

ELECTRICAL & COMPUTER ENGINEERING (ECE)

ECE 1618 Introduction to Engineering I (2)

This course will provide an introduction to the practice of engineering and the various areas within the engineering disciplines. Students will be informed of engineering curricula and career opportunities within the various engineering disciplines. This course will also introduce students to important topics for academic success, both at the major level and at the university level. Each week meets for 50 minutes of lecture and 100 minutes of activity. There is a \$15 course material fee.

General Education Attribute(s): First Year Seminar

Course Fee: Yes

ECE 1628 Introduction to Engineering II (2)

This course builds on the foundational skills in engineering design and practices developed in ENGR/ECE 1618. Students will design, build, test, and present engineering projects designed to solve specified problems within given constraints. Additionally, the impact of engineering from a global, social, economic, and environmental perspective is presented through case studies. Each week meets for 50 minutes of lecture and 100 minutes of activity. There is a \$15 course material fee. Prerequisite: ECE/ENGR 1618. Completion of ECE/ENGR 1618 and ECE/ENGR 1628 satisfies general education requirement First Year Seminar.

Requisite(s): Prereqs: ENGR/ECE 1618

General Education Attribute(s): First Year Seminar

Course Fee: Yes

ECE 2070 Electric Circuits (4)

An introduction to the analysis of electrical circuits. Use of analytical techniques based on the application of circuit laws and network theorems. Analysis of DC and AC circuits containing resistors, capacitors, inductors, dependent sources and/or switches. Natural and forced responses of first and second order RLC circuits; the use of phasors; AC power calculations; power transfer; and energy concepts. 150 minutes lecture and 150 minutes laboratory. Prerequisites: PHYS 2220 with a grade of C- or better, or the equivalent, or permission of the instructor. Cross-listed as ECE 2070 or ENGR 2070 or PHYS 2070.

Requisite(s): PHYS 2220 or 222 with a C- or better

Course Fee: Yes

ECE 2770 Special Topics in Engineering (1-4)

This course will be used to supplement regularly scheduled courses with additional material at the beginning level. May be repeated for credit with different topics up to a maximum of 4 units.

Repeatable for Credit: Yes, up to 4 units

ECE 2771 Special Topics Laboratory (1)

Optional laboratory for the study of topics at the beginning level. Co-requisite: ECE 2770

Requisite(s): Coreq: ECE 2770

ECE 3040 Signals and Systems (4)

Design, construction, and debugging of analog electronic circuits. Diodes, filters, oscillators, transistors, JFETs, op-amps, and basic analog circuit design. Broadband applications in networking and communications. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: MATH 2320 or MATH 2520 with a grade of C- or better, MATH 2610, and ENGR 2070 or ECE 2070 or PHYS 2070 with a grade of C- or better. There is a \$10 course material fee.

Requisite(s): Prereqs: C- or higher in all courses: ENGR/ECE/PHYS 2070 or ENGR/PHYS 207; MATH 2320 or 2520 or 203 or 233.

ECE 3070 Analog Circuits (4)

Design, construction, and debugging of analog electronic circuits. Diodes, filters, oscillators, transistors, JFETs, op-amps, and basic analog circuit design. Broadband applications in networking and communications. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: MATH 2320 or MATH 2520 with a grade of C- or better, MATH 2610, and ENGR 2070 or ECE 2070 or PHYS 2070 with a grade of C- or better. There is a \$10 course material fee.

Requisite(s): Prerequisites: C- or better in MATH 2320 or 2520 or 203 or 233 and MATH 2610 (D-) or 230 (D-) or 330 (D-) and C- or better in ENGR/ECE/PHYS 2070 or ENGR/ECE/PHYS 207.

