ELECTRICAL ENGINEERING (ELEN)

ELEN:101 Tools for Electrical Engineering (3 Credits)
Pre/Corequisite: MATH 221 or MATH 149. Orientation to degree programs and design practice in electrical and computer engineering. Introduction to computer applications and resources for engineering studies. (Formerly 4400:101)

ELEN:230 Circuits I Laboratory (1 Credit)
Pre/Corequisite: ELEN 231. Computation, computer aided circuit analysis, circuit theorem confirmation, report writing to include data analysis and reduction, introduction to electrical measurements. (Formerly 4400:230)

ELEN:231 Circuits I (3 Credits)
Pre/Corequisite: ELEN 230, MATH 223, PHYS 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. (Formerly 4400:231)

ELEN:301 Undergraduate Research I: Electrical Engineering (1 Credit)
Prerequisites: ELEN 230, ELEN 231, ELEN 330, ELEN 332, CPEN 220, [ELEN 101 or CPEN 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. (Formerly 4400:301)

ELEN:302 Undergraduate Research II: Electrical Engineering (1 Credit)
Prerequisites: [ELEN 301 or CPEN 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. (Formerly 4400:302)

ELEN:303 Undergraduate Research III: Electrical Engineering (1 Credit)
Prerequisites: [ELEN 302 or CPEN 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. (Formerly 4400:303)

ELEN:304 Undergraduate Research IV: Electrical Engineering (1 Credit)
(May be repeated. May not be applied to degree requirements.)
Prerequisite: ELEN 303 or CPEN 303, and permission. Research project, supervised by faculty member of the department; requires oral research presentation and written report. (Formerly 4400:304)

ELEN:307 Basic Electrical Engineering (4 Credits)
Prerequisite: PHYS 292. Pre/Corequisite: MATH 335. Covers fundamental aspects of electrical circuits, electronics and electrical machinery. Not open to an electrical or computer engineering major. (Formerly 4400:307)

ELEN: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: ELEN 341, [ELEN 350 or ELEN 354], ELEN 361, ELEN 371, and ELEN 381. Engineering capstone project selection and proposal, including preliminary technical specifications. Professional ethics. Intellectual property. Societal impact issues in engineering design. (Formerly 4400:309)

ELEN:330 Circuits II Laboratory (1 Credit)
Pre/Corequisite: ELEN 332. Computation, computer aided circuit analysis, circuit theorem confirmation, report writing to include data analysis and reduction, intermediate electrical measurements. (Formerly 4400:330)

ELEN:332 Circuits II (3 Credits)
Prerequisite: ELEN 231 with a grade of C- or better. Pre/Corequisites: MATH 335 and ELEN 330. Coupled magnetic circuits. Transient and frequency domain analyses of linear circuits. Bode plots, Laplace transforms, transfer functions, resonance, passive and active filters. (Formerly 4400:332)

ELEN:340 Signals & Systems (4 Credits)
Prerequisites: [CPSC 209 or CPEN 208 or CPEN 210 or BMEN 220], MATH 335 with a grade of C- or better, ELEN 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. (Formerly 4400:340)

ELEN:341 Introduction to Communication Systems (3 Credits)
Prerequisites: ELEN 340 with a grade of C- or better 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. (Formerly 4400:341)

ELEN:350 Engineering Electromagnetics (4 Credits)
Prerequisites: MATH 223, ELEN 231 and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisite: MATH 335. Vector analysis. Electrostatics: electrostatic field, scalar potential, dielectrics, boundary-value problems. Magnetostatics: Ampere's law, force and energy. Faraday's law, time-harmonic fields. Maxwell's equations: Introduction to plane waves. Propagation, reflection, and refraction, introduction to the concept of guided waves. Theory and application of transmission lines: transient and steady-state waves. The Smith chart. (Formerly 4400:350)

ELEN:360 Physical Electronics (3 Credits)
Prerequisites: ELEN 332 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. (Formerly 4400:360)

ELEN:361 Electronic Design (4 Credits)
Prerequisites: ELEN 340, ELEN 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. (Formerly 4400:361)

ELEN:371 Control Systems I (4 Credits)
Prerequisites: ELEN 340 with a grade of C- or better 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. (Formerly 4400:371)

