

ELECTRICAL & COMP ENGINEERING (ELC)

ELC 2130 Electrical Circuit Laboratory (1)

Co-requisite(s): ELC 2330

Laboratory experience in electrical circuit design using discrete components, standard bench equipment, and simulation in modern CAD software.

ELC 2137 Digital Logic Design Laboratory (1)

Co-requisite(s): ELC 2337

Pre-requisite(s): B or better in EGR 1302

Laboratory experience in digital circuit design using modern CAD tools and programmable logic devices.

ELC 2320 Electric Circuit Theory for non-ECE majors (3)

Pre-requisite(s): B or better in EGR 1302; C or better in MTH 1322; C or better in PHY 1430 or concurrent enrollment

Linear circuit elements, sources, Kirchhoff's laws, mesh and node equations, Thevenin and Norton equivalent circuits, resistive network analysis, sinusoidal steady-state analysis, power, transient analysis of simple circuits. Does not apply toward the degree requirements of Electrical and Computer Engineering majors.

ELC 2330 Electrical Circuit Theory (3)

Co-requisite(s): ELC 2130

Pre-requisite(s): B or better in EGR 1302; C or better in MTH 1322; C or better in PHY 1430 or concurrent enrollment

Linear circuit elements, sources, Kirchhoff's laws, mesh and nodal analysis, Thevenin and Norton equivalent circuits, resistive network analysis, sinusoidal steady-state analysis, AC and DC power, transient analysis of RL, RC, and RLC circuits.

ELC 2337 Digital Logic Design (3)

Co-requisite(s): ELC 2137

Pre-requisite(s): B or better in EGR 1302

Boolean algebra, number systems and representations, analysis and design of combinational and sequential logic circuits, minimization, small- and medium-scale integrated devices, programmable logic, and simulation of digital circuits. (3-0).

ELC 2V97 Special Topics or Project (1-3)

Cross-listed as EGR 2V97

Pre-requisite(s): Consent of department chair

This course provides the opportunity for recognition of supervised, non-research, academic experiences that are in addition to degree requirements. Registration requires approval by the department chair and sponsoring faculty member. The determination of degree credits is at the time of registration. One to three hours.

ELC 3114 Electronic Design Laboratory (1)

Pre-requisite(s): C or better in ELC 2130; C or better in ELC 3314 or concurrent enrollment

Laboratory experience in electronic design.

ELC 3314 Electronic Design (3)

Pre-requisite(s): C or better in CHE 1301; C or better in ELC 2330; C or better in ELC 3335 or concurrent enrollment; C or better in ELC 3114 or concurrent enrollment

Analysis and design of analog and digital electronic circuits using diodes, bipolar transistors, and field effect transistors. Design and application of digital and analog circuits.

ELC 3331 Electrical Networks and Systems (3)

Pre-requisite(s): C or better in ELC 2330

AC circuits and power, magnetically coupled circuits, analysis of networks and systems by Laplace and Fourier transform and state-variable methods, two-port networks, frequency response and network functions, transmission lines, and 3-phase ac power.

ELC 3335 Signals and Systems (3)

Pre-requisite(s): C or better in ELC 2330; C or better in MTH 2311; C or better in MTH 3325

Analysis of signals and systems in the time domain using differential equations and convolution with the impulse response, and in the frequency domain using Fourier series, Fourier transforms and Laplace transforms with transfer functions.

ELC 3336 Microprocessor Systems (3)

Pre-requisite(s): C or better in ELC 2337; C or better in CSI 1430

Program development of microprocessor systems using assembly and C/C++ programming languages. Topics include processor architecture, data representation, exceptions, I/O devices, memory management, and real-time operating system principles.

ELC 3337 Applied Electromagnetic Fields (3)

Pre-requisite(s): C or better in ELC 2330

Vector description of the electric and magnetic properties of free space (using the laws of Coulomb, Ampere, and Faraday). Maxwell's electromagnetic field equations. Wave propagation in unbounded regions, reflection and refraction of waves, waveguides, and transmission lines.

ELC 3338 Computer Organization (3)

Cross-listed as CSI 3338

Pre-requisite(s): C or better in ELC 3336 or C or better in CSI 3439

Introduction to the organization and design of general purpose digital computers. Topics include instruction sets, CPU structures, hardwired and microprogrammed controllers, memory, I/O systems, hardware description languages and simulations.

ELC 4311 Advanced Logic Design (3)

Pre-requisite(s): C or better in ELC 3338 or concurrent enrollment

Computer-automated design of digital circuits. Functional specification; structural and behavioral modeling using hardware description languages; simulation for design verification and timing analysis; circuit synthesis for FPGA implementation; testing and fault diagnosis.

ELC 4318 Avionics System Design (3)

Cross-listed as AVS 4318

Design of avionics systems for civil and military aircraft. Topics include avionics system technology and architectures; system engineering principles; radar, electro-optical, and radio frequency sensors; displays; and communication and navigation systems.