Course Fee: Yes

ECE 3200 Digital Circuits (4)

Introduce combinational logic and sequential logic designs, and microprocessors. Cover digital concepts, number systems, operations, and codes, logic gates, Boolean algebra and logic simplification, combinational logic and its functions, flip-flops and related devices, counters, shift registers, memory and storage, concepts of microprocessors, assembly language, computers, and buses. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: ENGR 2070 or ECE 2070 or PHYS 2070 with a grade of C- or better. There is a \$10 course material fee.

Requisite(s): Prerequisites: ENGR/ECE/PHYS 2070 with a grade of C- or better.

Course Fee: Yes

ECE 3220 Digital Design with VHDL (4)

Introduces logic system design using a hardware description language (VHDL). Covers the VHDL language in depth and explains how to use it to describe complex combinational and sequential logic circuits. Include a weekly lab where students will get hands-on experience implementing digital systems on Field Programmable Gate Arrays. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: CMPS 2010 with a grade of C- or better and ECE 3200. There is a \$10 course material fee.

Requisite(s): Prerequisites: CMPS 2010 with a grade of C- or better and ECE 3200.

Course Fee: Yes

ECE 3230 Digital Communications (4)

This course focuses on the representation of signals and noise, Gaussian processes, correlation functions and power spectra, linear systems and random processes, performance analysis and design of coherent and non-coherent communication systems, phase-shift-keying, frequency-shift-keying, and M-ary communication systems, optimum receivers and signal space concepts, information and its measure, source encoding, channel capacity, and error correcting coding. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: ECE 3040 with a grade of C- or better. There is a \$10 course material fee.

Requisite(s): Prerequisites: ECE 3040 with a grade of C- or better.

Course Fee: Yes

ECE 3250 Embedded Systems (4)

Introduce embedded systems. Cover embedded concepts, FPGA modules, combinational and sequential logic circuits design, finite state machines, memory and storage, sensor and motor interface. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: ECE 3070 and ECE 3200. There is a \$10 course material fee.

Requisite(s): Prerequisite: ECE 3070 and ECE 3200.

Course Fee: Yes

ECE 3280 Instrumentation, Control, and Data Acquisition (4)

Introduction to LabVIEW and NI Elvis board. Students learn how to use NI virtual instruments, such as function generators, oscilloscopes, etc., design a variety of projects on analog and digital inputs, outputs, and signal generations, and use both simulation and hardware test-beds to verify their projects and performance. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: ECE 3200. There is a \$10 course material fee.

Requisite(s): Prereqs: ECE 3200.

Course Fee: Yes

ECE 3320 Fields and Waves (4)

This course focuses on the fundamentals of electromagnetics. Students are expected to acquire expertise in vector analysis, electrostatic and magnetic fields, Maxwell's equations, plane waves, reflection, attenuation, and impedance. Knowledge of circuit theory, Matlab, differential equations, and calculus are required to successfully complete the course. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: MATH 2320 or MATH 2520 with a C- or better; ENGR 2070 or ECE 2070 or PHYS 2070 with a C- or better.

Requisite(s): Prereqs: C- or higher in all courses: ENGR/ECE/PHYS 2070 or ENGR/PHYS 207; MATH 2320 or 2520 or 203 or 233.

ECE 3340 Control Systems (4)

Introduce control system analysis and design. Cover control system modeling, time response, reduction of multiple systems, stability analysis, steady-state errors, root locus technique, PID controller, and fuzzy controller. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: ECE 3040 with a grade of C- or better.

Requisite(s): Prereqs: C- or higher in ECE 3040.

ECE 3370 Power Systems Fundamentals (4)

This course is an introductory subject in the field of electric power systems. Electric power systems have become increasingly important as a way of transmitting and transforming energy in industrial, military and transportation uses. The course covers basic elements of power system, three-phase circuit analysis, transformers, transmission line configuration, the per unit system and power flow. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: ECE 2070 or ENGR 2070 or PHYS 2070 with a grade of C- or better.

Requisite(s): Prerequisites: C- or higher in ECE/ENGR/PHYS 2070 or ENGR/PHYS 207.

