COURSES FOR ELECTRICAL ENGINEERING AND COMPUTER ENGINEERING

Electrical and Computer Engineering Courses

ECE121 Introduction to Electrical and Computer Engineering
Hours 1
Introduction to electrical and computer engineering disciplines, specializations, the engineering design process, mathematics required for these disciplines, computer-based modeling and simulation tools, and professional responsibilities.
Prerequisite(s): MATH 110

ECE225 Electric Circuits
Hours 4
Physical concepts and mathematical techniques of circuit analysis; DC, transient, and sinusoidal steady-state analysis of circuits; Includes laboratory experiments. Not open to students who have earned credit in ECE 320.
Prerequisite(s): (PH 105 or PH 125) and (PH 106 or PH 126) and (MATH 125 or MATH 145) and (MATH 126 or MATH 146) and (MATH 227 or MATH 247) and MATH 238

ECE320 Fundamentals Electrical Engr
Hours 3
Introduction to circuit analysis, methods, resistive circuits, AC circuits, first-order transients, AC power, operational amplifiers and machines. Not open to electrical engineering or computer engineering majors or to students who have earned credit for ECE 225.
Prerequisite(s): (PH 106 or PH 126) and (MATH 227 or MATH 247) and MATH 238

ECE326 Electric Networks
Hours 3
Prerequisite(s): ECE 225 and ECE 370 and MATH 355

ECE327 Audio Networks and Signals
Hours 3
Prerequisite(s): ECE 225 and MATH 370 and MATH 355

ECE330 Intro. to Semiconductor Device
Hours 3
Semiconductor device physics, p-n junction, Schottky diodes, BJT, MOS capacitor, MOSFET and optoelectronic devices. Brief introduction of microelectronic fabrication.
Prerequisite(s): PH 253 and ECE 225
Prerequisite(s) with concurrency: ECE 225

ECE332 Electronics I
W
Hours 4
Semiconductor materials and properties, fundamentals of p-n junctions, diodes, diode circuits and operation, signal generators, rectifier and wave-shaping circuits, bipolar and field effect transistors, MOSFET, transistor DC circuit analysis and basic transistor amplifiers. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course. Includes laboratory experiments.
Prerequisite(s): ECE 225 and (EN 102 or EN 103 or EN 121)
Writing

ECE333 Electronics II
W
Hours 4
Operational amplifiers, BJTs, MOSFETs, integrated current biasing and active loads, differential and multistage amplifiers, frequency response, feedback and stability, power amplifiers, and introduction to digital circuits. The lab deals with experiments illustrating concepts in electronics. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course. Includes laboratory experiments.
Prerequisite(s): ECE 332
Writing

ECE340 Electromagnetics
Hours 4
Electrostatics, magnetostatics, Maxwell's equations, plane waves, guided waves, and radiation.
Prerequisite(s): (PH 105 or PH 125) and (PH 106 or PH 126) and (MATH 125 or MATH 145) and (MATH 126 or MATH 146) and (MATH 227 or MATH 247) and MATH 238

ECE350 Electric Power & Machines
Hours 3
Single- and three-phase power system analysis. Theory and operation of electromechanical devices, including magnetic circuits, transformers, as well as DC and AC rotating machines. Fundamentals of power electronics.
Prerequisite(s): ECE 225 or ECE 320
ECE370 Signals And Systems
C
Hours 3
Time domain and frequency domain analysis of continuous and discrete
signals and systems; Fourier integral, Fourier series, Z-transform.
Numerical implementation using MatLab. Computing proficiency is
required for a passing grade in this course.
Prerequisite(s): ECE 225 and (CS 100 or CS 110 or RRS 101)

Computer Science
ECE380 Digital Logic
Hours 4
Number systems, Boolean algebra, logic functions and gates, design of
combinational logic systems, flip-flops, design of synchronous sequential
systems, and iterative networks. Includes laboratory experiments.
Prerequisite(s): CS 100 or CS 110 or RRS 101

ECE383 Microcomputers
C
Hours 4
Microprocessors, microcontrollers, assembly-language programming,
interrupts, polling and hardware interfaces. Computing proficiency
is required for a passing grade in this course. Includes laboratory
experiments.
Prerequisite(s): ECE 380

ECE399 Undergraduate Research Fellows

Computer Science

ECE408 Communications
Hours 3
Analog and digital communication systems, random signals, sampling,
filtering, analog-to-digital encoding, advanced digital modulation/
demodulation, source encoding/decoding, channel encoding/decoding,
multiplexing and system performance analysis.
Prerequisite(s): MATH 355 and ECE 370

ECE409 Communications Lab
Hours 1
Modeling and design of communication systems. Familiarization with
specialized communications equipment and techniques. Proper use of
laboratory instruments.
Prerequisite(s): ECE 370 and ECE 408
Prerequisite(s) with concurrency ECE 408

