



Electrical & Computer
ENGINEERING

Recommended Courses by ECE Topic Area

Graduate Students

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

http://www.engr.colostate.edu/ece/pdfs/current_students/graduate_student_handbook.pdf

A maximum of **6 credits** of 400-level coursework is allowed for Master of Science (M.S.) and Master of Engineering (M.E.) programs. Up to 8 credit hours at the 400-level are permitted when at least one course is a 4 credit course. M.S. students may count a maximum of **12 credits** outside of the ECE Department. M.E. students may count a maximum of **15 credits** outside of the ECE Department.

Course descriptions and additional course information can be found at:

http://www.engr.colostate.edu/ece/current_students/courses.php

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Biomedical Devices

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 404	Experiments in Optical Electronics	F	2	
ECE/BIOM 431	Biomedical Signal and Image Processing	S	3	
ECE 441	Optical Electronics	F	3	
ECE 471A	Semiconductor Physics	S	1	
ECE 471B	Semiconductor Junction	S	1	
ECE/BIOM 481A3	Intro to Optical Techniques in Biomedical Engineering	S, Odd years	3	
ECE 504	Physical Optics	F, Odd years	3	
ECE 505	Nanostructures: Fundamentals and Applications	F, Odd years	3	X
ECE/BIOM 517	Advanced Optical Imaging	F, Even years	3	
ECE/BIOM 518	Biophotonics	F, Odd years	3	
ECE/BIOM 526	Biological Physics	F, Odd years	3	X
ECE/BIOM 527A	Cells as Circuits	F, Odd years	1	
ECE/BIOM 527B	Signal and Noise in Biosensors	S, Even years	1	
ECE/BIOM 527C	Sensor Circuit Fundamentals	F, Odd years	1	
ECE/BIOM 527D	Electrochemical Sensors	F, Odd years	1	
ECE/BIOM 527E	Affinity Sensors	S, Even years	1	
ECE/BIOM 527F	Biophotonic Sensors Using Refractive Index	S, Even years	1	
ECE 541	Applied Electromagnetics	F, Odd years	3	
ECE 546	Laser Fundamentals and Devices	S	3	
ECE/MECH 569	Micro-Electromechanical Systems	S	3	
ECE 572	Semiconductor Transistors	S	1	
ECE 574	Optical Materials and Devices	S, Even years	3	X
ECE 641	Electromagnetics	As needed	3	
ECE 681A2	Random Walks	F, Even years	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 560	Linear Algebra	F	3	

Biomedical Signals and Systems

Course Number	Course Name	Semester Offered*	Credits	Online
ECE/BIOM 431	Biomedical Signal and Image Processing	S	3	
ECE 457	Fourier Optics	S	3	
ECE/BIOM 481A3	Intro to Optical Techniques in Biomedical Engineering	S, Odd years	3	
ECE 503	Ultrafast Optics	As needed	3	
ECE 504	Physical Optics	F, Odd years	3	
ECE 512	Digital Signal Processing	F	3	X
ECE 514	Applications of Random Processes	F	3	
ECE/BIOM 518	Biophotonics	F, Odd Years	3	
ECE 520	Optimization Methods for Control & Communications	S	3	
ECE/BIOM 526	Biological Physics	F, Odd years	3	X
ECE/BIOM 527A	Cells as Circuits	F, Odd years	1	
ECE/BIOM 527B	Signal and Noise in Biosensors	S, Even years	1	
ECE/BIOM 527C	Sensor Circuit Fundamentals	F, Odd years	1	
ECE/BIOM 527D	Electrochemical Sensors	F, Odd years	1	

Biomedical Signals and Systems, continued

Course Number	Course Name	Semester Offered*	Credits	Online
ECE/BIOM 527E	Affinity Sensors	S, Even years	1	
ECE/BIOM 527F	Biophotonic Sensors Using Refractive Index	S, Even years	1	
ECE/BIOM 537	Biomedical Signal Processing	S, Even years	3	
ECE 541	Applied Electromagnetics	F, Odd years	3	
ECE 604	Nonlinear Optics	F, Odd years	3	
ECE 652	Estimation and Filtering Theory	S, Odd years	3	
ECE 681A2	Random Walks	F, Even years	3	
MATH 419	Introduction to Complex Variables	F	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 560	Linear Algebra	F	3	

