ELECTRICAL AND COMPUTER ENGINEERING

(330) 941-3012

This program offers coursework leading to the Bachelor of Engineering with a major in electrical engineering. Traditional, computer/digital, and biomedical options are available. The first courses in the electrical and computer engineering are ECEN 1521 Digital Circuits and ECEN 1521L Digital Circuits Laboratory, and are available to all University students without prerequisites. Visit the office or website for details.

Mission

The Electrical and Computer Engineering program is committed to academic excellence, and it provides educational opportunities in electrical and computer engineering. We provide students at baccalaureate and master levels with diverse and comprehensive educational experiences which meet the highly demanding standards required by industry and preparation for further education.

We utilize the resources of the university and interact with industry to evaluate, optimize, and upgrade our teaching, research, scholarship, service and facilities to continue offering a high-standard educational environment. We promote students' intellectual growth to become fully developed, informed, and productive in order to serve themselves and their local and global communities effectively.

Program Educational Objectives

The Electrical and Computer Engineering program at Youngstown State University offers students a high standard of engineering education. In fulfillment of its mission, as well as the missions of the College of Science, Technology, Engineering, and Mathematics, and the University, the following Program Educational Objectives are established for the Electrical Engineering Program.

Within a few years of graduation, our graduates should:

- Competently design, analyze, test, and implement systems, devices, and processes in the field of electrical engineering within the constraints set by the client and by society, and disseminate the results. (SO--1,2,3,6)
- Commit to practicing engineering ethically and responsibly, both individually and within diverse teams, while holding paramount the impact of engineering decisions on society and ecology. (SO--1,2,4,5)
- Pursue career-long growth through continued learning in their engineering profession and/or pursuit of post graduate education, and to demonstrate leadership and influence within their profession. (SO--3,5,7)

Student Outcomes

The following (1 through 7) Student Outcomes support the program educational objectives. Attainment of these outcomes by students by the time of their graduation prepares graduating students to enter the professional practice of engineering.

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Electrical Engineering Annual Enrollment and Graduation Data

The Electrical Engineering BE Program has been accredited by the engineering accreditation commission of ABET (http://www.abet.org).

Laboratory Facilities

The Electrical and Computer Engineering program maintains well-equipped laboratory facilities for circuits, electronics, communications, electromagnetics, energy conversion, power systems, control systems, and digital systems. PC computing and wireless networking are available, as well as various licensed software packages.

Professional Practice

The Electrical and Computer Engineering program participates in the College of STEM Professional Practice Program.

Students who complete course and internship requirements related to the field may receive up to 2 s.h. of credit toward ECEN elective courses. Contact the department for details.

Tracks

Traditional, computer/digital, and biomedical options with design projects, computer simulation, and hands-on laboratory sessions are the pillars of the Bachelor of Engineering with a major in electrical engineering. These features provide students with the opportunity to prepare for a vast array of entry-level positions or advanced studies.

With faculty assistance, students tailor their programs to meet their educational objectives. This individualized approach includes choices of options and elective courses, participation in a co-op, and semester-by-semester scheduling of courses.

Traditional TRACK

The traditional option:

COURSE	TITLE	S.H.
Electrical Engineering Core		53
Other Engineering		11
Math		18
Science		15
Writing and Speech		9
General Education Courses		18
Total Semester Hours		**124**

Computer/digital TRACK

The computer/digital option:

COURSE	TITLE	S.H.
Electrical Engineering Core		41
Other Engineering		11
Computer Engineering/Science		19
Math		18
Science		15

Writing and Speech	9
General Education Courses	18
Total Semester Hours	**131**

Biomedical TRACK

The biomedical option:

COURSE	TITLE	S.H.
Electrical Engineering Core		41
Other Engineering		11
Math		18
Science including Biology and Organic Chemistry		32
Writing and Speech		9
General Education Courses		18
Total Semester Hours		**129**

Students in any of these options can participate in the co-op program. Scheduling is reasonably flexible, but there are some restrictions.

Course Scheduling

Scheduling of courses will depend upon your particular situation. Are you working part time? Will you pursue an internship? Do you wish a full or part-time academic pursuit of the degree? Answers to these questions will affect your scheduling of courses. The Electrical and Computer Engineering program attempts to schedule junior and senior courses to accommodate these situations.

