ENGINEERING

Programs

Bachelor

- Computer Engineering / Bachelor of Science (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/engineering/computer-engineering-bachelor-science/)
- Electrical Engineering / Bachelor of Science (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/engineering/electrical-engineering-bachelor-science/)

Minor

- Computer Engineering / Minor (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/engineering/computer-engineering-minor/)
- Electrical Engineering / Minor (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/engineering/electrical-engineering-minor/)

Non-Degree

- Pre-Electrical and Computer Engineering Program (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/engineering/pre-electrical-computer-engineering-program/)

Courses

ECEN 10000 - Introduction to Electrical and Computer Engineering (3)
This course introduces students to the practice of engineering. It exposes students to the fundamentals of hardware and software systems, and the process of building solutions that meet functional and technical requirements. It gives students an opportunity to hone problem solving skills in the context of a number of team-oriented engineering design activities.
Prerequisite: (MATH 11900 or MATH 19900 or MATH 20400 or MATH 20600 or MATH 20900))
Attributes: Experiential Learning Gen Ed

ECEN 20000 - Engineering Design and Tools (3)
This course introduces students to the processes, tools and techniques of engineering design, including the use of Computer-Aided Design (CAD) tools in various stages of the engineering design process. Major design phases are covered, including requirements analysis, system design of functional and physical architectures, and design verification. Students are introduced to tools for creating 3D models and parts used in project prototyping. CAD graphics modeling topics are covered, including orthographic projection, pictorials, dimensioning, sectioning, tolerances, and assembly drawings.
Prerequisite: MATH 19900 (may be taken concurrently) or MATH 20400 (may be taken concurrently) or MATH 20600 (may be taken concurrently) or MATH 20900 (may be taken concurrently)
Attributes: Experiential Learning Gen Ed

ECEN 21000 - Logic Design (3)
This course provides a modern introduction to logic design and technology. It covers a survey of common combinational circuit components, sequential circuit design and timing analysis and use of modern HDL CAD Tools for digital systems design, synthesis, and simulation. Topics include representation and manipulation of information, combinational and sequential logic fundamentals, digital logic technology, combinational and sequential functions, finite state machines, hardware descriptive language, programmable logic devices, memories, and register transfer logic (RTL) design.
Prerequisite: ECEN 10000 or CPEN 10000

ECEN 22000 - Circuit Analysis 1 (4)
This course provides an in-depth coverage of RLC circuit analysis techniques such as nodal, mesh, superposition, Thevenin and Norton theorems. Other topics include op-amp, RC transient, 2nd order circuit analysis, phasors, transfer functions, bode plots as well as operations of diodes and transistors.
Prerequisite: PHYS 21500 and MATH 23500 and MATH 30500 (may be taken concurrently)

ECEN 22100 - Circuit Analysis 2 (3)
This course focuses on the design and analysis of analog and digital circuits, particularly AC circuits, resonant circuits, two-port networks, filters and polyphase circuits. Other topics include pole-zero analysis, mutual inductance and circuit analysis using Laplace and Fourier techniques.
Prerequisite: ECEN 22000

ECEN 23000 - Signals and Systems (3)
This course provides an introduction to concepts and methodology of linear dynamic systems in relation to discrete- and continuous-time signals. Topics include representation of systems and signals; Fourier, Laplace, and Z-transforms; and convolution. Linear systems are described in terms of inputs and outputs and expressed as transfer functions. Systems are analyzed in the time domain and frequency domain. Filtering and processing of signals will be discussed as application of the theory. System response will be modeled and visualized using simulation software.
Prerequisite: ECEN 22000

ECEN 25000 - Semiconductor Devices (3)
This course covers the material properties of semiconductors, the physics of semiconductor operation, and the operating principles of diodes, bipolar and field-effect transistors, feedback and operational amplifiers and regulated power supplies. Circuit analysis techniques are applied and industry-standard tools and applications are used to model and understand the characteristics, operation, performance and limitations of fundamental electronic devices. Topics include wave-particle duality, semiconductor energy bands, formation of n and p-type carriers, p-n junctions, I-V characteristics, BJT and FET operating modes, and power regulators.
Prerequisite: ECEN 22000 and MATH 30000

