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 451	Introduction to Numerical Analysis II	S	3	
MATH 460	Information and Coding Theory	S	3	
MATH 463	Post-Quantum Cryptography	S, Odd years	3	
MATH 469	Linear Algebra I	S	3	
MATH 510	Linear Programming and Network Flows	F	3	
MATH 560	Linear Algebra	F	3	X
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	F, S	1	X
MATH 569C	Linear Algebra for Data Science: Matrix Factorizations and Transformations	F, S	1	X
MATH 676	Topics in Mathematics	F, S	3	
STAT 421	Introduction to Stochastic Processes	S	3	

CONTROLS

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 411	Control Systems	F	3	X
ECE 412	Digital Control and Digital Filters	S	3	X
ECE 455	Intro to Robot Programming/Simulation	F, 2025	3	X
ECE 512	Digital Signal Processing	F	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, 2026	3	
ECE 611	Nonlinear Control Systems	F, Even years	3	X
ECE 612	Robust Control Systems	S, Even years	3	X
ECE 652	Estimation and Filtering Theory	S, Odd years	3	X
ECE 656	Machine Learning and Adaptive Systems	S, Even years	3	X
ECE 666	Topics in Robotics	S, 2027	3	
MATH 417	Advanced Calculus I	F	3	
MATH 418	Advanced Calculus II	S, Even years	3	
MATH 466	Abstract Algebra I	F	3	
MATH 469	Linear Algebra II	S	3	
MATH 474	Introduction to Differential Geometry	F, Odd years	3	
MATH 517	Introduction to Real Analysis	F	3	
MATH 519	Complex Variables I	S	3	
MATH 560	Linear Algebra	F	3	X
MATH 561	Numerical Analysis I	S	4	
MATH 566	Introduction to Abstract Algebra I	F	3	
MATH 570	Topology I	F, Odd years	3	
MATH 617	Integration and Measure Theory	S	4	
MATH 618	Advanced Real Analysis	F	3	
MATH 670	Introduction to Differential Manifolds	As needed	3	
STAT 525	Time Series Analysis I	F	3	
STAT 620	Introduction to Measure Theoretic Probability	S	3	

DIGITAL SIGNAL AND IMAGE PROCESSING

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 512	Digital Signal Processing	F	3	X
ECE 513	Digital Image Processing	S	3	X
ECE 514	Applications of Random Processes	F	4	X
ECE 516	Information Theory	F	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE 521	Satellite Communication	S	3	X
ECE/MATH 522	Random Walks	F, Even years	3	X
ECE/BIOM 537	Biomedical Signal Processing	As needed	3	X
ECE 545	FPGA Signal Processing/Software-Defined Radio	As needed	3	X
ECE 556	AI for Radar and Remote Sensing	S	3	X
ECE 578	Satellite Data Analysis	S	3	X
ECE 579	Global Navigation Satellite Systems	S	3	
ECE 580C7	Machine Learning in Imaging and Spectroscopy	F, Even years	3	X
ECE 652	Estimation and Filtering Theory	S, Odd years	3	X
ECE 653	Detection Theory	F, Odd years	3	
ECE 656	Machine Learning and Adaptive Systems	F, Odd years	3	X
ECE 752	Topics in Signal Processing	As needed	3	
MATH 417	Advanced Calculus I	F	3	
MATH 418	Advanced Calculus II	S, Even years	3	
MATH 466	Abstract Algebra I	F	3	
MATH 469	Linear Algebra II	S	3	
MATH 474	Introduction to Differential Geometry	F, Odd years	3	
MATH 517	Introduction to Real Analysis	F	3	
MATH 519	Complex Variables I	S	3	
MATH 532	Mathematical Modeling of Large Data Sets	S, Even years	3	
MATH 560	Linear Algebra	F	3	X
MATH 566	Introduction to Abstract Algebra I	F	3	
MATH 570	Topology I	F, Odd years	3	
MATH 617	Integration and Measure Theory	S	4	
MATH 618	Advanced Real Analysis	F	3	
MATH 670	Introduction to Differential Manifolds	As needed	3	
STAT 525	Time Series Analysis I	F	3	

ENERGY, POWER, & SYSTEMS ENGINEERING-ENERGY SYSTEMS

Electric Power and Energy

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 411	Control Systems	F	3	X
ECE 461	Power Systems	F	4	
ECE 520[b]	Optimization Methods for Control & Communications	S	3	X
ECE 562	Power Electronics I	S, Even years	3	X
ECE/ENGR 565	Electrical Power Engineering	F, Odd years	3	X
ECE/ENGR 566	Grid Integration of Wind Energy Systems	S, Odd years	3	X
ENGR 510[b]	Engineering Optimization: Method/Application	F	3	X
MATH 417	Advanced Calculus I	F	3	
MATH 418	Advanced Calculus II	S	3	
MATH 419	Introduction to Complex Variables	F	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 451	Introduction to Numerical Analysis II	S	3	
MATH 519	Complex Variables	S	3	
MATH 560	Linear Algebra	F	3	X
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	F, S	1	X
MECH 575	Solar and Alternative Energies	S	3	X

[b] ECE520 is the preferred and recommended course. Students may take only one of the optimization courses to count toward their degree.