ECE430 Solid State Devices
Hours 3
Solid state physics for semiconductor devices, p-n junction, metal-
semiconductor junction, JFET/MESFET, MOSFET, BJT and non-ideal
behaviors of solid state devices. Organic thin film devices including
organic solar cells, thin film transistors, light emitting diodes and their
application for flexible displays.
Prerequisite(s): ECE 330

ECE438 Intgr Circuit Fabr Prin
Hours 3
Study of the processing tools used in semiconductor device fabrication.
Topics include semiconductor fundamentals, semiconductor device
fabrication processes, interconnections and contacts, integrated circuit
packaging, and chip yield.
Prerequisite(s): ECE 333 or MTE 271

ECE439 Thin Film Technology
Hours 3
Crystal structure and defects, film nucleation and growth models, growth
of polycrystalline and epitaxial films, vacuum science technology,
physical and chemical vapor deposition, solution based methods and thin
film characterization techniques.
Prerequisite(s): ECE 225 or PH 253

ECE440 Electromagnetic Waves
Hours 3
Mathematics and physics of the radiation, propagation and scattering of
electromagnetic waves. Boundary value problems involving finite and
infinite structures, waveguides, antennas and media.
Prerequisite(s): ECE 340

ECE451 Power Electronics
Hours 3
Detailed study on the theory and operation of power electronics
converters and systems. Overview of enabling power semiconductors
switching devices. Introduction to feedback control of converters.
Machine drive fundamentals.
Prerequisite(s): ECE 332 and ECE 350

ECE452 Power Electronics Laboratory
Hours 1
Laboratory experience in three phase power systems and electric
machinery. Laboratory experience on the theory and operation of power
electronic converters, systems and machine drives.
Prerequisite(s): ECE 332 and ECE 350
Prerequisite(s) with concurrency ECE 451

ECE453 Power Systems
Hours 3
Basic power systems concepts and per unit quantities; transmissions
line, transformer and rotating machine modeling; power flow;
symmetrical component of power systems; faulted power system
analysis.
Prerequisite(s): ECE 350
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
<th>Description</th>
<th>Prerequisite(s)</th>
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</thead>
<tbody>
<tr>
<td>ECE454</td>
<td>Power Systems Laboratory</td>
<td>1</td>
<td>Test and analysis of power systems and machine devices and the design of systems using devices.</td>
<td>ECE 350 and ECE 453</td>
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<td>Prerequisite(s) with concurrency: ECE 453</td>
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<tr>
<td>ECE455</td>
<td>Electromechanical Systems</td>
<td>3</td>
<td>Static and dynamic modeling, analysis, and simulation of mechanical, electrical, hydraulic and mixed systems. MATLAB and SIMULINK model development and simulation.</td>
<td>ECE 225 and MATH 238</td>
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<tr>
<td>ECE461</td>
<td>Quantum Well Elec &amp; Devices</td>
<td>3</td>
<td>Energy levels and wave functions of semiconductor microstructures; envelope function approximation; quantum wells, superlattices; excitons; optical and electrical properties; selection rules; quantum confined Stark Effect; Wannier-Stark localization; field-effect transistors, tunneling devices, quantum well lasers, electro-optic modulators and quantum-well intersubband photodetectors.</td>
<td>ECE 330 or PH 253</td>
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<tr>
<td>ECE462</td>
<td>Semiconductor Optoelectronics</td>
<td>3</td>
<td>Elemental and compound semiconductors; fundamentals of semiconductor physical properties; solid state physics; optical recombination and absorption; light emitting diodes; quantum well lasers; quantum dot lasers; blue lasers; semiconductor modulators; photodetectors; semiconductor solar cells; semiconductor nanostructure devices.</td>
<td>PH 253</td>
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<tr>
<td>ECE463</td>
<td>Magnetic Materials &amp; Devices</td>
<td>3</td>
<td>Diamagnetism and Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism, magnetic anisotropy, domains and the magnetization process, fine particles and thin films and magnetization dynamics.</td>
<td>ECE 340</td>
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<td>ECE466</td>
<td>Fund of Nanotechnology</td>
<td>3</td>
<td>Nanofabrication with electron beam lithography, focused ion beam, lithography, and nanoimprint; microscopies for nanostructures, including SEM, EDX, TEM, AFM, STM; nanoscale devices based on nanostructured materials (carbon nanotubes and metal oxide nanomaterials).</td>
<td>ECE 330 or PH 253</td>
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<tr>
<td>ECE475</td>
<td>Control Systems Analysis</td>
<td>3</td>
<td>Classical and modern feedback control system methods; stability; Bode, root locus, state variables, and computer analysis.</td>
<td>ECE 326 or ECE 327</td>
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<tr>
<td>ECE476</td>
<td>Control Systems Lab</td>
<td>1</td>
<td>Practical analysis and design of feedback control systems and components; electrical, mechanical, and electromechanical systems.</td>
<td>ECE 326 or ECE 327</td>
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<td>Prerequisite(s) with concurrency: ECE 475</td>
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<td>ECE479</td>
<td>Digital Control Systems</td>
<td>3</td>
<td>Frequency and time methods in discrete time control systems; sampling of continuous-time signals, stability, transform design techniques, and state variable analysis and design techniques.</td>
<td>MATH 237 and ECE 370 and ECE 475</td>
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<tr>
<td>ECE480</td>
<td>Digital Systems Design</td>
<td>3</td>
<td>Digital systems design with hardware description languages, programmable implementation technologies, electronic design automation design flows, design considerations and constraints, design for test, system-on-a-chip designs, IP cores, reconfigurable computing and digital system design examples and applications.</td>
<td>ECE 383 and CS 101 Corequisite: ECE 481</td>
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<tr>
<td>ECE481</td>
<td>Digital Systems Design Lab</td>
<td>1</td>
<td>Logic design and simulation via hardware description languages, use of electronic design automation tools, and CPU design.</td>
<td>None. Corequisite: ECE 480</td>
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<td>Prerequisite(s) with concurrency: ECE 480</td>
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<td>ECE482</td>
<td>Comp Visn Dig Image Proc</td>
<td>3</td>
<td>Introduction to computer vision and digital image processing with an emphasis on image representation, transforms, filtering, compression, boundary detection and pattern matching.</td>
<td>MATH 355 and ECE 285</td>
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<td>ECE483</td>
<td>Introduction to Machine Learning</td>
<td>3</td>
<td>Machine learning studies methods that allow computers to learn from the data and act without being explicitly programmed. This course provides an introduction to machine learning and covers various supervised and unsupervised learning techniques, methods of dimensionality reduction and assessment of learning algorithms.</td>
<td>MATH 355 or consent of instructor.</td>
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<tr>
<td>ECE484</td>
<td>Computer Architecture</td>
<td>3</td>
<td>Basic computer organization, computer arithmetic, assembly language, machine language, simple and pipelined central-processor organization, memory system hierarchy, and measuring computer performance.</td>
<td>ECE 383 and CS 101</td>
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</tbody>
</table>
ECE485 Programmable Logic Controllers  
**Hours 3**  
Programmable Logic Controllers, fundamentals of ladder logic programming and PLC systems, advanced PLC operation, and related topics, including networking, control applications and human-machine interface design.  
Prerequisite(s): ECE 383 and CS 101