ELEN:381 Energy Conversion (4 Credits)
Prerequisites: ELEN 332 and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisite: ELEN 350 or ELEN 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. (Formerly 4400:381)

ELEN:401 Senior Design Project I - Electrical Engineering (3 Credits)
Prerequisites: ELEN 309, senior standing, admission to an engineering major within the College of Engineering and Polymer Science, and ELEN 341, [ELEN 354 or ELEN 350], ELEN 361, ELEN 371, and ELEN 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. (Formerly 4400:401)
Gen Ed: - Capstone

ELEN:402 Senior Design Project II - Electrical Engineering (3 Credits)
Prerequisite: ELEN 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. (Formerly 4400:402)
Gen Ed: - Complex Issues Facing Society

ELEN:434 Active Circuits (3 Credits)
Prerequisite: ELEN 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. (Formerly 4400:434)

ELEN:441 Digital Communication (3 Credits)
Prerequisite: ELEN 341 or CPEN 440. Introduction to digital communications theory and systems. Sampling, formatting and baseband communications. Digital modulation techniques and optimal receivers. Error performance analysis. Error control. (Formerly 4400:441)

ELEN:445 Wireless Communications (3 Credits)
Prerequisite: ELEN 341 or CPEN 440. Theory and analysis of wireless communication systems, wireless propagation, multiple access, modulation, demodulation, multipath channel characterization, diversity, cellular and PCS services and standards. (Formerly 4400:445)

ELEN:447 Random Signals (3 Credits)
Prerequisite: ELEN 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. (Formerly 4400:447)

ELEN:448 Optical Communication Networks (3 Credits)
Prerequisites: ELEN 360. Optical waveguides and integrated components. Optical transmitters and receivers. Optical communications network design. (Formerly 4400:448)

ELEN:451 Electromagnetic Compatibility (3 Credits)
Prerequisite: ELEN 360. Introduction to electromagnetics, electromagnetic compatibility, crosstalk and effects on computers, communication lines and systems. (Formerly 4400:451)

ELEN:453 Antenna Theory (3 Credits)
Prerequisite: ELEN:350 or ELEN: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. (Formerly 4400:453)

ELEN:455 Microwaves (4 Credits)
Prerequisite: ELEN 354. Dynamic fields, Maxwell's equation and wave equations. Field analysis of wave guides, microwave components, techniques and systems. (Formerly 4400:455)

ELEN:461 Optical Electronics & Photonic Devices (3 Credits)
Prerequisites: ELEN 360. Lightwave engineering, photonic principles and optical electronic device technology. (Formerly 4400:461)

ELEN: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. (Formerly 4400:469)

ELEN:472 Control Systems II (4 Credits)
Prerequisite: ELEN 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. (Formerly 4400:472)

ELEN:481 Modern Power Systems (3 Credits)
Prerequisite: ELEN 381. Introduction to electricity utility load flow, faulty analysis, stability, surge protection and relaying. (Formerly 4400:481)

ELEN:483 Power Electronics I (3 Credits)
Prerequisite: ELEN 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. (Formerly 4400:483)

ELEN:484 Power Electronics Laboratory & Design Project (2 Credits)
Prerequisite: ELEN 483, ELEN 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. (Formerly 4400:484)

ELEN:485 Electric Motor Drives (3 Credits)
Prerequisite: ELEN 381. Application of electric machines, choice of motor for particular drive. Application of power semiconductor circuits in electric machinery. (Formerly 4400:485)

ELEN:486 Dynamics of Electric Machines (3 Credits)
See department for course description. (Formerly 4400:486)

ELEN:487 Electromagnetic Design of Electric Machines (3 Credits)
See department for course description. (Formerly 4400:487)

ELEN:488 Control of Machines (4 Credits)
See department for course description. (Formerly 4400:488)

ELEN:489 Electric and Hybrid Vehicles (3 Credits)
Prerequisite: ELEN 381. Basic principles of electric and hybrid vehicles. Characteristics of electric machines, internal combustion engines, transmissions, batteries, fuel cells, ultracapcators. Vehicle control strategies, communication networks, and overall system integration. (Formerly 4400:489)

ELEN:498 Special Topics: Electrical Engineering (1-3 Credits)
(May be taken more than once) Prerequisite: Permission of department chair. Special topics in electrical engineering. (Formerly 4400:498)