ELECTRICAL AND COMPUTER ENGINEERING

The Department of Electrical and Computer Engineering (https://www.uakron.edu/engineering/ECE/) offers undergraduate programs leading to the Bachelor of Science in Electrical Engineering and the Bachelor of Science in Computer Engineering, along with both the Associate of Applied Science and Bachelor of Science in Electrical and Electronic Engineering Technology. The department also offers graduate programs leading to a Master of Science in Electrical and Computer Engineering, and an interdisciplinary Doctor of Philosophy in Engineering.

Information specific to the available program options in electrical engineering and computer engineering is available:

- Assured Digital Microelectronics, Certificate (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/assured_digital_microelectronics_certificate/)
- Computer Engineering, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/computer-engineering-bs/)
- Digital Electronics & Microprocessors, Certificate (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/digital_electronics_microprocessors/)
- Electrical and Electronic Engineering Technology, AAS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/electronic-engineering-technology-aas/)
- Electrical and Electronic Engineering Technology, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/electronic-engineering-technology-bs/)
- Electrical Engineering, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/electrical-engineering-bs/)

Electrical and Electronic Engineering Technology (EEET)

EEET 120 Circuit Fundamentals (4 Units)
Pre/Corequisite: MATH 143, MATH 144, or MATH 145, or higher math or higher math placement. SI units, current, voltage, resistance, Ohm's Law, circuit analysis, network theorems, computer simulation, inductor, capacitor, RLC dc analysis, transients, laboratory support of circuit concepts, ac introduction. (Formerly 2860:120)

EEET 121 Introduction to Electronics and Computers (2 Units)
Pre/Corequisite: MATH 143, MATH 144, or MATH 145, or higher math or higher math placement . Introduces students to computer simulation, Boolean algebra, circuit manufacturing, laboratory practices, and to the electronics industry. (Formerly 2860:121)

EEET 122 AC Circuits (4 Units)
Prerequisite: EEET 120. Pre/Corequisite: MATH 154, MATH 149 or higher math or higher math placement. Sinusoidal voltage and current, reactance and impedance, methods of AC circuit analysis, AC power, transformers, AC meters and oscilloscopes, dependent and independent sources. (Formerly 2860:122)

EEET 123 Electronic Devices (4 Units)
Prerequisite: EEET 120. Physical theory, characteristics and operational parameters of solid-state devices. Analysis and design of electronic circuits incorporating these devices, utilizing characteristic curves and linear modeling. (Formerly 2860:123)

EEET 210 Industrial Control Panel Fabrication (2 Units)
Pre/Corequisite: MATH 143, MATH 144, or MATH 145, or higher math or higher math placement. This course will introduce students to shop fabricating skills involved in the creation of electrical control panels using mechanical and electrical fabricating tools. (Formerly 2860:210)

EEET 225 Applications of Electronic Devices (4 Units)
Prerequisites: EEET 122 and EEET 123. Frequency response, filter concepts, electronic amplifiers, power amplifiers, multistage amplifiers, differential amplifiers, operational amplifiers, voltage regulators, feedback and oscillators, special devices, computer simulation analysis. (Formerly 2860:225)

EEET 237 Digital Circuits (4 Units)
Prerequisite: EEET 121 or MATH 208. Devices used in logic circuits, interfacing, combinational logic, arithmetic circuits, encoders, multiplexers, programmable logic devices, flip-flops, counters, shift registers, computer modeling of digital circuits. (Formerly 2860:237)

EEET 238 Microprocessor Applications (4 Units)
Prerequisite: EEET 237. Programmable logic devices, computer modeling of digital circuits, memory circuits. Computer architecture, programming the microprocessor, microprocessor hardware, microprocessor applications, parallel I/O and programmable timers. (Formerly 2860:238)

EEET 242 Machinery & Controls (3 Units)
Prerequisite: EEET 120 or EEET 370. Introductory study of DC and AC motors and their control. Ladder logic input devices, relays, and motor starters are explored as applied to starting DC & AC 3 Phase Induction motors. Variable Frequency Drives and Softstarts are applied with various control input schemes to AC 3 Phase Induction motors. Application of Programmable Logic Controllers and Human Machine Interfaces to the control of AC 3 Phase Induction motors. (Formerly 2860:242)

