

## **CEE (Computer / Electrical Eng.) Courses for Computer Engineering Degree**

### **CEE 205 – Circuit Analysis and Design (4 cr.)**

Review of basic electrical quantities from physics such as charge, current, voltage, energy, power and resistance. Kirchhoff's laws, node and loop analysis, superposition, dependent sources and operational amplifiers. Review of capacitance and inductance, modeling of ideal and real capacitors and inductors, magnetic circuits, steady state and transient behavior of RC, RL, and RLC circuits. Sinusoids, phasors, complex impedance and steady state AC analysis. AC power, power factor correction, resonance and frequency response. Single and three phase power distribution and transformers. Use of computer analysis and simulation tools such as PSPICE, MultiSim and MATLAB. Introduction to digital multimeters, power supplies, function generators and oscilloscopes in the laboratory.

Prerequisite: Math 154, Physics 282 (or concurrent registration).

### **CEE 215 - Electronics (4 cr)**

Introduction to semiconductor physics, modeling of basic semiconductor devices such as diodes, bipolar and field effect transistors and thyristors. Biasing, small and large signal behavior of electronic circuits, temperature dependence of semiconductor devices. Time and frequency response of electronic devices and circuits including operational amplifiers. Differential, multistage and power amplifiers. Discussion of integrated circuit fabrication technology. Use of computer simulation tools such as PSPICE, MultiSim and MATLAB and basic electronic test equipment to verify device behavior and circuit performance.

Prerequisite: CEE 205 (or concurrent registration).

### **CEE 225 - Digital Logic (3 cr)**

Analysis and design of combinational and sequential logic circuits. Boolean algebra, number systems and logic gates. Minimization and realization of Boolean functions. Synchronous and asynchronous sequential logic including counters and registers. Programmable logic arrays. Finite state machines, state transition diagrams and state equivalence. Simulation of logic circuits using MultiSim.

Co-requisite: CEE 205

### **CEE 235 - Signals and Systems (3 cr)**

Linear system modeling using differential and difference equations, continuous and discrete convolution. Laplace and Z-transforms, transfer functions and frequency response of continuous and discrete systems. Fourier series representation of periodic signals. Spectral analysis of general signals using Fourier transforms. Development of the Fast Fourier Transform (FFT) algorithm and its use in the spectral analysis of sampled signals. Introduction to digital signal processing. Use of MATLAB with the Signal Processing Toolbox for signal and system analysis.

Prerequisite: CEE 205, MATH 250

**CEE 325 - Digital System Design (3 cr)**

Analysis of logic families at the device and circuit level. Switching characteristics of Bipolar Junction Transistors (BJT's) and Metal Oxide Semiconductor (MOS) transistors. Characteristics of Transistor – Transistor Logic (TTL) and Complementary Metal Oxide Semiconductor (CMOS) logic including speed, power consumption, noise rejection and fan-in, fan-out capability. Serial, parallel, and bus interfacing issues for logic. Analog to Digital (A/D) and Digital to Analog (D/A) converters. Design techniques for digital systems with an emphasis on hardware descriptive languages.

Prerequisites: CEE 215 and CEE 225.

**CEE 335 Fundamentals of Control Systems (4 cr)**

Review of Laplace transforms from mathematics, modeling of dynamical systems in the time and frequency domain, block diagrams, properties of feedback systems, root locus and frequency response analysis and design techniques. Velocity and position control servo systems. Introduction to digital control and concepts associated with embedded digital controllers. Programmable Logic Controllers and structured ladder logic programming. Extensive use of MATLAB and the Control System Toolbox in analysis and design. An introduction to the use of LabView for the control and instrumentation of systems. Laboratory experiments in Programmable Logic Controllers, microcontrollers and servo systems.

Prerequisites: CEE 235.