Systems Engineering–Energy Systems

Course Number	Course Name	Semester Offered*	Credits	Online
CIVE 546	Water Resource Systems Analysis	S	3	X
ECE 520[b]	Optimization Methods for Control & Communications	S	3	X
ECE/SYSE 532	Dynamics of Complex Engineering Systems	F	3	X
ECE/ENGR 565	Electrical Power Engineering	F, Odd years	3	X
ECE/ENGR 566	Grid Integration of Wind Energy Systems	S, Odd years	3	X
ECE 612	Robust Control Systems	S, Even years	3	X
ENGR 510[b]	Engineering Optimization: Method/Application	F	3	X
ENGR 531	Engineering Risk Analysis	S	3	X
MATH 417	Advanced Calculus I	F	3	
MATH 418	Advanced Calculus II	S	3	
MATH 419	Introduction to Complex Variables	F	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 451	Introduction to Numerical Analysis II	S	3	
MATH 519	Complex Variables	S	3	
MATH 560	Linear Algebra	F	3	X
MECH 513	Simulation Modeling & Experimentation	As needed	3	X
MECH 575	Solar and Alternative Energies	S	3	X
SYSE 530	Overview of Systems Engineering Processes	S	3	X
SYSE 567	Systems Engineering Architecture	S	3	X

[b] ECE520 is the preferred and recommended course. Students may take only one of the optimization courses to count toward their degree.

ELECTROMAGNETICS AND REMOTE SENSING

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 444	Antennas & Radiation	F, 2025	3	
ECE 512	Digital Signal Processing	F	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE 521	Satellite Communication	S	3	X
ECE 536	RF Integrated Circuit Design	F, Even years	3	
ECE 540	Computational Electromagnetics	F, Odd years	3	
ECE 541	Applied Electromagnetics	F, Even years	3	
ECE 548	Microwave Theory & Component Design	S, Odd years	3	
ECE 549	Radar Systems and Design	F, Odd years	3	X
ECE 556	AI for Radar and Remote Sensing	S	3	X
ECE 578	Satellite Data Analysis	S	3	X
ECE 579	Global Navigation Satellite Systems	S	3	
ECE 641	Electromagnetics	As needed	3	
ECE 642	Time-Harmonic Electromagnetics	As needed	3	
ECE 742	Topics in Electromagnetics	As needed	3	

LASERS AND OPTICAL ENGINEERING

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 404	Experiments in Optical Electronics	F	2	
ECE/MATH 430	Fourier & Wavelet Analysis with Applications	S	3	
ECE 441	Optical Electronics	F	3	
ECE 457[a]	Fourier Optics	S	3	X
ECE 415	Semiconductor Physics and Junctions	S	2	
ECE 502[a]	Advanced Fourier Optics	S	4	X
ECE 503	Ultrafast Optics	S, Even years	3	
ECE 504	Physical Optics	F, Odd years	3	X
ECE 505	Nanostructures: Fundamentals and Applications	As needed	3	X
ECE 506	Optical Interferometry and Laser Metrology	F, Odd years	3	X
ECE 507	Plasma Physics and Applications	S, Even years	3	
ECE 513	Digital Image Processing	S	3	X
ECE/BIOM 517	Advanced Optical Imaging	F, Even years	3	X
ECE/BIOM 518	Biophotonics	F, Odd years	3	X
ECE/BIOM 526	Biological Physics	F, Odd years	3	X
ECE/BIOM 527B	Biosensing: Signal and Noise in Biosensors	S, Even years	1	
ECE/BIOM 527F	Biophotonic Sensors Using Refractive Index	S, Even years	1	
ECE 546	Laser Fundamentals and Devices	S, Odd years	3	
ECE 572	Semiconductor Transistors	S	1	
ECE 573	Semiconductor Optoelectronics Laboratory	As needed	3	
ECE 574	Optical Materials and Devices	S, Even years	3	X
ECE 580C7	Machine Learning in Imaging and Spectroscopy	F, Even years	3	X
ECE 604	Nonlinear Optics	As needed	3	X
ECE 641	Electromagnetics	As needed	3	
ECE 650	Extreme Ultraviolet and Soft X-Ray Radiation	As needed	3	
ECE 673	Thin Film Growth	F	3	X
PH 451	Introductory Quantum Mechanics I	F	3	
PH 452	Introductory Quantum Mechanics II	S	3	

