

# COURSES FOR ELECTRICAL ENGINEERING AND COMPUTER ENGINEERING

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## 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.

Prerequisite(s): PH 106 or PH 126, MATH 227 or MATH 247, and MATH 238

### ECE320 Fundmtl 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

Response of circuits to transient signals, both deterministic and random. Laplace transform solution techniques for circuits and differential equations. Relationship between Laplace and Fourier transforms. Frequency response and representation of circuits and systems. Modeling of uncertainty in circuit elements.

Prerequisite(s): ECE 225 and MATH 238 and MATH 355

### ECE327 Audio Networks and Signals

Hours 3

Response of circuits to transient signals, both deterministic and random. Laplace transform and Fourier methods for the solution and modeling of circuits and audio networks. Frequency response and representation of circuits and systems. Modeling of uncertainty in circuit elements. Specific networks and equipment for audio signal processing.

Prerequisite(s): ECE 225 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 106 or PH 126, 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

Computer Science

**ECE399 Undergraduate Research Fellows**

Hours 1-5

The ECE Department offers the opportunity for select undergraduate students to become actively engaged in research and development programs lead by our faculty and graduate students. This opportunity provides undergraduate students with practical research experience, knowledge of modern research practices, and advanced technical skills. Students are evaluated on a pass/fail basis.

Prerequisite(s): Consent of the Instructor.

**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 semiconductor 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

**ECE454 Power Systems Laboratory**

Hours 1

Test and analysis of power systems and machine devices and the design of systems using devices.

Prerequisite(s): ECE 350 and ECE 453

Prerequisite(s) with concurrency: ECE 453

**ECE455 Electromechanical Systems**

Hours 3

Static and dynamic modeling, analysis, and simulation of mechanical, electrical, hydraulic and mixed systems. MATLAB and SIMULINK model development and simulation.

Prerequisite(s): ECE 225 and MATH 238

**ECE461 Quantum Well Elec & Devices**

Hours 3

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.

Prerequisite(s): ECE 330 or PH 253

**ECE462 Semiconductor Optoelectronics**

Hours 3

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.

Prerequisite(s): PH 253

**ECE463 Magnetic Materials & Devices**

Hours 3

Diamagnetism and Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism, magnetic anisotropy, domains and the magnetization process, fine particles and thin films and magnetization dynamics.

Prerequisite(s): ECE 340

**ECE466 Fund of Nanotechnology**

Hours 3

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).

Prerequisite(s): ECE 330 or PH 253

**ECE475 Control Systems Analysis**

Hours 3

Classical and modern feedback control system methods; stability; Bode, root locus, state variables and computer analysis.

Prerequisite(s): ECE 326

**ECE476 Control Systems Lab**

Hours 1

Practical analysis and design of feedback control systems and components; electrical, mechanical and electromechanical systems.

Prerequisite(s): ECE 326

Prerequisite(s) with concurrency: ECE 475

**ECE479 Digital Control Systems**

Hours 3

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.

Prerequisite(s): MATH 237 and ECE 370 and ECE 475

**ECE480 Digital Systems Design**

Hours 3

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.

Prerequisite(s): ECE 383. Corequisite: ECE 481

**ECE481 Digital Systems Design Lab**

Hours 1

Logic design and simulation via hardware description languages, use of electronic design automation tools, and CPU design.

Prerequisite(s): None. Corequisite: ECE 480

Prerequisite(s) with concurrency: ECE 480

**ECE482 Comp Visn Dig Image Proc**

Hours 3

Introduction to computer vision and digital image processing with an emphasis on image representation, transforms, filtering, compression, boundary detection and pattern matching.

Prerequisite(s): MATH 355 and ECE 285

**ECE483 Introduction to Machine Learning**

Hours 3

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.

Prerequisite(s): MATH 355 or consent of instructor.

**ECE484 Computer Architecture**

Hours 3

Basic computer organization, computer arithmetic, assembly language, machine language, simple and pipelined central-processor organization, memory system hierarchy, and measuring computer performance.

Prerequisite(s): ECE 383

**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

**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. 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 333 and 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

Prerequisite(s) with concurrency: ECE 333

**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 492

**ECE508 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, system performance analysis.

Prerequisite(s): ECE 370 and MATH 355

**ECE509 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 MATH 355

Prerequisite(s) with concurrency: ECE 508

**ECE530 Solid State Devices**

Hours 3

Solid state physics for semiconductor devices, PN junction, metal semiconductor, 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

**ECE538 Integr 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. Oral presentation and advance analytical work required.

