

## Electrical Comp Engineering (ECE)

### ECE 1000

#### Introduction to Electrical and Computer Engineering

3

\* Prerequisite(s): MATH 1060 or higher

Introduces engineering-problem-solving techniques, design processes, modeling and analysis of simple electrical and computer circuits using MATLAB and LabVIEW software packages. Emphasizes engineering design procedures by incorporating group projects and presentations. Lab access fee of \$45 applies.

### ECE 1020

#### Computer Engineering Problem Solving with MATLAB and LabVIEW

1

\* Prerequisite(s): MATH 1050 or higher

Introduces the field of Computer Engineering through programming in the MATLAB and LabVIEW languages. Teaches the design of various components of a prototype communication system while learning about the following aspects of MATLAB: scripts and function files, math functions, commands for array construction and manipulation, string expressions, logic operators, control flow, and graphics. No prior knowledge of computer engineering is assumed. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

### ECE 2210

#### Fundamentals of Electric Circuit Analysis

3

\* Prerequisite(s): MATH 1210, PHYS 2210

Explores fundamental electric circuit analysis techniques. Develops analysis techniques using Kirchoff's laws, Thevenin and Norton equivalents, superposition, and phasors. Covers transient and steady-state time-domain analysis, and frequency analysis. Lab access fee of \$45 for computers applies.

### ECE 2215

#### Fundamentals of Electric Circuit Analysis Lab

1

\* Prerequisite(s): MATH 1210, PHYS 2210

Covers fundamental electric circuit analysis techniques. Develops analysis techniques using Kirchoff's laws, Thevenin and Norton equivalents, superposition, and phasors. Covers transient and steady-state time-domain analysis, and frequency analysis. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

### ECE 2250

#### Circuit Theory

3

\* Prerequisite(s): MATH 1210, PHYS 2220, ECE 1000

Develops linear circuit theory and its application in the analysis and design of RLC active circuits. Covers DC, AC, and transient analysis utilizing node and mesh analysis. Lab access fee of \$45 for computers applies.

### ECE 2255

#### Circuit Theory Lab

1

\* Prerequisite(s): MATH 1210, PHYS 2220, ECE 1000

\* Corequisite(s): ECE 2250

Laboratory for ECE 2250 develops linear circuit theory and its application in the analysis and design of RLC active circuits. Covers DC, AC, and transient analysis utilizing node and mesh analysis. Introduces the use of CAD tools. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

### ECE 2700

#### Digital Design I

3

\* Prerequisite(s): MATH 1050 or MATH 1055

\* Corequisite(s): ECE 2705

Studies the design and application of combinational and sequential logic circuits with discrete and programmable logic devices. Lab access fee of \$45 for computers applies.

### ECE 2705

#### Digital Design I Lab

1

\* Prerequisite(s): MATH 1050 or MATH 1055

\* Corequisite(s): ECE 2700

Designed to accompany ECE 2700. Covers design of digital systems with discrete and programmable logic devices. Includes the use of CAD tools for system design and verification. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

### ECE 2750

#### Engineering Analysis

3

\* Prerequisite(s): MATH 1220 and ECE 1000

Studies Linear systems, abstract vector spaces, matrices through eigenvalues and eigenvectors, solution of ordinary differential equations, Laplace transforms, first order systems, and complex numbers. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

### ECE 3250

#### Energy Conversion

3

\* Prerequisite(s): ECE 2250, (Formal Acceptance into the Electrical Engineering Program, or Departmental Approval), and University Advanced Standing

Presents fundamental concepts of energy conversion including torque and power in singly/doubly excited electromagnetic systems, single and three-phase transformers, single and three-phase induction motors including speed control, three-phase synchronous generators and DC machines. Lab access fee of \$45 applies.

### ECE 3350

#### Control Systems

3

\* Prerequisite(s): ECE 2750, ECE 3770, University Advanced Standing, and (Formal Acceptance into the Electrical Engineering Program, or Departmental Approval)

Introduces the theory and practice of control systems engineering. Covers modeling in the frequency and time domains, analog and discrete transfer function models, reduction of multiple subsystems, system response specifications, control system characteristics, root locus analysis and design, frequency response analysis and design. Emphasizes computer-aided analysis. Lab access fee of \$45 applies.