ECE 3770 Special Topics in Engineering (1-4)

This course will be used to supplement regularly scheduled courses with additional material at the intermediate level. Course is repeatable, but only a combined total of 4 units of ECE 377x, 477x, and 48xx may be used for elective credit towards the major requirements.

Repeatable for Credit: Yes, up to 4 units

ECE 3771 Special Topics Laboratory (1)

Optional laboratory for the study of topics at the intermediate level. Course is repeatable, but only a combined total of 4 units of ECE 377x, 477x, and 48xx may be used for elective credit towards the major requirements. Corequisite: ECE 3770.

Requisite(s): Coreq: ECE 3770

ECE 4220 Digital Signal Processing (4)

This course provides an introduction to principles of Digital Signal Processing (DSP) including sampling theory, aliasing effects, frequency response, Finite Impulse Response filters, Infinite Impulse Response filters, spectrum analysis, Z transforms, Discrete Fourier Transform and Fast Fourier Transform. Overviews of modern DSP applications such as modems, speech processing, audio and video compression and expansion, and cellular protocols. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: ECE 3040 with a C- or better. There is a \$10 course material fee.

Requisite(s): Prerequisites: ECE 3040 with a grade of C- or better.

Course Fee: Yes

ECE 4240 Microprocessor System Design (4)

Introduce microprocessor architecture and organization. Cover bus architectures, types and buffering techniques, Memory and I/O subsystems, organization, timing and interfacing, Peripheral controllers and programming. Design a microprocessor system. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: ENGR 2070 or ECE 2070 or PHYS 2070 with a C- or better; ECE 3200. There is a \$10 course material fee.

Requisite(s): Prerequisite: C- or higher on ENGR/ECE/PHYS 2070 or ENGR 207; ECE 3200 or 320.

Course Fee: Yes

ECE 4250 Wireless Communications (4)

In this course analytical characterizations of mobile communications channels are developed. The main techniques for mitigating the mobile communication channel effects such as Equalization, Diversity, etc. are examined. Multiple access techniques used in wireless communications, such as FDMA as well as digital TDMA and CDMA techniques are presented. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: ECE 3040 with a grade of C- or better.

Requisite(s): Prerequisites: ECE 3040 with a grade of C- or better.

ECE 4260 Wireless Network (4)

This course focuses on wireless data communications including wireless internet. The students acquire knowledge into the current and future state-of-the-art of technology in the field of wireless communications. Another goal of the course is to ensure student(s) can explain the impact of commercial, political, and regulatory factors on the design of wireless systems. The course will treat current relevant technologies, and the exact content may change from year to year. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: MATH 2320 or MATH 2520 with a grade of C- or better.

Requisite(s): Prereqs: C- or higher in MATH 2320 or 2520 or 203 or 233

ECE 4370 Power Systems Analysis (4)

This course follows the discussions from the first course in power systems. This course focuses on power flow, symmetrical components, faulted system analysis, and protection schemes. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: ECE 3370. There is a \$10 course material fee.

Requisite(s): Prerequisite: ECE 3370 or 337.

Course Fee: Yes

ECE 4380 Power System Operation with Renewable Energy**Resources (3)**

Renewable energy, distributed generation, impacts of renewable energy based generation on power system operation, electrical energy markets, deregulated power system, hybrid power generation. Each week meets for 150 minutes of lecture. Prerequisite: ECE 3370

Requisite(s): Prerequisite: ECE 3370 or ECE 337.

ECE 4381 Power System Operation with Renewable Energy Resources Laboratory (1)

Laboratory in power system operations with renewable energy based generation. Completion of the laboratory component is required for Electrical Engineering majors to get elective credit for this course. Each week meets for 150 minutes of laboratory. Prerequisite or corequisite: ECE 4380.

