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 Engineering, and an interdisciplinary Doctor of Philosophy in Engineering.

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

- Computer Engineering, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/engineering-computer-bs/)
- Computer Engineering, Co-op Option, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/engineering-computer-co-op-bs/)
- Electrical Engineering, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/electrical-engineering-bs/)
- Electrical Engineering, Co-op Option, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/electrical-computer/electrical-engineering-co-op-bs/)

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

- Electrical and Electronic Engineering Technology, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/engineering-science-technology/electronic-engineering-technology-bs/)

Electrical and Electronic Engineering Technology (2860)

2860:120 Circuit Fundamentals (4 Credits)
Prerequisite: 2030:152 or permission. 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.

2860:121 Introduction to Electronics and Computers (2 Credits)
Prerequisite: 2030:151. Introduces students to computer simulation, Boolean algebra, circuit manufacturing, laboratory practices, and to the electronics industry.

2860:122 AC Circuits (4 Credits)
Prerequisite: 2860:120. Corequisite: 2030:154. Sinusoidal voltage and current, reactance and impedance, methods of AC circuit analysis, AC power, transformers, AC meters and oscilloscopes, dependent and independent sources.

2860:123 Electronic Devices (4 Credits)
Prerequisite: 2860:120. 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.

2860:210 Industrial Control Panel Fabrication (2 Credits)
Prerequisite: 2030:152. This course will introduce students to shop fabricating skills involved in the creation of electrical control panels using mechanical and electrical fabricating tools.

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

2860:237 Digital Circuits (4 Credits)
Prerequisite: 2860:121. 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.

2860:238 Microprocessor Applications (4 Credits)
Prerequisite: 2860:237. 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.

2860:242 Machinery & Controls (3 Credits)
Prerequisite: 2860:120 or 2860:370. 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.

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

2860:260 Electronic Project (2 Credits)

2860:290 Special Topics: Electronic Engineering Technology (1-4 Credits)
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).

2860:310 National Electrical Code and Electrical System Design (3 Credits)
Prerequisite: 2860:122 or 2860:370. 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.

2860:350 Advanced Circuit Theory (3 Credits)
2860:352 Microcontrollers (4 Credits)  
Prerequisite: 2860:238. Corequisite: 2860:350. 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.

2860:354 Advanced Circuits Applications (3 Credits)  

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

2860:370 Survey of Electronics I (3 Credits)  

2860:371 Survey of Electronics II (3 Credits)  
Prerequisite: 2860:370. Survey of the most commonly used solid state circuit components including typical applications. Introduction into digital circuits and microprocessor applications. For non-Electronic Technology majors.

2860:400 Computer Simulations in Technology (3 Credits)  
Prerequisites: 2030:345 and 2860:354. 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.

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

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

2860:451 Industrial Electrical Systems (3 Credits)  
Prerequisite: 2860:354. 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.

2860:453 Control Systems (4 Credits)  

2860:455 Senior Project (2 Credits)  
Prerequisite: Senior standing. 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).

Gen Ed: - Capstone

2860:490 Special Topics: Electronic Engineering Technology (1-4 Credits)  
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).

2860:497 Senior Honors Project: Electronic Technology (1-3 Credits)  
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)

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)  

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)  

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)

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)

4400:354 Electromagnetics II (3 Credits)

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)

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)

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)

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)

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.

Computer Engineering (4450)

4450:101 Tools for Computer 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.

4450:208 Programming for Engineers (3 Credits)
Prerequisite: 4400:101 or permission. Introduction to programming. Environment and tools. C programming language. Machine level data forms and organization.

4450:220 Digital Logic Design (4 Credits)

4450:301 Undergraduate Research I: Computer Engineering (1 Credit)
Prerequisites: completion of [4400:101 or 4450:101], 4400:230, 4400:231, 4400:330, 4400:332 and 4450:220 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.

4450:302 Undergraduate Research II: Computer 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.

4450:303 Undergraduate Research III: Computer 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.

4450:304 Undergraduate Research IV: Computer Engineering (1 Credit)
(May be repeated. May not be applied to degree requirements.)
Prerequisite: 4450:303 or 4450:303, and permission. Research project, supervised by faculty member of the department; requires oral research presentation and written report.

4450:309 Design Project Seminar - Computer Engineering (1 Credit)
Prerequisites: Junior or higher standing and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Co-requirements: [3460:426 or 4450:325], 4450:367, [4450:420 or 4450:427], 4450:422, and 4450:440. Engineering capstone project selection and proposal, including preliminary technical specifications. Professional ethics. Intellectual property. Societal impact issues in engineering design.

4450:320 Computer Systems (3 Credits)
Prerequisite: 3460:209 or 4450:208, 4450:220 or 3450:208. 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.

4450:325 Operating Systems Concepts (3 Credits)

4450:367 VLSI Design (3 Credits)
Prerequisites: 4400:360 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.

4450:401 Senior Design Project I - Computer Engineering (3 Credits)
Prerequisites: 4450:309, senior standing, admission to an engineering major within the College of Engineering and Polymer Science, and completion of [3460:426 or 4450:325], 4450:367, [4450:420 or 4450:427], 4450:422, and 4450:440 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
**4450:402 Senior Design Project II - Computer Engineering (3 Credits)**
Prerequisites: 4450:401 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

**4450:410 Embedded Scientific Computing (3 Credits)**

**4450:415 System Simulation (3 Credits)**

**4450:420 Computer Systems Design (3 Credits)**

**4450:422 Embedded Systems Interfacing (3 Credits)**
Prerequisites: [3460:209 or 4450:208] and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: 4400:360. 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.

**4450:427 Computer Networks (3 Credits)**
Prerequisite: 4450:320; 4450:325 or 3460:426. Network architecture and protocol layering. Network design principles, communication protocols, and performance measures. Socket programming, routing, error detection and correction, access control, multimedia networking.

**4450:440 Digital Signal Processing (3 Credits)**
Prerequisites: 4400:340 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.

**4450:462 Analog Integrated Circuit Design (3 Credits)**
Prerequisite: 4400:360. CMOS processes and layout; amplifiers, current mirrors, and comparators; current, voltage, and bandgap references; switched capacitor circuits. Frequency and noise analysis techniques.

**4450:465 Programmable Logic (3 Credits)**
Prerequisite: 4450:220, 3460:209 or 4450:208. Digital design with programmable devices. PLD and FPGA architectures. Logic design and technology mapping tools.

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

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