Advising is mandatory, and students are required to meet with their department advisors to choose their semester-by-semester courses. Also, up-to-date recommended schedule and curriculum lists are available on-line and at the department office.

For more information, visit **Electrical Engineering Major (https://ysu.edu/ academics/science-technology-engineering-mathematics/electrical-engineering-major/).**

Chair

Frank Xiying Li, Ph.D., Professor, Chair

Professor

Sina Bakhtar Chavari, Ph.D., Assistant Professor

Vamsi Borra, Ph.D., Assistant Professor

Guy Gadola, Ph.D., Assistant Professor

Siqing Wei, Ph.D., Assistant Professor

Lecturer

Edward Burden, M.S., Senior Lecturer

Subashini DeSilva, M.S., Lecturer

Teresa Ren, M.S., Lecturer

Ghasan Salim, Ph.D., Lecturer

Baccalaureate Degree

- Electrical Engineering (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-electrical-computer-engineering/electrical-computer-engineering-traditional-option/)

- Traditional Concentration
- Computer Digital Concentration
- Biomedical Concentration

Baccalaureate Degree Graduate Track

- Electrical Engineering, Traditional 4+1 Graduate Track (https:// catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-electrical-computer-engineering/electrical-engineering-traditional-four-plus-one-graduate-track/)
- Electrical Engineering, Computer/Digital 4+1 Graduate Track (https:// catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-electrical-computer-engineering/electrical-engineering-computer-digital-four-plus-one-graduate-track/)
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Minors

- Minor in Electrical and Computer Engineering (https://catalog.ysu.edu/ undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-electrical-computer-engineering/ minor-electrical-computer-engineering/)
- Minor in Mathematics (https://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/ department-mathematics-statistics/mathematics-minor/)

ECEN 1521   Digital Circuits   3 s.h.
Digital concepts and design techniques; number systems, switching algebra, logic gates, truth tables. Combinational logic circuits with an introduction to sequential circuits. Practical applications.
Coreq.: ECEN 1521L.

ECEN 1521L   Digital Circuits Laboratory   1 s.h.
Laboratory exercises to accompany ECEN 1521. Design and testing of combinational and sequential logic circuits. Experiments with digital hardware.

Prereq. or Coreq.: ECEN 1521.

ECEN 1555   Computer Engineering   3 s.h.
Introduction to the personal computer, applications software, technologies, microprocessors, microcomputer programming and applications. Basic operations of digital circuits, interfacing using integrated chips, and analog computers. Experiments accompany lectures, providing practical experience for students.

ECEN 1555H   Honors Computer Engineering   3 s.h.
The personal computer, its components, and the role it plays in control applications, instrumentation, and engineering design. Basic experiments using digital circuits, microcomputers, integrated circuits, and design software integrated into a project with the personal computer and instrumentation.
Prereq. or Coreq.: ENGL 1550H and admission to the Honors Program, or permission of instructor and Director of Honors Program.

ECEN 1560   Electrical Engineering Computing   2 s.h.
Problem solving techniques for the fields of electrical and computer engineering; procedural program development using the C/C++ programming language. Fundamentals of engineering drawing using AutoCAD commercial software packages. One hour lecture, three hours lab. ENGR 1555 may be taken concurrently.
Prereq.: MATH 1571 or concurrent high school technical drawing proficiency or ENGR 1555.

ECEN 2610   Computer Tools for Electrical and Computer Engineering   1 s.h.
Introduction to software packages and resources such as MATLAB, PSpice, and Quartus II for analysis and design of circuits and systems. Prereq. or Coreq.: ECEN 2632 and ECEN 2611.

ECEN 2611   Instrumentation and Computation Lab 1   1 s.h.
Laboratory experiments and computer exercises to accompany ECEN 2632. Laboratory experimentation and basic instrumentation. Computer-aided analysis and simulation.
Prereq. or Coreq.: ECEN 2632.

ECEN 2612   Instrumentation and Computation Lab 2   1 s.h.
Laboratory experiments and computer exercises to accompany ECEN 2633. Laboratory experimentation and basic instrumentation. Computer-aided analysis and simulation.
Prereq.: ECEN 2611.
Prereq. or Coreq.: ECEN 2633.

ECEN 2614   Basics of Electrical Engineering   3 s.h.
Introduction to electrical circuit elements and laws; DC and AC analysis. Introduction to digital devices and circuits with applications. Applications of electromagnetics. Intended for non-electrical engineering majors.
Prereq.: MATH 1571.