ECE486 Embedded Systems  
**Hours 3**  
Integration of microprocessors into digital systems. Includes hardware interfacing, bus protocols and peripheral systems, embedded and real-time operating systems, real-time constraints, networking, and memory system performance.  
Prerequisite(s): ECE 383 and CS 101 Corequisite: ECE 487

ECE487 Embedded Systems Laboratory  
**Hours 1**  
Projects provide hands-on experience in hardware interfacing, system-level design, real-time concepts and memory system performance.  
Prerequisite(s): ECE 383. Corequisite: ECE 486

ECE488 Computational Intelligence  
**Hours 3**  
Computational Intelligence is a discipline that relies on biologically inspired computation to solve real-world problems that otherwise are infeasible or impossible to solve using classical engineering approaches. The course will cover the fundamental techniques of computational intelligence and study practical applications in real-world engineering problems.  
Prerequisite(s): MATH 355 or consent of instructor.

ECE491 Special Problems  
**Hours 1-8**  
Investigation of a problem or problems, usually involving research with a faculty member. Credit is based on the individual assignment.

ECE492 Capstone Design I  
**Hours 2**  
First of a two-course sequence to provide design experience through capstone design, a team-based two-semester-long design project. Also, the first-semester course will include instruction in design methodology, engineering ethics, societal impacts, project economics, and management tools.  
Prerequisite(s): ECE 332  
Prerequisite(s) with concurrency: (ECE 408 and ECE 409) or (ECE 451 and ECE 452) or (ECE 453 and ECE 454) or (ECE 475 and ECE 476) or (ECE 480 and ECE 481) or (ECE 486 and ECE 487)

ECE493 Selected Topics  
**Hours 1-8**  
Special courses in all areas of electrical or computer engineering, offered as the need arises. Credit is based on the course requirements.

ECE494 Capstone Design II  
**Hours 2**  
Second of a two-course sequence to provide design experience through capstone design, a team-based two-semester-long design project.  
Prerequisite(s): ECE 333 and ECE 492