ELC 4320 Introduction to Optics (3)

Pre-requisite(s): C or better in ELC 3335

Geometrical optics, electromagnetic waves, diffraction, interference, polarization, Fourier optics, laser fundamentals, and optical communication basics. Laboratory sessions include semiconductor laser measurement, fiber optic coupling, and Michelson interferometer setup.

ELC 4321 Computational Photonics (3)

Pre-requisite(s): C or better in ELC 3337

This course provides an introduction to the computational methods for optics and photonics. Topics include applied numerical methods, electromagnetism, optical waveguides, and the finite-difference time-domain method. Matlab program and commercial software will be used to model different photonic devices.

ELC 4322 Integrated Photonics (3)

Pre-requisite(s): C or better in ELC 3337

This course provides an introduction to wave propagation, optical waveguide theory, and integrated photonic devices. Topics include dispersion, nonlinearity, dielectric slab waveguides, fiber optics, nanophotonic devices, and nanofabrication techniques. Students will learn fundamentals of scanning electron microscopy, atomic force microscopy, and focused ion beam technologies. It includes a hands-on simulation component using photonic design software.

ELC 4323 Solid-State Materials (3)

Pre-requisite(s): C or better in ELC 3337

Investigation of the materials used in electrical and optical devices, including metals, insulators, and semiconductors. Topics include crystal structure, quantum theory, band structure, thermal, electrical, and optical properties, and dielectric, magnetic, and superconducting properties of solids.

ELC 4324 Semiconductor Devices (3)

Pre-requisite(s): C or better in ELC 3337 and Senior Standing

Topics will include an introduction to semiconductor materials (optical and electronic properties), p-n junctions, transistors, bipolar junction transistors, field effect transistors, light-emitting diodes, lasers, and photodetectors.

ELC 4325 Fundamentals of Lasers (3)

Pre-requisite(s): C or better in ELC 3337 and Senior Standing

Introduction to the principles of operation of lasers, including interaction of light and matter, spontaneous and stimulated emission, optical gain and absorption, population inversion, optical resonators, laser rate equations, waveguides, Gaussian beams and wave propagation, and characteristics and applications of specific lasers, including gas lasers and semiconductor lasers.

ELC 4329 Introduction to Microfabrication (3)

Pre-requisite(s): C or better in EGR 3380

Introductory course on microfabrication processes with emphasis on hands-on training in the cleanroom at the BRIC. Students will learn key microfabrication processes and get trained on cleanroom equipment used to fabricate semiconductor devices, photonic devices, microfluidic devices, and microelectromechanical systems (MEMS).

ELC 4330 Introduction to Robotics (3)

Cross-listed as ME 4330

Pre-requisite(s): C or better in MTH 2321; C or better in MTH 3325

Analysis of robot manipulators, including forward and inverse kinematics, rigid-body rotation parameterizations, velocity kinematics, path planning, nonlinear dynamics, single and multi-variable control.

ELC 4331 Electric Machines and Drives (3)

Pre-requisite(s): C or better in ELC 3314; C or better in ELC 3337

Introduction to electric motors and drives systems. Topics covered include dc machines, ac machines, permanent magnet machines and emerging machines topologies and their associated power electronic motor drives. Course will also cover the transformer as a static electric machine as well as linear electric machine configurations. Application specific requirements and design considerations will be covered.

ELC 4332 Automatic Control Systems (3)

Pre-requisite(s): C or better in ELC 3335

Analysis and design of linear feedback control systems. Laplace transforms, transfer functions, signal-flow graphs, electrical and mechanical system modeling, state variables, system stability, time-domain response, root-locus method, Nyquist criterion, and compensator design. Laboratory exercises to illustrate course concepts.

ELC 4335 Systems Modeling and Control (3)

Pre-requisite(s): C or better in ELC 2320 or C or better in ELC 2330; C or better in ME 4325

Modeling, analysis, design, and control of dynamic systems involving mechanical, electrical, thermal, and fluid components. System behavior in time and frequency domains, state-space formulation, feedback control.

ELC 4340 Power Systems (3)

Pre-requisite(s): C or better in ELC 3335

Analysis of power systems, including energy sources, transmission lines, power flow, transformers, transmission and distribution systems, synchronous generators, stability, power system controls, short-circuit faults, and system protection.

ELC 4345 Power Electronics (3)

Pre-requisite(s): C or better in ELC 3314; C or better in 3114

Introduction to power electronic systems with emphasis on power control and switching circuits for AC/DC, DC/DC, and DC/AC converters. Associated laboratory component.

ELC 4350 Principles of Communication (3)

Pre-requisite(s): C or better in ELC 3335; C or better in STA 3381

Signal analysis, modulation techniques, random signals and noise, digital transmission, information theory, coding.

ELC 4351 Digital Signal Processing (3)

Pre-requisite(s): C or better in ELC 3335; C or better in STA 3381

Discrete-time signals and systems, sampling theory, z-transforms, spectral analysis, filter design, applications, and analysis and design of discrete signal processing systems. Credit cannot be earned for ELC 4351 if credit is earned for BME 4452.