ECEN 2632   Basic Circuit Theory 1   3 s.h.
Basic principles of linear circuits. Circuits concepts and laws, methods of analysis, network theorems. Source-resistor circuits. Inductors and capacitors. Analysis of AC circuits using phasors; impedance and admittance. Power calculations in DC and AC circuits.
Prereq. or Coreq.: MATH 1572.

ECEN 2633   Basic Circuit Theory 2   3 s.h.
Continuation of ECEN 2632. First- and second-order transients in RLC circuits. Mutual inductance and transformers. Three-phase circuits. Transform methods in circuit analysis, transfer functions, resonance.
Prereq.: ECEN 2632.
Prereq. or Coreq.: MATH 2673.

ECEN 3710   Signals and Systems   3 s.h.
Operation and analysis of communication, control, and computer systems at the signal level. Computer aided design tools and methods to analyze signals and systems. Continuous and discrete-time transforms. Noise analysis, signal detections, line codes, and multiplexing.
Prereq.: ECEN 2633, ECEN 1521 and MATH 3705.

ECEN 3711   Intermediate Laboratory 1   1 s.h.
Laboratory experiments and computer exercises in the areas of digital and analog electronics and logic and computer circuits. Designed to accompany the co-requisite courses.
Prereq.: ECEN 2612.
Prereq. or Coreq.: ECEN 3733 and ECEN 3771.

ECEN 3712   Intermediate Laboratory 2   1 s.h.
Laboratory experiments and computer exercises in the areas of digital and analog electronics, logic and computer circuits, and electromagnetics. Designed to accompany the co-requisite courses.
Prereq.: ECEN 3711.
Prereq. or Coreq.: ECEN 3742 and either ECEN 3772 or ECEN 3734.

ECEN 3717   Sensor Fundamentals   3 s.h.
Basic principles of sensors such as electro-chemical, -mechanical, -optical, and -thermal transducers. Signal conditioning and smart sensors. Applications to process control and environmental systems.
Prereq.: MATH 3705, and either PHYS 2611 or ECEN 2632.

ECEN 3730   Microprocessors and Microcontrollers   3 s.h.
Organization and structured assembly language programming. Digital controller devices and their relationships to processors and physical environments. Two hours lecture and three hours laboratory per week.
Prereq.: ECEN 3733.

ECEN 3733   Digital Circuit Design   3 s.h.
Modern digital circuit analysis and design. Latches, flip-flops, registers, counters, memories, programmable logic arrays, and arithmetic logic units. Logic gate-level synthesis and computer simulation using CAD tools. Synchronous and asynchronous finite-state machines.
Prereq.: ECEN 1521, ECEN 2633.

ECEN 3734   Computer Design   3 s.h.
Systematic methodologies for digital computer hardware and software designs. VLSI circuits. SOPC, CPLD, and FPGA designs. Hardware description languages.
Prereq.: ECEN 3733.

ECEN 3741   Electromagnetic Fields 1   3 s.h.
Maxwell's equations. Static electric and magnetic fields. Magnetic materials and forces, dielectrics, conductance, capacitance, and inductance. Poisson's and Laplace's equations.
Prereq.: ECEN 2633, prerequisite or concurrent MATH 3705.

ECEN 3742   Electromagnetic Fields 2   3 s.h.
Maxwell's equations. Time varying electric and magnetic fields. Electro-mechanical devices, transmission lines, microwaves. Antennas and radiation.
Prereq.: ECEN 3741.

ECEN 3771   Digital and Analog Circuits 1   3 s.h.
Terminal characteristics of electronic devices such as diodes, BJTs (bipolar junction transistors), FETs (field effect transistors), and operational amplifiers. The design of digital circuits with these devices. Basic bias and small-signal models for analog amplifiers. Computer-aided design and analysis.
Prereq.: ECEN 2633.

ECEN 3772   Digital and Analog Circuits 2   3 s.h.
Continuation of ECEN 3771. Bias and signal modeling for amplifier design. Large-signal, small-signal and DC amplifiers. Single-stage, multistage and power amplifiers. Frequency response. Applications with op amps such as amplifiers, comparators, filters, and oscillators. Computer-aided design and analysis.
Prereq.: ECEN 3771.

