

**School of Engineering offerings, with the exception of offerings that meet Liberal Learning requirements, are restricted to School of Engineering majors or to students with academic programs requiring specific School of Engineering offerings. Enrollment for non-majors interested in exploring School of Engineering offerings is by permission of the department chairperson.**

**ELC 251/Electronics**

**1 course unit**

(spring semester)

*Prerequisite:* ENG 212

Introduction to electronic devices and related circuits. Topics include diodes, bipolar junction and field-effect transistors, operational amplifiers, and related integrated circuit components.

**ELC 321/Signals and Systems**

**1 course unit**

(spring semester)

*Prerequisite:* ENG 272

*Corequisite:* ENG 212 Continuous and discrete signals and systems. Convolution, impulse response, system classifications, differential and difference equations. Fourier series, Fourier transform, Laplace transform, and z-transform. Transfer functions and stability.

**ELC 333/Electronics Lab**

**0.5 course unit**

(laboratory)

(spring semester)

*Corequisite:* ELC 251

A practical laboratory experience designing, simulating, breadboarding, and testing electronic circuits to complement the theory in ELC 251.

**ELC 341/Communication Systems**

**1 course unit**

(fall semester)

*Prerequisites:* ELC 251, ELC 321

Digital and analog communication systems including baseband, pulse, AM, FM, and digital modulated systems.

**ELC 343/Microcomputer Systems**

**0.5 course unit**

(fall semester)

*Prerequisite:* ENG 312

An introductory course in microcontrollers, microprocessors, embedded control architecture, and assembly language programming. Interfacing of external devices with microcontrollers is emphasized.

**ELC 361/Engineering Electromagnetics**

**1 course unit**

(spring semester)

*Prerequisites:* MAT 229 and ENG 212

An integration of theory and practical applications in electromagnetics, transmission lines, and electromagnetic fields and waves. Includes impedance matching, Smith Chart, CAD tools, and waveguides.

**ELC 363/Computer Engineering Lab I**

**0.5 course unit**

(laboratory hours)

(fall semester)

*Corequisite:* ELC 451

Hands on laboratory experience to reinforce the concepts covered in ELC 451. Students will do at least three projects involving computer data-path design, micro-code and finite state machine control, and memory and I/O subsystem analysis and design.

**ELC 373/Wireless and Communications Laboratory** **0.5 course unit**

(spring semester)

*Corequisite:* ELC 361

Design issues and modeling techniques in communication transmission systems. Experiments include linear, nonlinear, and digital modulation/demodulation and computer-aided design.

**ELC 383/Electronics II** **1 course unit**

(with design hour)

(occasionally)

*Prerequisite:* ELC 251

The continuation of ELC 251 covering the analysis and design of electronic circuits and systems: biasing, small-signal analysis, frequency response, feedback amplifiers, active filters, non-linear op-amp applications, and oscillators.

**ELC 391/Independent Study** **0.5-1 course unit**

(occasionally)

*Prerequisites:* Permission of instructor and department, senior status required

For advanced students wishing to pursue a special area of interest. Topic(s) developed in consultation with a faculty advisor.

**ELC 411/Embedded Systems** **1 course unit**

(with design hour)

(fall semester)

*Prerequisite:* ELC 251

*Corequisite:* ELC 343

This course deals with embedded systems and their interactions with their physical environments. It focuses on embedded system design issues such as limited memory, cost, performance guarantees, real-time operations, power, and reliability.

**ELC 423/Digital Signal Processing** **1 course unit**

(fall semester)

*Prerequisites:* ENG 312, ELC 321

Sampling data systems, z-transform, DFT, FFT, and digital filter design with applications to digital signal processing.

**ELC 431/RF/Microwave Engineering** **1 course unit**

(with design hour)

(occasionally)

*Prerequisite:* ELC 361

An extension of Engineering Electromagnetics. Topics include RF/microwave active devices, amplifier design using scattering parameters, and modern filter design.

**ELC 433/Signal Processing Lab** **0.5 course unit**

(laboratory)

(fall semester)

*Corequisite:* ELC 423

DSP systems will be designed and tested with MATLAB and LabVIEW and implemented with DSP processors.