### ECE 3450

#### Electromagnetics and Transmission Lines

3

\* Prerequisite(s): PHYS 2220, ECE 2250, University Advanced Standing, and (Formal Acceptance into the Electrical Engineering Program, or Departmental Approval)

Introduces the fundamentals of electromagnetic field theory and application: vector analysis, electric and magnetic fields, potential theory, dielectric and magnetic material properties, conductance, capacitance, and inductance, Maxwell's equations and circuit concepts. Explains transmission lines as a bridge to understanding electromagnetic field theory. Covers basic principles of radiation and propagation in waveguides and antennas. Lab access fee of \$45 applies.

### ECE 3710

#### Applied Probability and Statistics for Engineers and Scientists

3

\* Prerequisite(s): MATH 1210 and University Advanced Standing

Explores probability and statistical theory with an emphasis on engineering and computer science applications. Covers descriptive statistics, discrete and continuous random variables, probability distributions, hypothesis testing, expectation, estimation, ANOVA testing, and regression analysis. Includes computer analysis of data and simulation. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

# Course Descriptions

## **ECE 3730 Embedded Systems I**

**3**  
\* Prerequisite(s): ECE 2700, ECE 2250, (Formal Acceptance into the Electrical or Computer Engineering Program, or Departmental Approval), and University Advanced Standing

Presents an introduction to the basic building-blocks and the underlying scientific principles of embedded systems. Covers both the hardware and software aspects of embedded processor architectures and assembly language programming. Develops the theory and technology necessary for the interconnection of devices and systems to microcontrollers by using hardware and software examples and students' projects. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

## **ECE 3740 Digital Design II**

**3**  
\* Prerequisite(s): ECE 2700, (Formal Acceptance into the Electrical Engineering Program or Computer Engineering program, or Departmental Approval), and University Advanced Standing

Covers the design and verification of digital systems. Emphasizes hierarchal design principles and the use of programmable logic devices (PLDs). Utilizes modern CAD tools and design languages (VERILOG). Lab access fee of \$45 for computers applies.

## **ECE 3760 Electronic Systems**

**3**  
\* Prerequisite(s): ECE 2250, PHYS 2220, University Advanced Standing, and (Formal Acceptance into the Electrical Engineering Program or Computer Engineering program, or Departmental Approval)  
\* Corequisite(s): ECE 3765

Introduces semiconductor theory and the fundamentals of diode and transistor operation. Covers the use of discrete and integrated active devices in linear amplifier and switching applications. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

## **ECE 3765 Electronic Systems Lab**

**1**  
\* Prerequisite(s): ECE 2255, PHYS 2220, and University Advanced Standing  
\* Corequisite(s): ECE 3760

Designed to accompany ECE 3760. Covers electronic analog circuit design, simulation, construction, debugging and measurement of circuit performance quantities using advanced instrumentation techniques. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

## **ECE 3770 Signals and Systems**

**3**  
\* Prerequisite(s): ECE 2750, (Formal Acceptance into the Electrical Engineering Program or Computer Engineering program, or Departmental Approval), and University Advanced Standing

Examines the time and frequency domain analysis of continuous-time systems subjected to periodic and non-periodic input signals. Introduces signal and transform theory and the application of Laplace and Fourier transforms. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

## **ECE 3780 Communication Systems and Circuits**

**3**  
\* Prerequisite(s): ECE 3770, ECE 3710, (Formal Acceptance into the Electrical Engineering Program, or Departmental Approval), and University Advanced Standing

Introduces the fundamentals of electronic communication systems and circuits. Covers pulse code modulation, line coding, information rate, equalization, amplitude modulation, angle modulation, and noise in communication systems. Lab access fee of \$45 applies.