Requisite(s): Prerequisite or corequisite: ECE 4380

ECE 4460 Image Processing (4)

This course covers the following: digital image acquisition, image enhancement and restoration, image compression, spatial and frequency-based image filtering, color processing, low level image segmentation and feature extraction. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: ECE 3040 with a grade of C- or better. There is a \$10 course material fee.

Requisite(s): Prereqs: C- or higher in ECE 3040.

Course Fee: Yes

ECE 4470 Computer Vision (4)

This course covers the following: Image formation, early vision, image morphology, image segmentation, object/feature representation and an introduction to supervised and unsupervised learning with an emphasis on image understanding. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: MATH 2320 or MATH 2520 with a grade of C- or better; CMPS 3120 with a grade of C- or better or ECE 3040 with a grade of C- or better. There is a \$10 course material fee. Cross-listed as CMPS 4470 or ECE 4470.

Requisite(s): Prerequisite: MATH 2320 or MATH 2520 or 203 or 233 with C- or better and CMPS 3120 or 312 with C- or better or ECE 3040 or 304 with C- or better.

Course Fee: Yes

ECE 4550 Applied Machine Learning (4)

Students will learn the basics of machine learning including: supervised vs. unsupervised learning, regression, dimensionality reduction and reinforcement learning. Focus will be given to experimental setup including normalization, evaluation criteria and outlier detection. Experiments will be carried out with contemporary and classical methods on real world data sets in a wide range of applications. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: MATH 3200. Cross-listed as CMPS 4550 or ECE 4550.

Requisite(s): Prerequisite: MATH 3200.

ECE 4570 Robotics (4)

Introduce robotic systems. Cover Mindstorms NXT, motion control, target steering and trajectory planning, obstacle avoidance, line tracking, and multiple sensor fusion. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: CMPS 2010 and ECE 3040 with a grade of C- or better. There is a \$10 course material fee.

Requisite(s): Prerequisites: CMPS 2010 and ECE 3040 with a grade of C- or better.

Course Fee: Yes

ECE 4770 Special Topics in Engineering (1-4)

This course will often be used to supplement other courses with additional work at a more advanced level. Course is repeatable, but only a combined total of 4 units of ECE 377x, 477x, and 48xx may be used for elective credit towards the major requirements. Prerequisite: Permission of the instructor. May be repeated for credit up to a maximum of 4 units.

Repeatable for Credit: Yes, up to 4 units

Course Fee: Yes

ECE 4771 Special Topics Laboratory (1)

Optional laboratory for the study of topics at a more advanced level. Course is repeatable, but only a combined total of 4 units of ECE 377x, 477x, and 48xx may be used for elective credit towards the major requirements. Prerequisite: Permission of the instructor. Corequisite: ECE 4770. May be repeated for credit with different topics up to a maximum of 2 units.

Requisite(s): Coreq: ECE 4770

Repeatable for Credit: Yes, up to 2 units

ECE 4800 Undergraduate Research (1-4)

Independent study into a research topic under the supervision of a faculty member. Students will establish the research goals and objectives with their faculty supervisor. Course is repeatable, but only a combined total of 4 units of ECE 377x, 477x, and 48xx may be used for elective credit towards the major requirements. Prerequisite: Permission of the instructor. May be repeated for credit up to a maximum of 9 units.

Repeatable for Credit: Yes, up to 9 units

ECE 4860 Internship (1-4)

Internships may be arranged by the department with various agencies, businesses, or industries. The assignments and coordination of work projects with conferences and reading, as well as course credits, evaluation, and grading are the responsibility of the faculty liaison (or course instructor), working with the field supervisor. Offered on a credit, no-credit basis only. The department will determine the number of credit units offered. Course is repeatable, but only a combined total of 4 units of ECE 377x, 477x, and 48xx may be used for elective credit towards the major requirements. Prerequisite: Permission of the instructor. May be repeated up to a maximum of 9 units.