[a] Students cannot get credit for both ECE457 and ECE502

ROBOTICS

Robotic Control

Course Number	Course Name	Semester Offered*	Credits	Online
CS 445	Introduction to Machine Learning	S	4	X
ECE 411	Control Systems	F	3	X
ECE 412	Digital Control and Digital Filters	S	3	X
ECE 455	Intro to Robot Programming/Simulation	F, 2025	3	X
ECE 514	Applications of Random Processes	F	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, 2026	3	
ECE/CS 561	Hardware/Software Design of Embedded Systems	S, Odd years	4	X
ECE 611	Nonlinear Control Systems	F, Even years	3	X
ECE 612	Robust Control Systems	S, Even years	3	X
ECE 656	Machine Learning and Adaptive Systems	S, Even years	3	X
ECE 666	Topics in Robotics	S, 2027	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 469	Linear Algebra II	S	3	
MATH 569A	Linear Algebra for Data Science: Matrices & Vectors Spaces	F, S	1	X
MATH 569B	Linear Algebra for Data Science: Geometric Data Reduction	F, S	1	X
MATH 569C	Linear Algebra for Data Science: Matrix Factorizations and Transformations	F, S	1	X
MATH 569D	Linear Algebra for Data Science: Theoretical Foundations	F, S	1	X
MECH 564	Fundamentals of Robot Mechanics and Controls	S	3	X
MECH 630	Biologically Inspired Robotics	F, Odd years	3	

Robotics Vision

Course Number	Course Name	Semester Offered*	Credits	Online
CS 410	Introduction to Computer Graphics	F	3	X
CS 445	Introduction to Machine Learning	S	4	X
CS 612	Topics in Computer Graphics	S, Even years	4	
DSCI 475	Topological Data Analysis	S	2	
ECE 455	Intro to Robot Programming/Simulation	F, 2025	3	X
ECE 512	Digital Signal Processing	F	3	X
ECE 513	Digital Image Processing	S	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, 2026	3	
ECE 656	Machine Learning and Adaptive Systems	S, Even years	3	X
ECE 666	Topics in Robotics	S, 2027	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 469	Linear Algebra II	S	3	
MATH 474	Introduction to Differential Geometry	F, Odd years	3	

Robotics Vision, continued

Course Number	Course Name	Semester Offered*	Credits	Online
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	F, S	1	X
MATH 569B	Linear Algebra for Data Science: Geometric Data Reduction	F, S	1	X
MATH 569C	Linear Algebra for Data Science: Matrix Factorizations and Transformations	F, S	1	X
MATH 569D	Linear Algebra for Data Science: Theoretical Foundations	F, S	1	X
MECH 564	Fundamentals of Robot Mechanics and Controls	S	3	X
MECH 630	Biologically Inspired Robotics	F, Odd years	3	

SEMI-CONDUCTOR DEVICES AND PROCESSING

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 404	Experiments in Optical Electronics	F	2	
ECE 441	Optical Electronics	F	3	
ECE 415	Semiconductor Physics and Junctions	S	2	
ECE 504	Physical Optics	F, Odd years	3	X
ECE 505	Nanostructures	As needed	3	X
ECE 536	RF Integrated Circuit Design	F, Even years	3	
ECE 541	Applied Electromagnetics	F, Even years	3	
ECE 546	Laser Fundamentals and Device	S, Odd years	3	
ECE 571	VLSI System Design	S	4	
ECE 572	Semiconductor Transistors	S	1	
ECE 573	Semiconductor Optoelectronics Laboratory	As needed	3	
ECE 574	Optical Materials and Devices	S, Even years	3	X
ECE 641	Electromagnetics	As needed	3	
PH 531	Introductory Solid State Physics	S	3	

VLSI

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 450/451	Digital System Design and Laboratory	F	4	
ECE 452	Computer Organization and Architecture	S	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	X
ECE 534	Analog Integrated Circuit Design	As needed	4	
ECE 536	RF Integrated Circuit Design	F, Even years	3	
ECE 538	Design Analysis of Analog Digital Interface	As needed	4	
ECE 541	Applied Electromagnetics	F, Even years	3	
ECE 544	Silicon Photonics for Computing Systems	F	3	X
ECE 545	FPGA Signal Processing/Software-Defined Radio	As needed	3	X
ECE 554	Computer Architecture	S, Even years	3	X
ECE/CS 561	Hardware/Software Design of Embedded Systems	S, Odd years	4	X
ECE 571	VLSI System Design	S	4	
ECE 661	Advanced Topics in Embedded Systems – Lab	As needed	4	X
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 451	Introduction to Numerical Analysis II	S	3	
MATH 517	Introduction to Real Analysis	F	3	
MATH 560	Linear Algebra	F	3	X
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	F, S	1	X
STAT 421	Introduction to Stochastic Processes	S	3	
STAT 511	Design and Data Analysis for Researchers I	F	4	
STAT 512	Design Data Analysis for Researchers II	S	4	
STAT 520	Introduction to Probability Theory	F	4	