ELC 4353 Image Formation and Processing (3)

Cross-listed as BME 4353

Pre-requisite(s): C or better in ELC 3335 or concurrent enrollment; C or better in STA 3381

Introduction to image formation systems that provide images for medical diagnostics, remote sensing, industrial inspection, nondestructive materials evaluation and optical copying. Image processing, including image enhancement, analysis, and compression. Student specialization through assignments and project.

ELC 4357 Cardiovascular Engineering and Instrumentation (3)

Cross-listed as BME 4357, EGR 4357, ME 4357

See BME 4357 for course information.

ELC 4360 Software Systems (3)

Pre-requisite(s): C or better in ELC 3336

Software engineering methods and tools. Topics include the development lifecycle, requirements, specifications, design, implementation, verification, validation, and maintenance, project management and professional ethics.

ELC 4362 Wireless Sensor Networks (3)

Pre-requisite(s): C or better in ELC 3338; C or better in ELC 3314; or consent of instructor

Characterization and design of large-scale wireless sensor networks. Topics include wireless channel utilization, media access protocols, routing, energy management, synchronization, localization, data aggregation, and security. Laboratory exercises using wireless sensor devices, cross-development, and real-time operating systems.

ELC 4366 Quantum Mechanics for Engineers (3)

Pre-requisite(s): C or better in MTH 2311; C or better in MTH 3325; C or better in STA 3381

We will explore the surprising behaviors found in the quantum world, basic principles of wave functions, and the application of quantum mechanics in systems such as quantum harmonic oscillators, semiconductors, quantum-dot cellular automata, quantum computing, and quantum communication. We also learn to use linear algebra as a description for quantum systems, since this is important in the realms of quantum computing and molecular computing.

ELC 4367 Introduction to Quantum Computing (3)

Pre-requisite(s): C or better in MTH 2311; C or better in STA 3381

This course introduces the student to quantum information processing. First, linear algebra is established as the mathematical language for describing quantum computing. Then, several quantum information algorithms are demonstrated, building up to Shor's famous algorithm for defeating a widely-used classical encryption scheme. Alternate models of quantum computing, classical computing, and quantum communication also are discussed.

ELC 4372 Bioinstrumentation (3)

Cross-listed as BME 4372

Pre-requisite(s): C or better in ELC 2330

Principles of biomedical instrumentation and their real-world applications. Emphasis on understanding the basic design principles and technologies used in bioelectrical, biomechanical, and clinical instrumentation.

ELC 4377 Solar Energy (3)

Cross-listed as ME 4377

Pre-requisite(s): C or better in ELC 2330; C or better in ME 2345

A first course in the principles of solar energy collection, conversion and storage. Topics include solar photovoltaic and thermal collectors, sun-earth geometry, ground and sky radiation models, and balance-of-system components including stratified tanks, pumps, and power inverters. Students will learn industry-standard TRNSYS energy modeling software.

ELC 4378 Introduction to Biosensors (3)

Cross-listed as BME 4378

Pre-requisite(s): C or better in EGR 3380

Introductory course on Biosensors. Topics to be covered in this course are electrochemical sensors, immunosensors, Lab-on-a-chip biosensors, and photonic biosensors for the detection of biomolecules for the medical diagnosis.

ELC 4381 Antennas and Wireless Propagation I (3)

Pre-requisite(s): C or better in ELC 3337

Fundamentals of radiation and propagation, antenna parameters, linear antennas, linear and planar phased arrays, and microstrip antennas. Analysis and design principles, simulation and measurement.

ELC 4383 RF/Microwave Circuits I (3)

Pre-requisite(s): C or better in ELC 3337

Introduction to passive RF, microwave, and wireless circuit design. Topics include transmission line theory; network analysis; impedance matching techniques; design of resonators, couplers, and filters; diodes; mixers; and principles and techniques of microwave measurements.

ELC 4384 RF/Microwave Circuits II (3)

Pre-requisite(s): C or better in ELC 4383

This is a second course in radio-frequency and microwave circuits covering microwave amplifier and oscillator design. Topics include the ZY Smith chart, matching network design, gain calculations, design for amplifier stability, noise figure and low-noise amplifier design, gain matching, and negative resistance oscillator design. A final project will require the design, simulation, construction, and testing of an amplifier using microwave CAD tools and hands-on measurements.

ELC 4396 Special Topics in Electrical or Computer Engineering (3)

Pre-requisite(s): Consent of department chair

Study of advanced topics in electrical or computer engineering. This course may be repeated once under a different topic.

ELC 4438 Embedded Systems Design (4)

Pre-requisite(s): C or better in ELC 3336

Design and implementation of embedded computer systems using microcontrollers, sensors and data conversion devices, actuators, visual display devices, timers, and applications specific circuits. Software design using microprocessor cross-development systems and real-time operating system principles.

ELC 4V97 Special Projects in Electrical or Computer Engineering (1-6)

Pre-requisite(s): Consent of department chair

Advanced topics and/or special project activities in electrical or computer engineering.