ECEN 27000 - Applied Electromagnetics (3)
This course covers electromagnetic fields, including static electric and magnetic fields, energy storage, Maxwell's equations, conductors, insulators, transmission lines, and antennae.
Prerequisite: ECEN 22000 and PHYS 21800 and MATH 30000

ECEN 30000 - Computer Architecture 1 (3)
This course introduces computer architecture through hands-on microcontroller programming and interfacing. Students study CPU organization, instruction set architectures, memory and I/O subsystems, and machine-level programming. Programming assignments and design projects use C and assembly language to develop interrupt-driven, timing-aware embedded applications that integrate software and hardware.
Prerequisite: CPSC 21000 and ECEN 21000

ECEN 31000 - Computer Architecture 2 (3)
This course examines the organization and design of modern computer systems from both hardware and software perspectives. Topics include processor programming models, data representation, assembly language and C programming, memory systems, input/output interfacing, multiprocessing, and computer communication, as well as performance enhancement techniques such as pipelining, instruction-level parallelism, branch prediction, caching, and virtual memory. Students complete hands-on programming and design projects using Linux, C, hardware description languages, CAD tools, and embedded platforms such as the BeagleBone Black, and conclude with a survey of contemporary processor architectures.
Prerequisite: ECEN 30000

ECEN 32000 - Hardware and Software Systems (3)
This course discusses the operation, design and analysis of integrated computing systems, considering both the hardware and software and their impact on each other. The material will be taught from the application perspective of embedded systems. Topics include embedded systems as hardware/software platforms; networks of devices; communication buses; device drivers and interrupts; processes, threads, and tasks; real-time operation systems; embedded software development tools; real-time operating systems; and benchmarking of computer systems.
Prerequisite: ECEN 20000 and ECEN 21000 and ECEN 22000

ECEN 33000 - Digital Communications (3)
This course introduces the fundamental principles of wired and wireless digital communications systems, including conversion of information to digital data, encoding and decoding techniques, and the reliable transmission of digital data. Topics include foundational concepts such as bandwidth and power constraints, digital modulation methods, transceiver design principles, and channel coding. The course also introduces the operation and design of digital communication systems including cellular, sensor, wi-fi and satellite networks, as well as wired systems such as cable, phone and optical modems.
Prerequisite: ECEN 23000 and MATH 22000

ECEN 33500 - Digital Signal Processing (3)
This course covers the fundamental concepts of modern digital signal processing. The course includes topics such as the theory and implementation of fast Fourier transforms, FIR and IIR filter design, and applications of signal processing. DSP hardware and software implementations are covered, as well as DSP simulations through Matlab.
Prerequisite: ECEN 23000

ECEN 34000 - Introduction to VLSI Design (3)
This course covers the basic theories and techniques of Very Large Scale Integrated (VLSI) circuit design and CMOS technology. Topics include standard CMOS fabrication process, CMOS design and layout rules, simulation and testing, low power VLSI techniques, and various design tools and methodologies. Performance impact of VLSI design choices on speed, power consumption, reliability and cost are also covered.
Prerequisite: ECEN 21000 and ECEN 25000

ECEN 35000 - Electronic Circuits (3)
This course covers the analysis and design of analog and digital electronic circuits using bipolar junction transistors and MOS field effect transistors. Students will learn how these devices work and how they can be used to design amplifiers and integrated circuits.
Prerequisite: ECEN 25000

ECEN 37000 - Electromechanics (3)
This course covers power and energy fundamentals, three-phase power, electromagnetic forces and torques, network equivalents, and how electromechanical devices such as motors, generators, and relays work.
Prerequisite: ECEN 22000

ECEN 37500 - Control Systems (3)
This course covers the design and analysis of automatic control strategies for electromechanical systems. It covers traditional and state-space control techniques and computer simulation of such systems.
Prerequisite: ECEN 22000 and ECEN 20000