Communications

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 421	Telecommunications I	F	3	
ECE/MATH 430	Fourier and Wavelet Analysis with Apps.	S	3	
ECE 444	Antennas & Radiation	F	3	
ECE 456	Computer Networks	S	4	X
ECE 512	Digital Signal Processing	F	3	X
ECE 514	Applications of Random Processes	F	3	
ECE 516	Information Theory	F	3	
ECE 520	Optimization Methods for Control & Communications	S	3	
ECE 521	Satellite Communication	S	3	
ECE 580B4	FPGA Signal Processing/Software-Defined Radio	S, Odd years	3	
ECE 614	Principles of Digital Communications	S, Even years	3	
ECE 652	Estimation and Filtering Theory	S, Odd years	3	
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	
MATH566	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 720 ^a	Probability Theory	As needed	3	

^a Course recommended for PhD level students only

Computer Architecture

*Subject to change. Please see the course schedule regarding semester course offerings

Course Number	Course Name	Semester Offered*	Credits	Online
CS 414	Object Oriented Design	F	4	X
CS 420	Introduction to Analysis of Algorithms	F	4	X
CS 435	Introduction to Big Data	S	4	
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 475	Parallel Programming	F	4	X
CS 481A1	Introduction to Database Technology	SU	2	X
CS 530	Fault-Tolerant Computing	S	4	X
CS 535	Big Data	F	4	
CS 545	Machine Learning	F	4	X
CS 553	Algorithmic Language Compilers	As needed	4	
CS 555	Distributed Systems	F	4	
CS 556	Computer Security	S	4	X
CS 575	Parallel Processing	As needed	4	X
ECE 450/451	Digital System Design and Laboratory	F	4	
ECE 452	Computer Organization and Architecture	S	4	X
ECE 514	Applications of Random Processes	F	3	
ECE 554	Computer Architecture	S	3	X
ECE/CS 560	Foundations of Fine-Grain Parallelism	F, Odd years	4	
ECE/CS 561	Hardware/Software Design of Embedded Systems	F	4	X
ECE 571/575	VLSI System Design/Lab	S, Even years	4	
ECE 580B4	FPGA Signal Processing/Software-Defined Radio	S, Odd years	3	
ECE 580B9	Manycore System Design Using Machine Learning	F, Odd years	3	
ECE 661	Advanced Topics in Embedded Systems	S, every 3 years	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 510	Linear Programming and Network Flows	F	3	
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 420	Introduction to Analysis of Algorithms	F	4	X
CS 435	Introduction to Big Data	S	4	
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 475	Parallel Programming	F	4	X

Computer Engineering, continued

Course Number	Course Name	Semester Offered*	Credits	Online
CS 481A1	Introduction to Database Technology	SU	2	X
CS 530	Fault-Tolerant Computing	S	4	X
CS 535	Big Data	F	4	
CS 545	Machine Learning	F	4	X
CS 553	Algorithmic Language Compilers	As needed	4	
CS 555	Distributed Systems	F	4	X
CS 556	Computer Security	S	4	X
CS 575	Parallel Processing	As needed	4	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
ECE 514	Applications of Random Processes	F	3	
ECE 554	Computer Architecture	S	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, Even years	3	
ECE/CS 560	Foundations of Fine-Grain Parallelism	F, Odd years	4	
ECE/CS 561	Hardware/Software Design of Embedded Systems	F	4	X
ECE 571/575	VLSI System Design/Lab	S, Even years	4	
ECE 580B4	FPGA Signal Processing/Software-Defined Radio	S, Odd years	3	
ECE 580B6	Silicon Photonics in Computing Systems	F, Even years	3	X
ECE 580B9	Manycore System Design Using Machine Learning	F, Odd years	3	
ECE 656	Machine Learning and Adaptive Systems	S, Even years	3	
ECE/CS 658	Internet Engineering	F, Even years	4	X
ECE 661	Advanced Topics in Embedded	S, every 3 years	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 510	Linear Programming and Network Flows	F	3	
MATH 532	Mathematical Modeling of Large Data Sets	S, Even years	3	
MECH 564	Fundamentals of Robot Mechanics and Controls	S	3	
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 435	Introduction to Big Data	S	4	
CS 445	Introduction to Machine Learning	S	4	X
CS 530	Fault Tolerant Systems	S	4	X
CS 535	Big Data	F	4	
CS 545	Machine Learning	F	4	X
CS 556	Computer Security	S	4	X
CS 557	Advanced Networking and the Internet	S	4	X
ECE 456	Computer Networks	S	4	X
ECE 514	Applications of Random Processes	F	3	

