

ELECTRICAL ENGINEERING (4400)

4400:101 Tools for Electrical Engineering (3 Credits)

Corequisite: 3450:221 or 3450:149. Orientation to degree programs and design practice in electrical and computer engineering. Introduction to computer applications and resources for engineering studies.

4400:230 Circuits I Laboratory (1 Credit)

Corequisite: 4400:231. Computation, computer aided circuit analysis, circuit theorem confirmation, report writing to include data analysis and reduction, introduction to electrical measurements.

4400:231 Circuits I (3 Credits)

Corequisite: 4400:230, 3450:223, 3650:292. DC and AC linear circuit analysis. Operational amplifier circuits. Loop and nodal analyses. Network theorems. Phasor techniques, steady-state AC power, three-phase systems.

4400:301 Undergraduate Research I: Electrical Engineering (1 Credit)

Prerequisites: 4400:230, 4400:231, 4400:330, 4400:332, 4450:220, [4400:101 or 4450:101] with a combined average grade of 3.0 or higher, admission to an engineering major within the College of Engineering and Polymer Science, and permission. Research project, supervised by faculty member of the department; requires oral research presentation and written report.

4400:302 Undergraduate Research II: Electrical Engineering (1 Credit)

Prerequisites: [4400:301 or 4450:301], admission to an engineering major within the College of Engineering and Polymer Science, and permission. Research project, supervised by faculty member of the department; requires oral research presentation and written report.

4400:303 Undergraduate Research III: Electrical Engineering (1 Credit)

Prerequisites: [4400:302 or 4450:302], admission to an engineering major within the College of Engineering and Polymer Science, and permission. Research project, supervised by faculty member of the department; requires oral research presentation and written report to the department, and presentation of work in a research venue outside the department.

4400:304 Undergraduate Research IV: Electrical Engineering (1 Credit)

(May be repeated. May not be applied to degree requirements.)

Prerequisite: 4400:303 or 4450:303, and permission. Research project, supervised by faculty member of the department; requires oral research presentation and written report.

4400:307 Basic Electrical Engineering (4 Credits)

Prerequisite: 3650:292; corequisite: 3450:335. Covers fundamental aspects of electrical circuits, electronics and electrical machinery. Not open to an electrical or computer engineering major.

4400:309 Design Project Seminar - Electrical Engineering (1 Credit)

Prerequisites: Junior or higher standing and admission to an engineering major within the College of Engineering and Polymer Science. Pre/ Corequisites: 4400:341, 4400:354, 4400:361, 4400:371, and 4400:381. Engineering capstone project selection and proposal, including preliminary technical specifications. Professional ethics. Intellectual property. Societal impact issues in engineering design.

4400:330 Circuits II Laboratory (1 Credit)

Corequisite: 4400:332. Computation, computer aided circuit analysis, circuit theorem confirmation, report writing to include data analysis and reduction, intermediate electrical measurements.

4400:332 Circuits II (3 Credits)

Prerequisite: 4400:231 with a grade of C- or better. Corequisites: 3450:335 and 4400:330. Coupled magnetic circuits. Transient and frequency domain analyses of linear circuits. Bode plots, Laplace transforms, transfer functions, resonance, passive and active filters.

4400:340 Signals & Systems (4 Credits)

Prerequisites: [3460:209 or 4450:208 or 4800:220], 3450:335 with a grade of C- or better, 4400:332 with a grade of C- or better, and admission to an engineering major within the College of Engineering and Polymer Science. Linear systems theory and transform analysis techniques for continuous and discrete systems. Convolutions, Laplace transforms, continuous and discrete Fourier transforms. Difference equations and Z transforms.

4400:341 Introduction to Communication Systems (3 Credits)

Prerequisites: 4400:340 and admission to an engineering major within the College of Engineering and Polymer Science. Introduces analog and digital communication systems and signal processing. Time-sampling and filtering. Modulation and demodulation techniques. Noise and bandwidth requirements. System design and performance analysis.

4400:353 Electromagnetics I (4 Credits)

Prerequisites: 4400:231 and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: 3450:335. Vector analysis. Electrostatics: electrostatic field, scalar potential, dielectrics, boundary-value problems. Magnetostatics: magnetic circuits. Maxwell's equations: Faraday's law, time-harmonic fields. Introduction to plane waves.

4400:354 Electromagnetics II (3 Credits)

Prerequisites: 4400:353 and admission to an engineering major within the College of Engineering and Polymer Science. Theory and application of transmission lines: transient and steady-state waves. Plane EM waves: propagation, reflection, and refraction. Waveguides open and closed-boundary guiding structures.

4400:360 Physical Electronics (3 Credits)

Prerequisites: 4400:332, 4450:220 and admission to an engineering major within the College of Engineering and Polymer Science. PN junction, diffusion, tunneling, FET and BJT device physics, equivalent circuits for electronic devices, time and frequency analysis, biasing and logic families.

4400:361 Electronic Design (4 Credits)

Prerequisites: 4400:340, 4400:360 and admission to an engineering major within the College of Engineering and Polymer Science. Power amplification, feedback, oscillators, linear integrated circuits, modulation and demodulation circuits.

4400:371 Control Systems I (4 Credits)

Prerequisites: 4400:340 and admission to an engineering major within the College of Engineering and Polymer Science. Introduction to servomechanisms and feedback. Modeling and response of feedback control systems. Stability of linear systems. Experiments include analog simulation and basic servomechanism.