EEET 251 Electronic Communications (4 Units)
Prerequisite: EEET 225. Resonance, coupling, filters, oscillators, mixers, power amplifiers, AM, FM, receivers. (Formerly 2860:251)

EEET 260 Electrical and Electronic Project (2 Units)
Prerequisites: EEET 225 and EEET 242. Design, construction, and testing of an electrical or electronic circuit of choice. Progress reports, oral, and a poster presentation required. Discussion of electrical and electronic design, fabrication, and troubleshooting techniques. (Formerly 2860:260)

EEET 290 Special Topics: Electronic Engineering Technology (1-4 Units)
Prerequisite: Permission of instructor. Directed study in a special field of interest chosen by the student in consultation with the instructor(may be repeated for a total of six credits). (Formerly 2860:290)

EEET 310 National Electrical Code and Electrical System Design (3 Units)
Prerequisite: EEET 122 or EEET 370. This course provides students with the skills necessary to apply the National Electrical Code (NFPA 70) to the design and installation of electrical systems and circuits. (Formerly 2860:310)

EEET 350 Advanced Circuit Theory (3 Units)
Pre/Corequisite: MATH 356 or MATH 335. Nodal, mesh, Thevenin, and dependent sources in resistive circuits. Inductor and capacitor as time domain elements. First- and second-order circuit analysis. Phasor analysis. Operational amplifier analysis. (Formerly 2860:350)

EEET 352 Microcontrollers (4 Units)
Prerequisite: EEET 238. Corequisite: EEET 350. Using a typical microcontroller, study its architecture, program it, use subroutines and interrupts, use it in various applications, utilize various on-board modules including analog-to-digital, and timers. (Formerly 2860:352)

EEET 354 Advanced Circuits Applications (3 Units)
Prerequisites: [MATH 335 or MATH 356] and EEET 350. Introduction to calculus based circuit analysis. Emphasizing Laplace transforms in operational circuit analysis, transfer functions, impulse function, Bode diagrams, Fourier Series. (Formerly 2860:354)

EEET 360 Virtual Instrumentation and Data Acquisition (3 Units)
Prerequisites: EEET 122 and EEET 370. An introduction to instrumentation, data acquisition (DAQ) and graphical programming used in manufacturing and laboratory environments. (Formerly 2860:360)

EEET 370 Survey of Electronics (3 Units)
Prerequisite: MATH 154, MATH 149 or higher math or placement in higher math. Fundamentals of DC and AC electrical circuits and rotating machinery. For non-Electrical and Electronic Engineering Technology majors. (Formerly 2860:370)

EEET 400 Computer Simulations in Technology (3 Units)
Prerequisites: [MATH 335 or MATH 356] and [EEET 122 or EEET 370]. Introduce the use of software widely used in industry to simulate and study electrical circuits and signals. Methods of data sampling, management and presentation will be studied. (Formerly 2860:400)

EEET 402 Advanced Programmable Logic Controllers and Sensors (3 Units)
Prerequisite: MCET 405. Application of programmable logic controllers (PLCs) and single loop controllers to the analog control of industrial processes including variable frequency drives. Industrial sensors including temperature, flow, level, pressure, vacuum and weight. Signal scaling, open loop control and closed loop on/off, min/max process variable control and PID control. Application of PLCs in an industrial control network and the application of HMIs. The application of Process Meters in process control environment will be explored.