Computer Networking, continued

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 516	Information Theory	F	3	
ECE 521	Satellite Communication	S	3	
ECE 554	Computer Architecture	S	3	X
ECE/CS 560	Reconfigurable Computing	F, Odd years	4	
ECE/CS 658	Internet Engineering	F, Even years	4	X
ECE 681A2	Random Walks	F, Even years	3	
MATH 460	Information and Coding Theory	S	3	
MATH 532	Mathematical Modeling of Large Data Sets	S, Even years	3	
STAT 421	Introduction to Stochastic Processes	S	3	
STAT 520	Introduction to Probability Theory	F	4	

Controls

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 411	Control Systems	F	4	
ECE 412	Digital Control and Digital Filters	S	3	X
ECE 455	Intro to Robot Programming/Simulation	F	3	
ECE 512	Digital Signal Processing	F	3	X
ECE 520	Optimization Methods for Control & Communications	S	3	
ECE 555	Advanced Robotics: Redundancy & Optimization	S, Even years	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	
ECE 656	Machine Learning and Adaptive Systems	S, Even years	3	
ECE 666	Topics in Robotics	S, Odd years	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	
MATH 561	Numerical Analysis I	S	4	
MATH566	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	

Digital Signal and Imaging Processing

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 444	Antennas & Radiation	F	3	
ECE/ENGR 509	Signal Processing for Power Systems	F	3	X
ECE 512	Digital Signal Processing	F	3	X
ECE 513	Digital Image Processing	S	3	X
ECE 514	Applications of Random Processes	F	4	
ECE 516	Information Theory	F	3	
ECE 520	Optimization Methods for Control & Communications	S	3	
ECE 521	Satellite Communication	S	3	
ECE/BIOM 537	Biomedical Signal Processing	S, Even years	3	
ECE 580B4	FPGA Signal Processing/Software-Defined Radio	S, Odd years	3	
ECE 652	Estimation and Filtering Theory	S, Odd years	3	
ECE 653	Detection Theory	F, Odd years	3	
ECE 656	Neural Networks and Adaptive Systems	F, Odd years	3	
ECE 681A2	Random Walks	F, Even years	3	
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	
MATH566	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	

Electric Power and Energy (See also Systems Engineering – Energy Systems)

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 411	Control Systems	F	4	
ECE 461/462	Power Systems I	F	4	
ECE 465	Electrical Energy Generation Technologies	S	3	
ECE 466	Integrated Lighting Systems	S	3	
ECE/ENGR 508	Introduction to Power System Markets	F, Odd years	3	X
ECE/ENGR 509	Signal Processing for Power Systems	F	3	X
ECE 510	Wide-area Monitoring for Power Systems	S	3	X
ECE 520 ^b	Optimization Methods for Control & Communications	S	3	
ECE 562	Power Electronics I	F	3	
ECE/ENGR 565	Electrical Power Engineering	S	3	X

Electric Power and Energy (See also Systems Engineering – Energy Systems), continued

*Subject to change. Please see the course schedule regarding semester course offerings

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 566	Grid Integration of Wind Energy Systems	F, Even years	3	X
ECE/ENGR 623	Electric Power Quality	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	
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.

Electromagnetics and Remote Sensing

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 444	Antennas & Radiation	F	3	
ECE 512	Digital Signal Processing	F	3	X
ECE 514	Applications of Random Processes	F	3	
ECE 520	Optimization Methods for Control & Communications	S	3	
ECE 521	Satellite Communication	S	3	
ECE 536	RF Integrated Circuit Design	F, Even years	3	
ECE 540	Computational Electromagnetics	F, Even years	3	
ECE 541	Applied Electromagnetics	F, Odd years	3	
ECE 542	Parallel CAD Algorithms for IC Design	As needed	3	
ECE 548	Microwave Theory & Component Design	S, Odd years	3	
ECE 549	Radar Systems and Design	F, Odd years	3	X
ECE 641	Electromagnetics	As needed	3	
ECE 642	Time-Harmonic Electromagnetics	As needed	3	
ECE 742	Topics in Electromagnetics	As needed	3	

Embedded Systems

Course Number	Course Name	Semester Offered*	Credits	Online
CS 414	Object Oriented Design	F	4	X
CS 420	Introduction to Analysis of Algorithms	F	4	X
CS 435	Introduction to Big Data	S	4	
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

Embedded Systems, continued

*Subject to change. Please see the course schedule regarding semester course offerings

