

Lower Division

ECE/ENGR 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. Satisfies general education requirement First-Year Seminar.

ECE/ENGR 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. Prerequisite: ENGR/ECE 1618. Satisfies general education requirement First-Year Seminar.

ECE/ENGR/PHYS 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. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: PHYS 2220 with a grade of C- or better, or permission of the instructor.

ECE 2600 High-speed Rail (4)

The course gives an overview of the high-speed rail (HSR) technology crossing electrical transmission and traction drive control systems, power supply technology, signal and communication systems, mechanical and civil engineering, and transportation scheduling, and provides an opportunity to learn a variety of software packages regarding the aerodynamics impact on a high speed train, operating the high speed train and designing the train interior layout, and the passage service system. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: MATH 1040 or 1060 and basic computer skills.

ECE 2770 Special Topics in Engineering (1-3)

This course will be used to supplement regularly scheduled courses with additional material at the beginning level.

ECE 2771 Special Topics Laboratory (1)

Optional laboratory for the study of topics at the beginning level. Corequisite: ECE 2770.

Upper Division

ECE 3040 Signals and Systems (4)

Time and frequency domain techniques for signal and system analysis. Fourier series and transforms, and Laplace transforms. Topics in differential equations and probability. Use of a numerical computing environment such as MATLAB. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: MATH 2320 or 2520 or 203 or 233 with a grade of C- or better and ENGR/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better.

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: ENGR/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better; MATH 2320 or 2520 or 203 or 233 with a grade of C- or better.

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/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better.

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: ENGR/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better; ECE 3200 or 320.

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,

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channel capacity, and error correcting coding. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: ENGR/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better; ECE 3040 or 304; MATH 2320 or 2520 or 203 or 233 with a grade of C- or better.

ECE 3250 Embedded Systems (4)

Introduce embedded systems. Cover embedded concepts, NI sbRIO embedded system devices, LabVIEW RT and 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 3200.

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 or consent of the instructor.

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: ENGR/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better; MATH 2320 or 2520 or 203 or 233 with a grade of C- or better.

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.

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: ENGR/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better.

ECE 3380 Power Electronics and Electrical Drives (4)

The course is an introduction to switched-mode power converters, electromechanical energy conversion systems, and electric drives. It provides a basic knowledge of circuitry for the control and conversion of electrical power with high efficiency. These converters can change and regulate the voltage, current, or power; dc-dc converters, ac-dc rectifiers, dc-ac inverters, and ac-ac cycloconverters are in common use. Applications include electronic power supplies, aerospace and vehicular hybrid power systems, and renewable energy systems. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: ECE 3070, 3320, 3370.

ECE 3770 Special Topics in Engineering (1-3)

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.

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.

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: ENGR/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better; ECE 3040 or 304; MATH 2320 or 2520 or 203 or 233 with a grade of C- or better.

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/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better; ECE 3200 or 320.

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: ENGR/ECE/PHYS 2070 or ENGR/PHYS 207 with a grade of C- or better; ECE 3040 or 304; MATH 2320 or 2520 or 203 or 233 with a grade of C- or better.

ECE 4260 Wireless Networks (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 2520 or 203 or 233 with a grade of C- or better.

ECE 4330 Mechatronics (4)

Intelligent electro-mechanical systems. Topics include electronics (A/D, D/A converters, op-amps, filters, power devices), software program design (event-driven programming, state machine-based design), DC and stepper motors, basic sensing and basic mechanical design. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisites: CMPS 2020 with a grade of C- or better, ECE 3070, and 3200.

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.

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.

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.

ECE/CMPS 4460 Image Processing (4)

Digital image acquisition, image enhancement and restoration, image compression, computer implementation and testing of image processing techniques. Students gain hands-on experience of complete image processing systems, including image acquisition, processing, and display through laboratory experiments. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: ECE 3040.

ECE/CMPS 4470 Computer Vision (4)

Imaging formation, early vision processing, boundary detection, region growing, two-dimensional and three-dimensional object representation and recognition techniques. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: MATH 2320 or 2520 or 203 or 233 with a grade of C- or better; CMPS 3120 or 312 or ECE 3040 or 304.

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: ENGR/ECE/PHYS 2070 ENGR/PHYS 207 with a grade of C- or better; ECE 3040 or 304.

ECE 4770 Special Topics in Engineering (1-3)

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.

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. Corequisite: ECE 4770. Prerequisite: Permission of the instructor.

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.

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-

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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.

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.

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

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.

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: ECE 4910 and completion of at least 90 units. Prerequisite or Corequisite: Completion of or concurrent enrollment in all GE course requirements for engineering majors. Satisfies general education requirement Capstone.

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 is repeatable. 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.

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 is repeatable. 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.

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 is repeatable. 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.