EEET 406 Communication Systems (3 Units)
Prerequisites: EEET 251 and EEET 354. Digital communications, transmission lines, waveguides, microwave devices and antennas. (Formerly 2860:406)

EEET 420 Biomedical Electronic Instrumentation (3 Units)
Prerequisite: EEET 354. Introduction to electrical signals from the body, transducers, recording devices, telemetry, microprocessor applications, and electrical safety of medical equipment. (Formerly 2860:420)

EEET 451 Industrial Electrical Systems (3 Units)
Prerequisite: EEET 354. Electric power, industrial nameplates, power factor correction, mutual inductance, linear transformers, power transformers, polyphase systems, per-phase analysis, system grounding, protective device coordination computer-aided analysis. (Formerly 2860:451)

EEET 452 Advanced Microcontrollers (3 Units)
Prerequisite: EEET 352. This is an advanced embedded programming class for technologists covering structured programming, embedded operating systems, multitasking, semaphores and queues, WiFi, HTML and web page servers, data servers, clocks and scheduling, sending email, WAN access, Bluetooth, and UDP communication. Hands-on hardware includes LEDs, RGB LED strands, DAC/DMA audio generation, PIR proximity sensors, and may optionally include inertial sensors. (Formerly 2860:452)

EEET 453 Control Systems (4 Units)
Prerequisites: MCET 405 and [EEET 354 or ELEN 332]. Modeling and responses of closed-loop systems. Laplace transforms, root-locus analysis. Stability, compensation, digital control, optimal control. Digital computer in system simulation and design. System application using PLC analog programing and PID control. (Formerly 2860:453)

EEET 455 Senior Project (2 Units)
Prerequisites: Admission to the BS in Electrical Engineering Technology and EEET 354. Capstone experience consisting of Electrical or Electronic Project emphasizing creative technical analysis or design and presentation. (may be repeated for a total of six credits). (Formerly 2860:455)
Gen Ed: Capstone

EEET 490 Special Topics: Electronic Engineering Technology (1-4 Units)
Prerequisite: Permission of instructor. Directed study in a special field of interest chosen by the student in consultation with the instructor (may be repeated for a total of six credits). (Formerly 2860:490)

EEET 497 Senior Honors Project: Electronic Technology (1-3 Units)
Prerequisites: Senior standing in Honors Program, permission of department preceptor, and major in electronic technology. Independent research leading to completion of Senior Honors Thesis or other original work. (May be repeated for a total of six credits) (Formerly 2860:497)

Electrical Engineering (ELEN)

ELEN 101 Tools for Electrical Engineering (3 Units)
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 Unit)
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 Units)
Pre/Corequisite: MATH 223 and 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 Unit)
Prerequisites: [ELEN 101 or CPEN 101], [ELEN 230, ELEN 231, ELEN 330, ELEN 332, CPEN 221, and CPEN 222 each with a grade of B or better], 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 (2 Units)
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 307 Basic Electrical Engineering (3 Units)
Prerequisite: PHYS 292. Pre/Corequisite: MATH 335. 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 Unit)
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 362 or ELEN 361], [ELEN 370 or ELEN 371], and [ELEN 380 or 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 Unit)
Prerequisite: ELEN 230. 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 Units)
Prerequisite: ELEN 231 with a grade of C- or better. Pre/Corequisite: MATH 335. 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 Units)
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 Units)
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 Units)
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 Units)
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 Units)
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 362 Electronic Design (3 Units)
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.

ELEN 370 Control Systems I (3 Units)
Prerequisites: ELEN 340 with a grade of C- or better and admission to an engineering major within the College of Engineering and Polymer Science. Modeling and response of control systems. Stability of linear systems. Feedback control design using time-domain, s-domain, and frequency-domain methods.

ELEN 371 Control Systems I (4 Units)
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 376 Electronics and Controls Lab (1 Unit)
Prerequisite: Admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisites: ELEN 362 and ELEN 370. Component modeling, design, and laboratory implementation of feedback circuits and control systems.

ELEN 380 Energy Conversion (3 Units)
Prerequisites: ELEN 332 and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisite: ELEN 350. Fundamentals of electromechanical energy conversion. Principles of operation of transformers, commutator machines, induction and synchronous machines.

ELEN 381 Energy Conversion (4 Units)
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 382 Energy Conversion Lab (1 Unit)
Pre/Corequisite: ELEN 380. Laboratory exercises to complement lecture course ELEN 380. Transformer modeling. Electrical and mechanical measurements of AC and DC motor and generator configurations. Safe laboratory practices.