Course Number	Course Name	Semester Offered*	Credits	Online
CS 464	Principles of Human-Computer Interaction	S	4	
CS 475	Parallel Programming	F	4	X
CS 530	Fault-Tolerant Computing	S	4	X
CS 545	Machine Learning	F	4	X
CS 575	Parallel Processing	As needed	4	X
ECE 450/451	Digital System Design and Laboratory	F	4	
ECE 452	Computer Organization and Architecture	S	4	X
ECE 455	Intro to Robot Programming/Simulation	F	3	
ECE 456	Computer Networks	S	4	X
ECE 514	Applications of Random Processes	F	3	
ECE 554	Computer Architecture	S	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, Even years	3	
ECE/CS 560	Foundations of Fine-Grain Parallelism	F, Odd years	4	
ECE/CS 561	Hardware/Software Design of Embedded Systems	F	4	X
ECE 571/575	VLSI System Design/Lab	S, Even years	3	
ECE 580B4	FPGA Signal Processing/Software-Defined Radio	S, Odd years	3	
ECE 661	Advanced Topics in Embedded Systems	S, every 3 years	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 510	Linear Programming and Network Flows	F	3	
MECH 564	Fundamentals of Robot Mechanics and Controls	S	3	
STAT 421	Introduction to Stochastic Processes	S	3	

High Performance Computing

Course Number	Course Name	Semester Offered*	Credits	Online
CS 414	Object Oriented Design	F	4	X
CS 420	Introduction to Analysis of Algorithms	F	4	X
CS 435	Introduction to Big Data	S	4	
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 475	Parallel Programming	F	4	X
CS 530	Fault-Tolerant Computing	S	4	X
CS 545	Machine Learning	F	4	X
CS 555	Distributed Systems	F	4	
CS 556	Computer Security	S	4	X
CS 575	Parallel Processing	As needed	4	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

High Performance Computing, continued

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 514	Applications of Random Processes	F	3	
ECE 554	Computer Architecture	S	3	X
ECE 555	Advanced Robotics: Redundancy & Optimization	S, Even years	3	
ECE/CS 560	Foundations of Fine-Grain Parallelism	F, Odd years	4	
ECE/CS 561	Hardware/Software Design of Embedded Systems	F	4	X
ECE 580B4	FPGA Signal Processing/Software-Defined Radio	S, Odd years	3	
ECE 580B6	Silicon Photonics in Computing Systems	F, Even years	3	X
ECE 580B9	Manycore System Design Using Machine Learning	F, Odd years	3	
ECE 661	Advanced Topics in Embedded Systems	S, every 3 years	4	X
ECE 666	Topics in Robotics	S, Odd years	3	
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 469	Linear Algebra I	S	3	
MATH 510	Linear Programming and Network Flows	F	3	
MATH 560	Linear Algebra	F	3	
MATH 676				
STAT 421	Introduction to Stochastic Processes	S	3	

Lasers and Optics

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	Fourier Optics	S	3	
ECE 471A	Semiconductor Physics	S	1	
ECE 471B	Semiconductor Junction	S	1	
ECE 503	Ultrafast Optics	As needed	3	
ECE 504	Physical Optics	F, Odd years	3	
ECE 505	Nanostructures: Fundamentals and Applications	F, Odd years	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	
ECE/BIOM 518	Biophotonics	F, Odd years	3	
ECE/BIOM 526	Biological Physics	F, Odd years	3	X
ECE/BIOM 527B	Biosensing: Signal and Noise in Biosensors	F, Even years	1	
ECE/BIOM 527F	Biophotonic Sensors Using Refractive Index	S, Even years	1	
ECE 546	Laser Fundamentals and Devices	S	3	
ECE 572	Semiconductor Transistors	S	1	
ECE 573	Semiconductor Optoelectronics Laboratory	S, Even years	3	
ECE 574	Optical Materials and Devices	S, Even years	3	X

Lasers and Optics, continued

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 604	Nonlinear Optics	F, Odd years	3	
ECE 641	Electromagnetics	As needed	3	
ECE 647	Synchrotron Rad, FELs, and Hard X-ray Optics	F, Odd years	3	X
ECE 650	Extreme Ultraviolet and Soft X-Ray Radiation	As needed	3	
ECE 673	Thin Film Growth	F	3	X
PH 451	Intro to Quantum Mechanics I	F	3	