## **ECE 3785 Communication Systems and Circuits Lab**

**1**  
\* Prerequisite(s): ECE 3770, ECE 3710, and University Advanced Standing  
\* Corequisite(s): ECE 3780

Covers hands on experiments related to course work, in the area of communication systems and circuits. Includes digital and analog modulation for the baseband and bandpass communications. Provides appropriate wireless communication techniques for modern circuits and applications using mini projects. Lab access fee of \$45 applies.

## **ECE 4250 Power Systems Engineering**

**3**  
\* Prerequisite(s): ECE 3250, (Formal Acceptance into the Electrical Engineering Program, or Departmental Approval), and University Advanced Standing

Introduces power system analysis and design with the aid of a personal computer. Emphasizes AC power generation, distribution and usage. Covers single-phase and 3-phase power, motors, generators, power distribution and the grid, generation plants, smart grids, and power flow control. Lab access fee of \$45 applies.

## **ECE 4260 Smart Power Grids**

**3**  
\* Prerequisite(s): ECE 2250 and University Advanced Standing

Introduces fundamentals and system analysis of power grids, smart grids and microgrids with emphasis on distributed renewable power generations, distribution, usage and energy storage. Covers single-phase, three-phase and per-unit power calculations; solar and wind generators, and load flow calculation control.

## **ECE 4700 Computer Architecture for Engineering Applications**

**3**  
\* Prerequisite(s): ECE 3740 and University Advanced Standing

Uses register transfer languages and simulation tools to describe and simulate computer operation; central processing unit organization, microprogramming, input/output, pipelining, virtual memory concepts, VLIW, superscalar out of order, ILP, and memory system architectures. Lab access fee of \$45 applies.

## **ECE 4730 Embedded Systems II**

**3**  
\* Prerequisite(s): ECE 3730, ECE 3740, and University Advanced Standing

Presents the design of hardware and software required for embedded, real-time systems. Covers types of real-time systems, fuzzy logic, sensors, real-time operating systems, C programming skills, and wireless sensor networks. Lab access fee of \$45 for computers applies.

## **ECE 4750 Digital Signal Processing**

**3**  
\* Prerequisite(s): ECE 3770, ECE 3710, and University Advanced Standing

Introduces the theory of digital signal processing and its application to practical problems. Covers spectrum representation, Nyquist sampling, z-transform, discrete Fourier transform, discrete-time Fourier transform, FIR (Finite Impulse Response) and IIR (Infinite Impulse Response) digital filter design. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

## **ECE 4755 Digital Signal Processing Lab**

**1**  
\* Prerequisite(s): ECE 3770 and University Advanced Standing

Performs software and hardware experiments illustrating the basic principles and techniques of digital signal processing. Teaches programming of real-time signal processing algorithms on a concrete DSP chip, and Accelerate the DSP code on the GPU. Lab access fee of \$45 applies.

**ECE 4760  
VLSI Design**

**3**  
 \* Prerequisite(s): ECE 3760 and University  
 Advanced Standing  
 \* Corequisite(s): ECE 4765

Focuses on theories and techniques of VLSI design on CMOS technology. Studies the fundamental concepts and structures of designing digital VLSI systems, including CMOS devices and circuits, standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures, interconnect analysis, CMOS chip layout, simulation and testing, low power techniques, design tools and methodologies, VLSI architecture. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

**ECE 4765  
VLSI Design Laboratory**

**1**  
 \* Prerequisite(s): ECE 3765 and University  
 Advanced Standing  
 \* Corequisite(s): ECE 4760

Covers the complete process of building a ready-to-fabricate CMOS integrated circuit using commercial design software. Includes the layout design of CMOS transistors, gate level design, design using VHDL, CHIP design and pin configuration, and simulation of the circuit for slack time and power consumption. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

**ECE 4770  
Artificial Neural Networks**

**3**  
 \* Prerequisite(s): MATH 1210 and University  
 Advanced Standing

Introduces a range of topics in the field of artificial neural networks: modeling of brains, applicable algorithms, and related applications. Develops the theory of a number of neural network models such as Perceptron, Multilayer Perceptron, and Hopfield networks. Emphasizes algorithms for implementing simple artificial neural networks and their applications. Software fee of \$10 applies. Lab access fee of \$45 for computers applies.

