**Note:** Several of the courses required for Computer Engineering are listed under the Computer Science Program. Additionally, all Computer Engineering and Electrical Engineering courses descriptions are listed under the Computer Engineering Degree Program and carry the ECE prefix.

***Lower Division***

**ECE 160 Introduction to Engineering (3)**

This course will provide an introduction to the practice of engineering by reviewing its history and current state. Students are informed about various areas within the discipline of engineering, e.g. chemical, agricultural, and electrical. Finally the impact of engineering from a global, social, and political perspective is presented through a number of case studies.

**ECE 277 Special Topics in Computer and Electrical Engineering (1-5)**

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

***Upper Division***

**ECE 304 Signals and Systems I (5)**

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 200 minutes and lab meets for 150 minutes. Prerequisite: MATH 204 or 234 or consent of the instructor.

**ECE 306 Complex Analysis in Engineering (5)**

The complex number field, harmonic and analytic functions, conformal mapping, integration, Cauchy’s Theorem, singularities, calculus of residues, applications to elliptic systems arising in engineering. Use of a numerical computing environment such as Matlab. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: MATH 204 or 234 or consent of the instructor.

**ECE 307 Analog Circuits (5)**

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 200 minutes and lab meets for 150 minutes. Prerequisite: ENGR 207 or PHYS 207 or consent of the instructor.

**ECE 320 Digital Circuits (5)**

An introduction to the logical design of digital computers including the analysis and synthesis of combinatorial and sequential circuits, and the use of such circuits in building processor components and memory. The course will apply the circuit theory to the design of an elementary processor with a small instruction set with absolute addressing and a hard-wired control unit. An assembly language for this processor will also be developed. This course includes a laboratory which will cover a mix of actual circuit work together with circuit synthesis and testing using software. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: One course in programming or permission of the instructor.

**ECE 322 Digital Design with VHDL (5)**

This course uses a hardware description language (HDL) to design application-specific integrated circuits. The continuation of CMPS 320 includes modern digital design technology, in-depth treatment of algorithms and architectures for digital machines and comprehensive treatment of behavioral modeling in advanced digital design. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: ECE 320 or CMPS 320.

**ECE 325 Properties of Materials (5)**

Fundamental electrical, optical, and magnetic properties of materials, elementary quantum mechanics, crystal structure, energy bands, metals and semiconductors. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: ECE 307 and PHYS 223.

**ECE 330 Signals and Systems II (5)**

Analysis of both continuous-time and discrete-time signals, convolution, frequency domain analysis, Fourier series, Fourier transforms, and z-transforms, filters, applications to communications and control systems. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: MATH 204 or 234 and ENGR 207 or PHYS 207.

**ECE 332 Fields and Waves (5)**

Vector analysis, electrostatic and magnetic fields, Maxwell’s equations, plane waves. Reflection, attenuation, and impedance. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: MATH 204 or 234 and PHYS 223.

**ECE 336 Electrical Machinery (5)**

This course is an introduction to the analysis and design of electromechanical energy conversion systems, magnetic circuit theory, general transformer and machinery theory, DC and AC motors and generators. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: ECE 304 and 307.

**ECE 337 Fundamentals of Power Systems (5)**

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 200 minutes and lab meets for 150 minutes. Prerequisites: ENGR 207 or PHYS 207 and ECE 304 or consent of the instructor.

**ECE 377 Special Topics in Computer and Electrical Engineering (1-5)**

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

**ECE 420 Embedded Systems (5)**

Built on logic designs, using assembly and C languages to study embedded systems with regard to their software, hardware, theories and implementation methodology. Various embedded system development tools, such as assemblers, debuggers and cross compilers, will be introduced and used in the course. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: CMPS 224 and ECE 320 or CMPS 320.

**ECE 422 Digital Signal Processing (5)**

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. Emphasis on hardware design to achieve high-speed real and complex multiplications and additions. Pipelining, Harvard, and modified Harvard architectures. Overviews of modern DSP applications such as modems, speech processing, audio and video compression and expansion, and cellular protocols. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: PHYS 221, MATH 203 or 233, and ECE 320 or CMPS 320.