ELEN 401 Senior Design Project I - Electrical Engineering (2 Units)
Prerequisites: ELEN 309, senior standing, admission to an engineering major within the College of Engineering and Polymer Science, and [ELEN 341, [ELEN 350 or ELEN 354], [ELEN 362 or ELEN 361], [ELEN 370 or ELEN 371], and [ELEN 380 or ELEN 381] all with a grade of C or better]. 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 Units)
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)

ELEN 434 Active Circuits (3 Units)
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 Units)
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 Units)
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 Units)
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 Units)
Prerequisites: ELEN 360. Optical waveguides and integrated components. Optical transmitters and receivers. Optical communications network design. (Formerly 4400:448)

ELEN 451 Electromagnetic Compatibility (3 Units)
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 Units)
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 Units)
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 Units)
Prerequisites: ELEN 360. Lightwave engineering, photonic principles and optical electronic device technology. (Formerly 4400:461)

ELEN 469 Introduction to Sensors and Actuators (3 Units)
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 Units)
Prerequisite: ELEN 370 or 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 Units)
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 Units)
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 Units)
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 Units)
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 Units)
See department for course description. (Formerly 4400:486)

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

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

ELEN 489 Electric and Hybrid Vehicles (3 Units)
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 Units)
(May be taken more than once) Prerequisite: Permission of department chair. Special topics in electrical engineering. (Formerly 4400:498)

Computer Engineering (CPEN)

CPEN 101 Tools for Computer Engineering (3 Units)
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 4450:101)

CPEN 208 Programming for Engineers (3 Units)
Prerequisite: ELEN 101 or permission. Introduction to programming. Environment and tools. C programming language. Machine level data forms and organization. (Formerly 4450:208)

CPEN 210 Computational Problem Solving (3 Units)
Pre/Corequisites: [CPEN 208 or CPSC 209] and MATH 335. Elements of computation required for modeling and analysis of engineering systems. Complex algebra, linear systems of equations, numerical calculus, difference and differential equations, solution of nonlinear equations. (Formerly 4450:210)

CPEN 221 Digital Logic Design (3 Units)
Pre/Corequisites: ELEN 101 or CPEN 101 or BMEN 101. Boolean algebra and simplification of logic functions. Combinational and sequential circuits. Finite-state machine descriptions. (Formerly 4450:221)

CPEN 222 Digital Logic Design Laboratory (1 Unit)
Pre/Corequisite: CPEN 221. Design of digital systems with hardware description language and simulation. (Formerly 4450:222)

CPEN 301 Undergraduate Research I: Computer Engineering (1 Unit)
Prerequisites: [ELEN 101 or CPEN 101], [ELEN 230, ELEN 231, ELEN 330, ELEN 332, CPEN 221, and CPEN 222 each with a grade of B or better], 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 4450:301)

CPEN 302 Undergraduate Research II: Computer Engineering (2 Units)
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 4450:302)

CPEN 309 Design Project Seminar - Computer Engineering (1 Unit)
Prerequisites: Junior or higher standing and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisites: CPEN 420, CPEN 422, [CPSC 426 or CPEN 325], ELEN 340, and ELEN 360. Engineering capstone project selection and proposal, including preliminary technical specifications. Professional ethics. Intellectual property. Societal impact issues in engineering design. (Formerly 4450:309)

CPEN 320 Computer Systems (3 Units)
Prerequisites: [CPSC 209 or CPEN 208] and [CPEN 220 or CPEN 221 or MATH 208]. Introduces the design and architecture of modern computer systems. Data and instruction representation. Conventional computer organization. Hardware and software design processes. The hardware/software interface. (Formerly 4450:320)

CPEN 325 Operating Systems Concepts (3 Units)
Prerequisites: CPEN 320, CPSC 210. Processes and threads. Process communication and resource sharing. Deadlock resolution. Memory management. File systems. Introduction to network operating systems. (Formerly 4450:325)

CPEN 401 Senior Design Project I - Computer Engineering (2 Units)
Prerequisites: CPEN 309, senior standing, admission to an engineering major within the College of Engineering and Polymer Science, and [CPEN 420, CPEN 422, [CPEN 325 or CPSC 426], ELEN 340, and ELEN 360 with a grade of C or better in each]. 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 4450:401)
Gen Ed: Capstone