**CEE 345 - Microprocessor System Design (3 cr)**

Study of the internal organization of microprocessors including Arithmetic Logic Unit (ALU), registers, memory addressing, internal bus structure, interrupt structure, serial and parallel Input/Output (I/O), bus timing and protocols. Instruction set and assembly language coding. Use of assemblers, software and hardware debuggers including In Circuit Emulator (ICE) units.

Pre-requisites: CEE 325 and CS 245

**CEE 355 - Electromagnetic Wave Propagation (3 cr)**

Review of electrostatics and magnetostatics from physics, review of vector algebra and vector calculus from mathematics. The electromagnetic spectrum, Maxwell's equations, electromagnetic wave propagation in various guided and unguided media, relationship between circuit theory and fields, transmission lines, waveguides and antennas. Applications of electromagnetic wave propagation. Use of computer aided analysis tools.

Prerequisites: MATH 250, PHYS 282, CEE 205.

**CEE 405 - Senior Design I (2 cr)**

First of a two semester sequence in the design and implementation of an embedded system by the individual student. General design methodology including functionality, manufacturability, cost, reliability, safety, aesthetics and environmental concerns. Development of system performance specifications and project planning including timelines. Students will develop the paper design in this course and perform analyses and

software simulations for the design. A final written and oral report will be required.  
Prerequisites: Senior standing.

### **CEE 410 - Senior Design II (2 cr)**

The second of a two semester sequence in the design and implementation of an embedded system by an individual student. This course will involve the implementation and testing of the paper design.

Prerequisite: CEE 405.

### **CEE 425 - Data Communications & Computer Networking (3 cr)**

Coding and modulation techniques for data transmission, error detection and error correction techniques will be studied. Network topologies, Open Systems Interconnect (OSI) model, Local & Wide Area Networks (LAN's & WAN's), network protocols with an emphasis on Transport Code Protocol/Internet Protocol (TCP/IP), switching and routing techniques. Network management, security, encryption and hashing. Traffic analysis and simulation of networks. Laboratory exercises will involve the design, implementation and testing of a simple LAN/WAN and measurements of system performance.

Prerequisites: CEE 235 and CS 441.

### **CEE 435 - Digital Signal Processing (3 cr)**

Review of discrete time systems in the time and frequency domain including difference equations, convolution and Z-transforms Sampling techniques, signal reconstruction and aliasing. Theory and design of Finite Impulse Response (FIR) filters and windowing. Theory and design of Infinite Impulse Response (IIR) filters and comparisons to FIR filters. The effect of finite word length in digital signal processing. The Fast Fourier Transform (FFT) and spectral analysis of discrete time signals. Introduction to specific Digital Signal Processing (DSP) chip with its associated architecture, instruction set and software development tools. Extensive use of MATLAB and its Signal Processing Toolbox.

Prerequisites: CEE 235.

### **CEE 445 - Embedded Systems (3 cr)**

A structured approach to the development and design of microprocessor, microcontroller, Digital Signal Processor (DSP) and Programmable Intelligent Computer (PIC) embedded systems. Processor selection, partitioning of hardware/firmware, configuration and interfacing of peripheral components. Assemblers and higher level language support for embedded processors will be studied. Study of a chosen microcontroller including architecture, memory, interrupt handling, I/O interfacing and instruction set and software development tools. Laboratory experiments will include the design and implementation of an embedded system.

Prerequisites: CEE 345.

### **CEE 455 - Fundamental of Wireless Communication (3 cr)**

Design and analysis of wireless communication systems. Introduction to wireless, frequency allocations, network architectures, discussion of first, second and third

generation systems. Amplitude, frequency and phase modulation. Time and frequency multiplexing. Relationship between information content, channel bandwidth and modulation schemes. Analysis of radio propagation, calculation of path loss, fading, scattering and shadowing. Signal encoding and error control. Introduction to broadband, spread spectrum and multiple access systems. Transmitting and receiving antennae. Wireless regulation, licensing and security considerations. Use of computer software in the evaluation of system performance and spectral analysis of signals.  
Prerequisites: CEE 235 and CEE 355.

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