**ECE 423 Digital Communications (5)**

Principles and techniques fundamental to the analysis and design of digital communication systems. The basic building blocks of a digital communication system including channel encoders/decoders, digital modulators/demodulators and channel characteristics. Channel impairments such as signal-to-noise ratios, distortion, interference, transmission errors and fading. Wired and wireless systems. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: ECE 320 or CMPS 320.

**ECE 424 Microprocessor System Design (5)**

Architecture and hardware design of microprocessor-based systems, including bus structure, interrupts handling, I/O ports, control signal, and peripherals. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: CMPS 224 and ECE 320 or CMPS 320.

**ECE 425 Wireless Communications (5)**

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 that allow multiple users to share a given spectrum is examined. Students will learn how to design a cellular system for a given coverage area, and how to carry out the performance analysis of the designed system. They will also know how to increase the capacity (number of users accommodated) in a cellular system. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: ECE 304 and 330 or consent of the instructor.

**ECE 426 Wireless Networks (5)**

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 communication. 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 200 minutes and lab meets for 150 minutes. Prerequisite: ECE 304 or consent of the instructor.

**ECE 432 Instrumentation, Control, and Data Acquisition (5)**

Study of analog (and computer-controlled) systems, classical and modern system design methods, s-domain (and z-domain) transfer function models, state space, dynamics of linear systems, and frequency domain analysis and design techniques. Introduction to controllability and observability. Implementation of PID controllers. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: MATH 203 or 233 and CMPS 223 or consent of the instructor.

**ECE 433 Mechatronics (5)**

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 200 minutes and lab meets for 150 minutes. Prerequisites: ECE 307, 320, and CMPS 223.

**ECE 434 Introduction to Control Theory (5)**

This course is an introduction to the analysis and design of feedback control systems, including classical control theory in the time and frequency domain. Modeling of physical, biological and information systems using linear and nonlinear differential equations. Stability and performance of interconnected systems, including use of block diagrams, Bode plots, Nyquist criterion, and Lyapunov functions. Robustness and uncertainty management in feedback systems through stochastic and deterministic methods. Introductory random processes, Kalman filtering, and norms of signals and systems. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: ECE 304, 306, 330, and MATH 340.

**ECE 446 Image Processing (5**)

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 200 minutes and lab meets for 150 minutes. Prerequisites: CMPS 223 and ECE 304.

**ECE 447 Computer Vision (5)**

Imaging formation, early vision processing, boundary detection, region growing, two-dimensional and three-dimensional object representation and recognition techniques. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: CMPS 223 and ECE 304 or consent of the instructor.

**ECE 457 Robotics (5)**

The course will provide an opportunity for students to understand intelligent robot system architecture and to design algorithms and programs for control and planning of intelligent robot systems based on analytical modeling and behavior modeling. Students will use simulation software (Webots) and hardware test-bed (Kheraper II) to verify their algorithm and program performance during their project work. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: CMPS 223.

**ECE 464 Power Electronics and Semiconductors (5)**

The course is an introduction to switched-mode power converters. 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 200 minutes and lab meets for 150 minutes. Prerequisite: ECE 304 and 307.

**ECE 477 Special Topics in Computer and Electrical Engineering (1-5)**

This course will often be used to supplement other courses with additional work at a more advanced level. Prerequisite: Permission of the instructor

**ECE 489 Experiential Prior Learning (1-5)**

Majors in Computer and Electrical Engineering with significant prior experience in computers 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 224 and have the approval of the department.

**ECE 490A Senior Project I (3)**

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: Upper-division standing.

**ECE 490B Senior Project II (3)**

This is the completion phase of the project. The student(s) will present a project report to the entire class, explaining the nature of the work, the finished product, and its relationship to the field. Prerequisite: Upper-division standing and ECE 490A.