CPEN 402 Senior Design Project II - Computer Engineering (3 Units)
Prerequisites: CPEN 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 4450:402)

CPEN 410 Embedded Scientific Computing (3 Units)
Prerequisites: [CPEN 208 or CPSC 209] and ELEN 340. Fixed point, floating point representation and coding. Processor/DSP implementations. Assemblers, C language semantics. Adapting scientific library routines for embedded use. Minimizing complexity. Ill-conditioned problems. (Formerly 4450:410)

CPEN 415 System Simulation (3 Units)
Prerequisite: ELEN 371 or CPEN 440. Computer simulation of dynamic systems. Discrete system stability, linear multistep and Runge-Kutta methods, nonlinear systems, stiff systems, distributed systems and real-time computing. (Formerly 4450:415)

CPEN 420 Computer Systems Design (3 Units)
Prerequisite: CPEN 320. Design of advanced processors at the microarchitecture level. Pipelining. Superscalar, vector and VLIW architectures. Instruction-level parallelism. Compiler support. Multiprocessor architectures. (Formerly 4450:420)

CPEN 422 Embedded Systems Interfacing (3 Units)
Prerequisites: [CPSC 209 or CPEN 208], [CPEN 221 or CPEN 220], ELEN 332 and admission to an engineering major within the College of Engineering and Polymer Science. Microcontroller structures and embedded peripherals. Interfaces to physical environments. Software access to peripherals including timers, ADCs and DACs. Synchronous and asynchronous communications. Interrupts. Real-time operating systems. (Formerly 4450:422)

CPEN 427 Computer Networks (3 Units)
Prerequisite: CPEN 320; CPEN 325 or CPSC 426. Network architecture and protocol layering. Network design principles, communication protocols, and performance measures. Socket programming, routing, error detection and correction, access control, multimedia networking. (Formerly 4450:427)

CPEN 440 Digital Signal Processing (3 Units)
Prerequisites: ELEN 340 and admission to an engineering major within the College of Engineering and Polymer Science. Signal sampling and reconstruction; data-converter models. Unilateral and bilateral z transforms. Discrete Fourier Transform (DFT); Fast Fourier Transform (FFT). Digital filter structures and design methods. (Formerly 4450:440)

CPEN 450 Hardware Security and Trust (3 Units)
Prerequisite: CPEN 221 or EEET 237. Design, implementation, and deployment of secure and trustworthy hardware platforms, including chips, boards, and systems. Adversarial attack mechanisms and system vulnerabilities. Countermeasures to mitigate attacks. Hands-on experiments.

CPEN 462 Analog Integrated Circuit Design (3 Units)
Prerequisite: ELEN 360. CMOS processes and layout; amplifiers, current mirrors, and comparators; current, voltage, and bandgap references; switched capacitor circuits. Frequency and noise analysis techniques. (Formerly 4450:462)

CPEN 465 Programmable Logic (3 Units)
Prerequisites: [CPEN 220 or {CPEN 221 and CPEN 222}], and [CPSC 209 or CPEN 208]. Digital design with programmable devices. PLD and FPGA architectures. Logic design and technology mapping tools. (Formerly 4450:465)

CPEN 466 VLSI Design (3 Units)
Prerequisites: ELEN 360 and admission to an engineering major within the College of Engineering and Polymer Science. Digital logic circuits. Very large scale integration (VLSI) fabrication processes and layout design. Delay and power of digital circuits. Latches and flip-flops in VLSI. Memory design. System-level design issues. Design project. (Formerly 4450:367)

CPEN 467 VLSI Circuits & Systems (3 Units)
Prerequisite: CPEN 367. High performance adders and multipliers for very large scale integration (VLSI) systems. Architectural synthesis. Design for high performance, low power, and testability. (Formerly 4450:467)

CPEN 498 Special Topics: Computer Engineering (1-3 Units)
(May be taken more than once) Prerequisite: Permission of department chair. Special topics in computer engineering. (Formerly 4450:498)