ECEN 38000 - Electric Power Systems (3)
This course covers the analysis and design of three-phase electric power systems, including the generation, transmission, distribution, and consumption of electric power. It describes the physical and mathematical principles that govern electric power generation and consumption, how to describe the reliability of such systems, and how to model their operation numerically.
Prerequisite: ECEN 22000

ECEN 40000 - Electrical and Computer Engineering Practice (3)
This course prepares the senior Electrical and/or Computer Engineering student for the practical application of engineering principles to the senior design course and professional practice. Various skills that are of vital importance to the professional engineer are covered, including engineering ethics, teamwork, communication skills and problem-solving, with emphasis on the application of systematic design process, product life cycle management and reliability analysis. This course is the first part of the Capstone experience where the Capstone project is researched and developed. It must be taken in the semester directly preceding the semester ECEN 49600 is taken.
Prerequisite: MATH 22000 and (ECEN 22100 or ECEN 31000 or ECEN 32000 or ECEN 38000)

ECEN 41000 - Artificial Intelligence (3)
Topics central to Artificial Intelligence are covered, including knowledge representation, the predicate calculus, goal-directed and data-directed search techniques, and rule-based expert systems. Two languages for problem-solving is presented: LISP and PROLOG.
Prerequisite: MATH 21000 (may be taken concurrently) and CPSC 21000 (may be taken concurrently)

ECEN 45000 - Robotics (3)
This course introduces the student to the modeling, identification, and control of robotic systems. The course focuses on the implementation of identification and control algorithms on a two-link robot. Topics include the mathematical modeling of robotic systems and the analysis, simulation, and implementation of both linear and nonlinear representations of such systems. The design and integration of sensors and actuators and algorithms for responding and controlling these devices will be pursued.
Prerequisite: (ECEN 41000 and CPSC 24500 and CPSC 31500) or CPSC 47000

ECEN 47500 - Power Electronics (3)
This course considers electronic circuits for conditioning and managing large electric power signals such as those found in power supplies, motor controls, and smart electrical grid devices. It covers switching functions for control; ac and dc power conversion; power semiconductor switching devices; motor control, and smart grid device design and operation.
Prerequisite: ECEN 35000 (may be taken concurrently) and ECEN 37000 (may be taken concurrently)

ECEN 48000 - Renewable Energy Systems (3)
This course covers the design and analysis of efficient electrical energy systems that minimize adverse environmental impact. Topics include green generation technologies such as solar and wind as well as new power transmission and distribution architectures such as microgrids and the use of smart-grid technologies for autonomous control.
Prerequisite: ECEN 38000 (may be taken concurrently)

ECEN 49600 - Electrical-Computer Engineering Senior Project (3)
This is the culminating experience in the Computer Engineering program. Students will work in teams to implement a computer engineering solution to a realistic problem initially researched and developed in CPEN 40000. Such solutions will consist of both hardware and software components. This course must be taken in the student's final semester in the program.
Prerequisite: ECEN 40000
Attributes: Advanced Writing, Experiential Learning Gen Ed

ECEN 49800 - Electrical and Computer Engineering Internship (1-3)
This course is an electrical and/or computer engineering internship work experience. Students acquire practical experience through an industry partner company that will assign relevant and meaningful tasks to complement concepts and theory learned in the classroom. This course will help prepare the student for a future role as a professional engineer. The student must apply for and be accepted by the employer for an internship position, and must work a minimum of 210 hours to receive 3 credits. This course is repeatable.

ECEN 49900 - Independent Study in Computer Engineering (1-3)
This course is designed to meet the needs of Computer Engineering majors wishing to study an advanced topic not found in the curriculum. Prerequisite Consent of the department chairperson. To qualify for an Independent Study, a student must have successfully completed 60 credit hours, at least 12 of which were earned at Lewis, and have earned at Lewis a minimum 3.0 cumulative GPA.
Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.