Repeatable for Credit: Yes, up to 9 units

ECE 4870 Cooperative Education (1-4)

The Cooperative Education program offers a sponsored learning experience in a work setting, integrated with a field analysis seminar. The field experience is contracted by the Cooperative Education office on an individual basis, subject to approval by the department. The field experience, including the seminar and reading assignments, is supervised by the cooperative education coordinator and the faculty liaison (or course instructor), working with the field supervisor. Students are expected to enroll in the course for at least two semesters. Offered on a credit, no-credit basis only. The department will determine the number of credit units offered. Course is repeatable, but only a combined total of 4 units of ECE 377x, 477x, and 48xx may be used for elective credit towards the major requirements. Prerequisite: Permission of the instructor. May be repeated up to a maximum of 4 units.

Repeatable for Credit: Yes, up to 4 units

ECE 4890 Experiential Prior Learning (1-4)

Majors in Computer and Electrical Engineering with significant prior experience in computers and/or electronics may have some of their experience count for academic credit toward their degree. In order to be considered for experiential learning credit the student must have completed CMPS 2010 and have the approval of the department. Only a combined total of 4 units of ECE 377x, 477x, and 48xx may be used for elective credit towards the major requirements. Prerequisite: CMPS 2010 with a grade of C- or better and permission of the instructor. May be repeated for credit up to a maximum of 4 units.

Requisite(s): ECE 4890 requisites

Repeatable for Credit: Yes, up to 4 units

ECE 4910 Senior Project I (2)

After consultation with the faculty supervisor and investigation of relevant literature, the student(s) shall prepare a substantial project with significance in the designated area. The timeline, teamwork responsibilities, milestones, and presentation(s) will be scheduled. Prerequisite: At least 12 units of 3000- or 4000- level ECE and CMPS courses. There is a \$10 course material fee.

Requisite(s): Prereqs: at least 12 semester units of upper division ECE or CMPS courses

Course Fee: Yes

ECE 4928 Senior Project II (2) 🦋

This is the completion phase of the project. Students will present a project report to the entire class, explaining the nature of the work, the finished product, and its relationship to the field. Students will demonstrate proficiency in critical thinking, information literacy, written communication, and quantitative reasoning in their written project report. Additionally, students will demonstrate an understanding of their academic pursuits by reflecting on their studies of the arts, humanities, natural sciences, behavioral sciences, and social sciences. Prerequisite: at least 90 units, completion of JYDR; and ECE 4910. For engineering majors only. Satisfies general education requirement Senior Capstone. There is a \$25 materials fee.

Requisite(s): Prerequisite: At least 90 units, completion of JYDR; and ECE 4910.

General Education Attribute(s): Capstone

Course Fee: Yes

ECE 4960 Leadership in Engineering (1-2)

Leadership in computer and electrical engineering related activities that meet campus and/or community needs. Offered on a credit, no-credit basis only. Course credits cannot be used as elective credit towards the major requirements but can be used as additional university units. Prerequisite: Permission of the instructor. May be repeated up to a maximum of 2 units.

Repeatable for Credit: Yes, up to 2 units

ECE 4970 Service Learning in Engineering (1-2)

Service learning in computer and electrical engineering related activities that meet campus and/or community needs. Students will design and/or implement a service learning project in consultation with their faculty supervisor and, if applicable, community partners. Offered on a credit, no-credit basis only. Course credits cannot be used as elective credit towards the major requirements but can be used as additional university units. Prerequisite: Permission of the instructor. May be repeated up to a maximum of 2 units.

Repeatable for Credit: Yes, up to 2 units

ECE 4980 Teaching in Engineering (1-2)

Experience supporting teaching activities in department courses, providing tutoring in the department tutoring center, leading problem-solving sessions, and/or supporting other instructional activities in the department. Offered on a credit, no-credit basis only. Course credits cannot be used as elective credit towards the major requirements but can be used as additional university units. Prerequisite: Permission of the instructor. May be repeated up to a maximum of 2 units.

Repeatable for Credit: Yes, up to 2 units