ECEN 4803   Linear Control Systems   3 s.h.
System modeling, responses and performance measures. Stability analysis by root locus, Bode, and Nyquist plots. Computer-aided control system design. Compensator design. Three hours lecture per week.
Prereq.: ECEN 2633, ECEN 3712, MATH 3705, MECH 2620.

ECEN 4803L   Linear Control Systems Laboratory   1 s.h.
Laboratory exercises to accompany ECEN 4803. Three hours laboratory per week.1 s.h.
Prereq.: ECEN 2633, ECEN 3712, MATH 3705, MECH 2620.
Prereq. or Coreq.: ECEN 4803.

ECEN 4811   Senior Laboratory   1 s.h.
Laboratory experiments and computer exercises in the areas of applied electromagnetics, energy conversion. Designed to accompany the co-requisite course.
Prereq.: ECEN 3712.
Prereq. or Coreq.: ECEN 4844.

ECEN 4820   5G Wireless Networks   3 s.h.
This course will cover the fundamental aspects of wireless networks, with emphasis on current and next-generation wireless networks. Various aspects of wireless networking will be covered including: Introduction to Wireless networks and technical challenges, Coding and Modulation Techniques, Multiplexing Techniques (SDMA, TDMA, FDMA, CDMA), Cellular Systems (1G, 2G, 3G, 4G, 5G), Wireless LAN/PAN/MAN, Internet of Things.
Prereq. or Coreq.: ECEN 3710.

ECEN 4844   Electromagnetic Energy Conversion   3 s.h.
An examination of lumped electromagnetic parameters with development of theoretical, experimental, and design parameters for electrical energy conversion devices such as transformers, motors, and generators. Typical and special applications.
Prereq.: ECEN 3741 or concurrent: MECH 2620.

ECEN 4851   VLSI System Design   3 s.h.
Basic MOSFET models. Layout of inverters, NAND, NOR, PLA, PAL and ROMs. CMOS process and design rules. VLSI system design methodology and computer EDA tools such as PSpice and layout editors.
Prereq.: ECEN 3771, ECEN 3733.

ECEN 4852   Neural Networks and Robotics   3 s.h.
Principles for control applications and robotics, direct inverse control, neural networks, and fuzzy set theory. Applications including adaptive control, neural networks for motion control and path planning in robotics.
Prereq.: ECEN 3733.

ECEN 4854   Principles of Electromagnetic Compatibility   3 s.h.
Review of electromagnetic theories. Techniques of electromagnetic compatibility in electronic systems and computer hardware. Modeling and simulation of transmission lines and circuits. Electromagnetic discharge and grounding problems for high-frequency applications. Radio-frequency emissions from electronic devices. Shielding techniques to prevent ESD and EMI.
Prereq.: ECEN 3742 and MATH 3705.

ECEN 4855   Advanced Digital Control   3 s.h.
Fundamentals of sampled linear control systems, digital controllers and observers. Analysis techniques including difference and state-variable equations, transfer functions, transforms. Sampling, stability, and discrete approximation.
Prereq.: ECEN 3733.

ECEN 4856   Embedded System Design   4 s.h.
Fundamentals of small-scale and medium-scale embedded systems. Design techniques for processors, timers, input device interfacing, interrupt controllers, and drive circuits. Real-time operating system programming tools. Hardware-software co-designs. Three hours lecture, three hours laboratory.
Prereq.: ECEN 3733.

ECEN 4881   Modern Control System Design   3 s.h.
Advanced control system analysis and design. LQR, pole placement, state observer design. Introduction to system identification and adaptive controllers. MATLAB simulation and real-time implementation of controllers. Three hours lecture, three hours laboratory per week.
Prereq.: ECEN 4803.

ECEN 4899   Senior Design Project   3 s.h.
An electrical/computer engineering design problem is chosen or assigned; students work in teams. Proposals are presented which describe the design problem and approaches to it. The final design is presented in written and oral forms. This capstone course is intended to mimic a typical industrial or research project and includes ethical and economical considerations with the engineering work. Three-hour lecture/discussion per week.
Prereq.: ECEN 4811 and 27 semester hours of ECEN courses.
Gen Ed: Capstone 2024.

ECEN 4899L   Senior Design Project Lab   1 s.h.
Laboratory exercises to accompany ECEN 4899. Three hours laboratory per week.
Prereq.: ECEN 4811 and 27 semester hours of ECEN courses.
Prereq. or Coreq.: ECEN 4899.