**ECE539 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, thin film characterization techniques.

Prerequisite(s): ECE 225 or PH 253

**ECE540 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

**ECE551 Power Electronics**

Hours 3

Detailed study on the theory and operation of power electronic converters and systems. Overview of enabling power semiconductor switching devices. Introduction to feedback control of converters. Machine drives fundamentals.

Prerequisite(s): ECE 332 and ECE 350

**ECE552 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 350 and ECE 332

Prerequisite(s) with concurrency: ECE 551

**ECE553 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

**ECE554 Power Systems Laboratory**

Hours 1

Test and analysis of power systems and machine devices and the design of systems using devices.

Prerequisite(s): ECE 350

Prerequisite(s) with concurrency: ECE 553

**ECE555 Electromechanical Systems**

Hours 3

Static and dynamic modeling, analysis, and simulation of mechanical, electrical, hydraulic, and mixed systems. MATLAB and SIMULINK model development and simulation.

Prerequisite(s): ECE 225 and MATH 238

**ECE561 Quantum Well Elec & Devices**

Hours 3

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, quantum-well intersubband photodetectors.

Prerequisite(s): ECE 330 or PH 253

**ECE562 Semiconductor Optoelectronics**

Hours 3

Elemental and compound semiconductors; fundamentals of semiconductors physical properties, solid state physics, optical recombination and absorption, light emitting diodes, quantum well lasers, quantum dots lasers, blue lasers, semiconductor modulators, photodetectors, semiconductor solar cells and semiconductor nanostructure devices.

Prerequisite(s): PH 253

**ECE563 Magnetic Materials & Devices**

Hours 3

Diamagnetism and Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism, magnetic anisotropy, domains and the magnetization process, fine particles and thin films, magnetization dynamics.

Prerequisite(s): ECE 340

**ECE579 Digital Control Systems**

Hours 3

Frequency and time domain methods in discrete time control systems; sampling of continuous-time signals, stability, transform design techniques, state variable analysis, and design techniques.

**ECE580 Digital Systems Design**

Hours 3

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, digital system design examples and applications.

**ECE581 Digital Systems Design Lab**

Hours 1

Logic design and simulation via hardware description languages, use of electronic design automation tools, and CPU design.

**ECE582 Comp Visn Dig Image Proc**

Hours 3

Introduction to computer vision and digital image processing with an emphasis on image representation, transforms, filtering, compression, boundary detection, and pattern matching.

Prerequisite(s): MATH 355 and CS 124

**ECE584 Adv Computer Architect**

Hours 3

Computer architectures, computer design, memory systems design, parallel processing concepts, supercomputers, networks, and multiprocessing systems.

**ECE585 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

**ECE586 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 distributed process control.

Prerequisite(s): ECE 383. Corequisite: ECE 587

**ECE587 Embedded Systems Laboratory**

Hours 1

Design and implementation experience with microcontrollers, interfacing, digital control systems, bus protocols and peripheral systems, real-time constraints, embedded and real-time operating systems, distribution process control.

Prerequisite(s): ECE 383 Corequisite: ECE 586

**ECE588 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.

**ECE593 Special Topics**

Hours 1-5

Advanced topics of a specialized nature.

**ECE598 Non-Thesis Research**

Hours 1-6

*No description available*

**ECE599 Thesis Research**

Hours 1-12

*No description available*

**ECE637 Fund Solid State Engineering**

Hours 3

Fundamentals of solid state physics and quantum mechanics are covered to explain the physical principles underlying the design and operation of semiconductor devices. The second part covers applications to semiconductor microdevices and nanodevices such as diodes, transistors, lasers and photodetectors incorporating quantum structures.

Prerequisite(s): PH 253

**ECE662 Advanced Nanoscience**

Hours 3

Advanced quantum physics; basics of nanotechnology, molecular and nanoelectronics; fundamentals in nanophotonics; interaction of light and matter; nanostructure characterization; bionanotechnology.

Prerequisite(s): PH 253

**ECE663 Spin Electronics**

Hours 3

Electron spin. Giant magnetoresistance theory. Spin-tunneling phenomena in magnetic tunneling junctions. Spin structure to spin electronics. Image of magnetization configuration. Magnetic materials for spin electronic devices. Spin transport to design of magnetic nanodevices.

Prerequisite(s): ECE 463 or ECE 563

**ECE693 Special Topics**

Hours 1-9

Advanced topics of a specialized nature.

**ECE699 Dissertation Research**

Hours 1-12

*No description available*