Robotic Control

Course Number	Course Name	Semester Offered*	Credits	Online
CS 445	Introduction to Machine Learning	S	4	X
ECE 411	Control Systems	F	4	
ECE 412	Digital Control and Digital Filters	S	3	X
ECE 455	Intro to Robot Programming/Simulation	F	3	
ECE 514	Applications of Random Processes	F	3	
ECE 520	Optimization Methods for Control & Communications	S	3	
ECE 555	Advanced Robotics: Redundancy & Optimization	S, Even years	3	
ECE/CS 561	Hardware/Software Design of Embedded Systems	F	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	
ECE 666	Topics in Robotics	S, Odd years	3	
MATH 450	Introduction to Numerical Analysis I	F	3	
MATH 469	Linear Algebra II	S	3	
MECH 564	Fundamentals of Robot Mechanics and Controls	S	3	
MECH 681A4	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 510	Image Computation	S	4	
CS 612	Topics in Computer Graphics	S, Even years	4	
ECE 455	Intro to Robot Programming/Simulation	F	3	
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	
ECE 555	Advanced Robotics: Redundancy & Optimization	S, Even years	3	
ECE 656	Machine Learning and Adaptive Systems	S, Even years	3	
ECE 666	Topics in Robotics	S, Odd years	3	

Robotics Vision, continued

Course Number	Course Name	Semester Offered*	Credits	Online
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	
MECH 564	Fundamentals of Robot Mechanics and Controls	S	3	
MECH 681A4	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 471A	Semiconductor Physics	S	1	
ECE 471B	Semiconductor Junction	S	1	
ECE 504	Physical Optics	F, Odd years	3	
ECE 505	Nanostructures	F, Odd years	3	X
ECE 536	RF Integrated Circuit Design	F, Even years	3	
ECE 542	Parallel CAD Algorithms for IC Design	As needed	3	
ECE 546	Laser Fundamentals and Device	S	3	
ECE/MECH 569	Micro-Electro-Mechanical Devices	S	3	
ECE 571/575	VLSI System Design/Lab	S, Even years	4	
ECE 572	Semiconductor Transistors	S	1	
ECE 573	Semiconductor Optoelectronics Laboratory	S, Even years	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	

Systems Engineering – Energy Systems (See also Electric Power and Energy)

Course Number	Course Name	Semester Offered*	Credits	Online
CIVE 546	Water Resource Systems Analysis	S	3	X
ECE/ENGR 508	Introduction to Power System Markets	F, Odd years	3	X
ECE/ENGR 509	Signal Processing for Power Systems	F	3	X
ECE 520 ^b	Optimization Methods for Control & Communications	S	3	
ECE/ENGR 532	Dynamics of Complex Engineering Systems	F	3	X
ECE/ENGR 565	Electrical Power Engineering	S	3	X
ECE 566	Grid Integration of Wind Energy Systems	F, Even years	3	X
ECE 612	Robust Control Systems	S, Even years	3	X
ECE/ENGR 623	Electric Power Quality	S, Odd years	3	X
ENGR 510 ^b	Engineering Optimization: Method/Application	F	3	X
ENGR 530	Overview of Systems Engineering Processes	S	3	X
ENGR 531	Engineering Risk Analysis	S	3	X

Systems Engineering – Energy Systems (See also Electric Power and Energy), continued

*Subject to change. Please see the course schedule regarding semester course offerings

Course Number	Course Name	Semester Offered*	Credits	Online
ENGR 567	Systems Engineering Architecture	S	3	X
MECH 513	Simulation Modeling & Experimentation	As needed	3	X
MECH 575	Solar and Alternative Energies	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	

^bECE520 is the preferred and recommended course. Students may take only one of the optimization courses to count toward their degree.

VLSI

Course Number	Course Name	Semester Offered*	Credits	Online
ECE 442	Numerical Algorithms for VLSI Modeling	F	4	
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	
ECE 534/535	Analog Integrated Circuit Design	As needed	3	
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, Odd years	3	
ECE 542	Parallel CAD Algorithms for IC Design	As needed	3	
ECE 554	Computer Architecture	S	3	X
ECE/CS 561	Hardware/Software Design of Embedded Systems	F	4	X
ECE 571/575	VLSI System Design/Lab	S, Even years	3	
ECE 580B4	FPGA Signal Processing/Software-Defined Radio	S, Odd years	3	
ECE 580B9	Manycore System Design Using Machine Learning	F, Odd years	3	
ECE 661	Advanced Topics in Embedded Systems – Lab	S, every 3 years	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	
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	