**ECE 4780  
Wireless and Mobile Communications**

**3**  
 \* Prerequisite(s): ECE 3780 and University  
 Advanced Standing

Covers the fundamentals of modern digital wireless communication systems and their applications to modern wireless communication technologies such as 5G NR, MIMO, IEEE 802.11ax (Wi-Fi 6), and broadband satellite communication. Includes digital modulation schemes and their performance analysis in the presence of noise, intersymbol interference (ISI), equalizers, synchronization, multipath fading, spread spectrum, OFDM, multiple access techniques, error control codes, and information theory. Introduces both software and hardware designs. Lab access fee of \$45 applies.

**ECE 4800  
Computer Engineering Senior Design Project**

**3**  
 \* Prerequisite(s): ECE 3740 and University  
 Advanced Standing

Serves as a project-oriented capstone course for computer engineering majors. Emphasizes major hardware and software design. Includes identification and completion of a suitable design project to be mutually selected by the faculty supervisor and student. Requires weekly written and oral presentations as well as a final written project report and an oral presentation. Requires completion of a program level assessment test. Software fee of \$10 applies. Course fee of \$27 for materials/testing applies. Lab access fee of \$45 for computers applies.

**ECE 481R  
Electrical and Computer Engineering Internship**

**1 to 3**  
 \* Prerequisite(s): Admission to Computer Engineering program or Electrical Engineering program, Instructor Approval, and University  
 Advanced Standing

Provides an opportunity to gain career-related experience while earning academic credit. Credit is determined by the number of hours a student works during the semester. May be Graded Credit/No Credit. May be repeated for a maximum of three credits toward graduation.

**ECE 4850  
Machine Learning**

**3**  
 \* Prerequisite(s): CS 1400, ECE 3710, and  
 University Advanced Standing

Provides a broad introduction to machine learning (ML). Uses techniques such as probability and statistics, linear algebra, and optimization to learn from and make predictions on data without human intervention. Covers the concepts behind several machine learning modeling and algorithms to be prepared for conducting research and industrial application of machine learning.

**ECE 4900  
Electrical and Computer Engineering Capstone I WE**

**3**  
 \* Prerequisite(s): ECE 4730 and University  
 Advanced Standing

Electrical and Computer Engineering Capstone I and Capstone II focus on team-oriented design and technical writing by incorporating group projects, oral presentations and written reports. Incorporates engineering standards and realistic constraints including economic, environmental, sustainability, manufacturability, ethical, social, political, health and safety. Emulates the problems encountered by engineers working in commercial, industrial, and governmental entities. Capstone I and Capstone II must be taken in consecutive semesters. Lab access fee of \$45 applies.

**ECE 490R  
Advanced Current Topics in Computer Engineering**

**1 to 3**  
 \* Prerequisite(s): Department Approval and  
 University Advanced Standing

Provides exposure to emerging technologies and topics of current interest in computer engineering. Varies each semester depending upon the state of technology. May be repeated for a maximum of 6 credits toward graduation without prior written department approval. Lab access fee of \$45 applies.

**ECE 491R  
Independent Study**

**1 to 3**  
 \* Prerequisite(s): Prior written Department  
 Chair approval and University Advanced  
 Standing.

Offers independent study as directed by a faculty advisor in reading, individual projects, etc. Varies each semester depending upon the state of technology. A maximum of 3 credit hours may be counted towards graduation without prior written Department approval.

**ECE 4950  
Electrical and Computer Engineering Capstone II WE**

**3**  
 \* Prerequisite(s): ECE 4900 and University  
 Advanced Standing

Electrical and Computer Engineering Capstone I and Capstone II focus on team-oriented design and technical writing by incorporating group projects, oral presentations and written reports. Capstone II meets one of two Writing Enriched courses required for graduation in Electrical Engineering and Computer Engineering. Capstone II incorporates engineering standards and realistic constraints including economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political. Emulates the problems encountered by engineers working in commercial, industrial, and governmental entities. Capstone I and Capstone II must be taken in consecutive semesters. Lab access fee of \$45 applies.