**ELC 441/Digital Engineering Systems** **1 course unit**

(with design hour)

(spring semester of odd numbered years)

*Prerequisites:* ENG 312, ELC 251

Treatment of digital system engineering problems: power, noise, signaling, and timing.

**ELC 451/Computer Architecture and Organization**

**1 course unit**

(spring semester)

*Prerequisite:* ENG 312

*Corequisite:* ELC 343

Microprocessor design philosophy, data typing and addressing modes, multi-processors, multi-tasking, process communications, memory management, and virtual memory.

**ELC 453/Digital Control Systems**

**1 course unit**

(same as MEC 453)

(occasionally)

*Prerequisite:* ENG 352

Digital control systems, dynamic response modeling, design, and compensation techniques.

**ELC 463/Computer Engineering Lab II**

**0.5 course unit**

(laboratory hours)

(spring semester)

*Prerequisite:* ELC 363

A semester-long design experience involving the formal design and simulation of a major microprocessor or microcomputer system or subsystem. Students will do a major project consisting of the design and simulation of a small microprocessor or microcomputer, cache controller, etc.

**ELC 471/VLSI Design**

**1 course unit**

(with design hour)

(occasionally)

*Prerequisites:* ELC 251 ELC 451

Structured design methodologies for VLSI systems. Topics include switching models, device equations, combinational and sequential systems design, simulation, timing, verification and tools for computer-aided design.

**ELC 477/Power Systems and Renewable Energy**

**1 course unit**

(with design hour)

(occasionally)

*Prerequisites:* ELC 251, ENG 272

As the energy resources on which our society currently relies (e.g. petroleum, coal) are exhausted, the need for innovation in power and energy systems engineering grows. Specifically, engineers must examine methods to increase energy renewability as well as efficiency in energy conversion, distribution, and utilization. It is appropriate that this course places focus on electric power systems, as electric power is the "medium" with most promise to support new energy technologies. This course provides students with knowledge of as well as the ability to model and analyze the nonlinear behavior of electric power systems. Focus is placed on 3-phase power, complex power and power factor, transformer modeling, synchronous machine modeling, transmission line modeling, load flow analysis, economic dispatch, and energy renewability.

**ELC 473/Bioinstrumentation**

**1 course unit**

(same as BME 473, MEC 473)

(with laboratory)

(spring semester)

*Prerequisites:* ENG 212, ENG 214

Theory and design of biomedical instruments used for measurements on humans and animals. Detailed coverage of sensors and transducers that quantify force, pressure, flow, sound, temperature and displacement. Origin of biopotentials (ECG, EMG, EEG) and biological signal processing. Consideration of noise, interference, and electrical safety issues.

## Computer and Electrical Engineering Courses-4

### **ELC 475/Advanced Digital Signal Processing**

**1 course unit**

(with design hour)

(fall semester)

(occasionally)

*Prerequisite:* ELC 423

Digital filter design, discrete random signals, effects of finite word length arithmetic, fast Fourier transform and applications, power spectrum estimation, and implementation using DSP microprocessors.

### **ELC 483/Robotics**

**1 course unit**

(same as MEC 483)

(with design hour)

(occasionally)

*Prerequisite:* ENG 272

Introduction to robotics foundations in kinematics, dynamics, control, trajectory generation, actuation, sensing, and design. Laboratory projects involving building mobile robots and operating manipulators are incorporated to reinforce the basic principles introduced in the lecture.

### **ELC 495, 496/Senior Project I, II**

**0.5, 0.5 course unit**

(every semester)

*Prerequisites:* Senior standing

Senior project focuses students' previous experience upon a specific technical project. Library research, design, cost analysis, construction, testing, and project management. Students work closely with a faculty advisor.

### **ELC 497/Mentored Research I**

**0.5 course unit**

(every semester)

*Prerequisite:* Electrical Engineering or Computer Engineering major, a cumulative GPA of at least 3.5 and permission of the Department

Intensive research activity in an advanced area of Electrical or Computer Engineering under the supervision of a faculty mentor. This course is for students in the Research Track of the Electrical and Computer Engineering Department, and be repeated up to four times.