ECEN 5800   Special Topics   1-3 s.h.
Special topics, new developments in Electrical Engineering. Subject matter, special prerequisites, and credit hours to be announced in advance of each offering. May be repeated with different subject matter to a maximum of 6 s.h.
Prereq.: Senior standing in Electrical and Computer Engineering.

ECEN 5807   Advanced Digital and Analog Circuits   3 s.h.
Chip circuitry for devices such as BJT, CMOS, and ECL-based digital logic chips. Switching devices such as SCRs, triacs, and timers. Switching power supplies. Power amplifiers. Applications and specifications of off-the-shelf IC devices. Computer-aided design and analysis.
Prereq.: ECEN 3772.

ECEN 5808   Advanced Signals and Systems   3 s.h.
Communication and control system modeling and simulations; signal analysis in continuous-time, discrete-time and frequency domains. Advanced communication system applications.
Prereq.: ECEN 3710 and MATH 3705.

ECEN 5816   Theory and Fabrication of Solid-State Devices   3 s.h.
An introductory study of physical theory, design, and fabrication of discrete devices and integrated circuits. Electronic properties of semiconductors such as carrier concentration, energy gap, mobility, lifetime. Techniques of fabrication such as oxidation, diffusion, alloying ion implantation, metallization, masking.
Prereq.: ECEN 3741 and ECEN 3771.

ECEN 5817   Sensor Design and Application   3 s.h.
Designs and applications for measurement and control; includes electro-chemical, -mechanical, -optical, and -thermal transducers. Signal conditioning and smart sensors.
Prereq.: ECEN 3771 or ECEN 3717.

ECEN 5820   Function, Design, and Application of Medical Imaging Systems   3 s.h.
Introduction to the Physics, Instrumentation, Image Processing Methods used in common medical imaging modalities. Systems covered include X-Ray, CT, Ultrasound, MRI, nuclear medicine, and fluorescence. Primary foci will be system construction as well as image reconstruction and processing. Students will engage in limited hands-on image acquisition and code-based processing.
Prereq.: PHYS 2611 or ECEN 3741.
Prereq. or Coreq.: ECEN 3710.

ECEN 5830   Digital Signal Processing   3 s.h.
Discrete time signals and systems; discrete, fast, and inverse Fourier transforms. Digital filter analysis and design, digital signal processing applications. Two hours lecture, three hours laboratory.
Prereq.: ECEN 3710.

ECEN 5835   Computer Architecture with VHDL   4 s.h.
Use of hardware description languages to design computer components and systems. Arithmetic and logic units, control units, VHDL models for memories and busses, interfacing, transfer design. Survey of modern computer systems.
Prereq.: ECEN 3734.

ECEN 5840   Electric Power Systems   4 s.h.
Modeling of power system components. Power flow, faults, protection systems, and stability problems. Special projects and laboratory experiments including CAD applications for analysis, design, and simulation of power system networks. Three hours lecture, three hours laboratory per week.
Prereq. or Coreq.: ECEN 4844.

ECEN 5850   Communications Applications   3 s.h.
Applicable technologies and "real-world" communication components and systems. Design and analysis tools. Emerging technologies, "killer apps", networking, data acquisition, and convergence.
Prereq.: ECEN 3710 or ECEN 5808.

ECEN 5860   Fundamental of Antenna Design and Application   3 s.h.
Examination of dipole, loop aperture, and microstrip antennas; array theory; radiation resistance, directivity, equivalent circuits, input impedance, and basic transceiver architecture. Investigation of practical applications of antennas and arrays in communications systems, radar systems and airborne navigation systems.
Prereq.: ECEN 3742 grade of "C" or better and 21 s.h. of ECEN courses.

ECEN 5879   Computer-Aided Design   3 s.h.
The design, analysis, and modeling of linear and nonlinear networks and systems using a simulation and modeling computer program. Development and use of library models of devices, subcircuits, and subsystems.
Prereq.: ECEN 2611 and 21 s.h. of ECEN courses.

ECEN 5890   Power Electronics   4 s.h.
SCRs, rectifier circuits, commutation techniques, AC controllers, converters, and inverters. Special projects and laboratory experiments including computer applications for analysis, design, and simulation of power electronics network. Three hours lecture, three hours laboratory per week.
Prereq.: ECEN 3771 and 21 s.h. of ECEN courses.