4400:381 Energy Conversion (4 Credits)

Prerequisites: 4400:332 and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: 4400:353. Nonelectrical to electrical energy conversions and vice versa: thermal, chemical, solar. Fundamentals of electromechanical energy conversion. Principles of operation of transformers, commutator machines, induction and synchronous machines.

4400:401 Senior Design Project I - Electrical Engineering (3 Credits)

Prerequisites: 4400:309, senior standing, admission to an engineering major within the College of Engineering and Polymer Science, and 4400:341, 4400:354, 4400:361, 4400:371, and 4400:381 with a combined average grade of 2.0 or higher. Design and preparation phase of an engineering team project. System specification, design, and simulations; ordering of components; subsystem implementations. Requires project presentations and report.

Gen Ed: - Capstone

4400:402 Senior Design Project II - Electrical Engineering (3 Credits)

Prerequisite: 4400:401 and admission to an engineering major within the College of Engineering and Polymer Science. Implementation and evaluation phases of an engineering design project. Requires a project presentation and report.

Gen Ed: - Complex Issues Facing Society

4400:434 Active Circuits (3 Credits)

Prerequisite: 4400:340. Applications of operational amplifiers including bilinear transfer functions, scaling, cascade design, biquad circuits, lowpass, high pass, bandpass-filters, Butterworth and Chebyshev response, sensitivity, delay filters, frequency transformations, ladder design, simulated element design, leapfrog simulation and switched-capacitors.

4400:441 Digital Communication (3 Credits)

Prerequisite: 4400:341 or 4450:440. Introduction to digital communications theory and systems. Sampling, formatting and baseband communications. Digital modulation techniques and optimal receivers. Error performance analysis. Error control.

4400:445 Wireless Communications (3 Credits)

Prerequisite: 4400:341 or 4450:440. Theory and analysis of wireless communication systems, wireless propagation, multiple access, modulation, demodulation, multipath channel characterization, diversity, cellular and PCS services and standards.

4400:447 Random Signals (3 Credits)

Prerequisite: 4400:340. Applications of set theory, discrete and continuous sample spaces; probability, random variables, distribution functions, density functions, stochastic processes, random signals, system function, power spectrum and correlation functions.

4400:448 Optical Communication Networks (3 Credits)

Prerequisites: 4400:360. Optical waveguides and integrated components. Optical transmitters and receivers. Optical communications network design.

4400:451 Electromagnetic Compatibility (3 Credits)

Prerequisite: 4400:360. Introduction to electromagnetics, electromagnetic compatibility, crosstalk and effects on computers, communication lines and systems.

4400:453 Antenna Theory (3 Credits)

Prerequisite: 4400:354. Theory of EM radiation. Wire antennas, arrays, receiving antennas, reciprocity. Integral equations for induced currents, self and mutual impedances. Equivalence principle, radiation from aperture antennas.

4400:455 Microwaves (4 Credits)

Prerequisite: 4400:354. Dynamic fields, Maxwell's equation and wave equations. Field analysis of wave guides, microwave components, techniques and systems.

4400:461 Optical Electronics & Photonic Devices (3 Credits)

Prerequisites: 4400:360. Lightwave engineering, photonic principles and optical electronic device technology.

4400:469 Introduction to Sensors and Actuators (3 Credits)

Prerequisite: Senior standing or permission. Introduction to the theory and practice of sensors and actuators; sensing and actuation technologies; performance, and interfacing.

4400:472 Control Systems II (4 Credits)

Prerequisite: 4400:371. Sampled-data control system analysis and design. Discrete-time representation of sampled-data systems. Cascade, feedforward and state-variable compensation techniques. Digital computer implementation.

4400:481 Modern Power Systems (3 Credits)

Prerequisite: 4400:381. Introduction to electricity utility load flow, faulty analysis, stability, surge protection and relaying.

4400:483 Power Electronics I (3 Credits)

Prerequisite: 4400:360. Steady-state analysis and design of power electronic converters: AC/DC converters (rectifiers), DC/DC converters, DC/AC PWM and resonant converters, AC/AC converters and cycloconverters.

4400:484 Power Electronics Laboratory & Design Project (2 Credits)

Prerequisite: 4400:483, 4400:583 or equivalent. Experiments on different types of power electronic converters: AC/DC, DC/DC, DC/AC, and AC/AC. Design project to include design, simulation, building, and testing of a power electronic circuit.

4400:485 Electric Motor Drives (3 Credits)

Prerequisite: 4400:381. Application of electric machines, choice of motor for particular drive. Application of power semiconductor circuits in electric machinery.

4400:486 Dynamics of Electric Machines (3 Credits)

See department for course description.

4400:487 Electromagnetic Design of Electric Machines (3 Credits)

See department for course description.

4400:488 Control of Machines (4 Credits)

See department for course description.

4400:489 Electric and Hybrid Vehicles (3 Credits)

Prerequisite: 4400:381. Basic principles of electric and hybrid vehicles. Characteristics of electric machines, internal combustion engines, transmissions, batteries, fuel cells, ultracapacitors. Vehicle control strategies, communication networks, and overall system integration.

4400:498 Special Topics: Electrical Engineering (1-3 Credits)

(May be taken more than once) Prerequisite: Permission of department chair. Special topics in electrical engineering.