

## 1.5 COURSE DESCRIPTION

### EE 200 Digital Logic Circuit Design

(3-3-4)

Number systems & codes. Logic gates. Boolean algebra. Karnaugh maps. Analysis and synthesis of combinational systems. Decoders, multiplexers, adders and subtractors, PLA's. Types of flip-flops. Memory concept. Counters. Registers. Sequential circuit design. System level digital design. HDL (Verilog) use in the design and synthesis of digital systems.

**Prerequisites: MATH 101 and PHYS 101**

### EE 203 Electronics I

(3-3-4)

Opamp Linear Applications. PN junction and zener diode. Diode basic circuit analysis and diode applications (rectifier and limiters). MOSFET and BJT (DC, small signal analysis). Amplifier configurations and characteristics. CMOS digital circuits.

**Prerequisite: EE211 and EE200**

### EE 207 Signals and Systems

(3-0-3)

Introduction to Signals and Systems. Time-Domain Analysis. Convolution. Fourier Series and Applications. Fourier Transform and Applications. Laplace Transform and Applications. Discrete-Time Signals and Systems. Sampling. Difference Equations and Z-Transform. Introduction to Discrete Time Fourier Transform and its applications.

**Prerequisite: EE 211**

### EE 211 Electric Circuits I

(3-0-3)

Basic laws: Ohm's, KVL, KCL. Resistive circuits. Circuit analysis techniques. Network theorems: Thevenin's, Norton's, Source transformation, Superposition, Maximum power transfer. Op Amps. Energy storage elements. First and second order circuits. Phasor techniques for steady-state sinusoidal circuits.

**Prerequisites: MATH 102 and PHYS 102**

### EE 213 Electric Circuits II

(2-3-3)

Important power concepts of AC circuits. Three phase circuits. s-domain analysis. Frequency selective circuits. Two-port networks. Transformers.

**Prerequisite: EE 211**

### EE 303 Electronics II

(3-3-4)

Differential amplifiers. Multistage amplifiers. Amplifier frequency response (for single stage, multistage and opamp). Passive and Active filters. Feedback: Circuit topologies and analysis. Oscillators. Introduction to A/D and D/A.

**Prerequisite: EE 203**

### EE 311 – Fundamentals of EE Design

(2-0-2)

Introduction to engineering design. Literature survey. Formulation of practical engineering problems. Problem analysis, Engineering design process. Modeling, implementation, and evaluation using computer design tools. Report writing, presentation skills, and team work.

**Prerequisite: EE 203 and EE 207**

### EE 315 Probabilistic Methods in Electrical Engineering

(3-0-3)

Fundamentals of probability theory: single and two discrete and continuous random variable. Probability density function. Gaussian and other distributions. Functions of one and two random variables. Joint and conditional probabilities. Moments and statistical averages. Central limit theorem. Introduction to random process. Concept of stationarity and ergodicity. Correlation function. Power spectrum density. Response of linear systems to random signals.

**Prerequisite: EE 207**

- EE 340 Electromagnetics** (3-3-4)  
Electrostatics: Coulomb's law, Gauss's law, electric potential, electric dipoles, resistance, capacitance. Magnetostatics: Biot-Savart law, Ampere's law, Magnetic forces. Magnetic boundary conditions, inductance. Time varying fields: Faraday's Law, Maxwell's equations, Plane wave propagation. Reflection and refraction. Introduction to transmission line theory. Waveguides and Antennas.  
**Prerequisite: EE 211 and MATH 301**
- EE 350 Cooperative Work** (0-0-0)  
The starting of the cooperative work in the summer just preceding the senior year. Description as given in **EE 351**.  
**Prerequisites: ENGL 214, Approval from department with completion of 90 credit-hours**
- EE 351 Cooperative Work (Continued)** (0-0-6)  
A continuous period of 28 weeks spent in the industry working in any of the fields of electrical engineering. During this training period, the student is exposed to the profession of electrical engineering through working in many of its fields. The student is required to submit, and present, a formal written report of his work. Limited to EE students with COOP option.  
**Prerequisites: EE 350**
- EE 352 Cooperative Work (Continued)** (0-0-6)  
This course is the same as EE 351. The only difference is that EE 352 is for students who choose to start their coop program during the second term of the academic year.  
**Prerequisites: ENGL 214, Approval from department with completion of 90 credit-hours**
- EE 360 Electric Energy Engineering** (3-3-4)  
Fundamentals of electric energy systems. Electric energy conversion. Components of electric energy systems. Transformers (1 and 3 phases). AC machine fundamentals. Synchronous and Induction machines. DC machine fundamentals. Overhead transmission lines and underground cables.  
**Prerequisite: EE 213**
- EE 370 Communications Engineering I** (3-3-4)  
Review of signal and linear systems. Amplitude modulation (AM, DSB, SSB, VSB). Angle modulation (FM, PM). Sampling, Quantization, PCM, DPCM, DM. Multiplexing. Line coding and baseband transmission. Band-limited channels and ISI. Digital carrier modulation (PSK, ASK, FSK, and M-ary). Examples of modern communication systems  
**Prerequisites: EE 207 and EE 203**
- EE 380 Control Engineering I** (3-3-4)  
Introduction to feedback control systems. Block diagram and signal flow graph representation. Mathematical modeling of physical systems. Stability of linear control systems. Time-domain and frequency-domain analysis tools and performance assessment. Lead and lag compensatory design. Proportional, integral, and derivative control.  
**Prerequisite: EE 207**
- EE 390 Digital System Engineering** (3-3-4)  
Microprocessor hardware models. Instruction sets. Assembly language programming and debugging. Memory and input/output mapping. Input and output instructions. Input/output interfacing. Introduction to interrupts.  
**Prerequisites: CSE 103, EE 200**
- EE 400 Telecommunication Networks** (3-3-4)

Network Architectures. Network Layers: OSI Model and TCP/IP Model. Physical Layer Protocols and Digital Transmission Fundamentals. Data Link Layer Protocols. Network Layer Protocols: IP Protocols. Medium Access Control systems. Packet Switching and Circuit Switching. Routing in Packet Switching Networks. Security Protocols.

**Prerequisites: EE 315 and EE 370**

**EE 402 Control Engineering II**

**(3-0-3)**

Review of stability criteria and techniques. Linear feedback system design and compensation methods. Introduction to nonlinear control systems: the describing function and phase plane analysis. Stability criteria for nonlinear systems. On-off control systems and optimum switching. Introduction to optimal control theory. Simulations.

**Prerequisite: EE 380**

**EE 406 Digital Signal Processing**

**(3-0-3)**

Classification of signals and their mathematical representation. Discrete-time systems classification. Linear shift-invariant system response, difference equations, convolution sum, and frequency response. Discrete Fourier transform. Z-transform and its application to system analysis. Realization forms. Sampling and aliasing. Finite impulse response (FIR). Design windowing technique. Introduction to infinite impulse response (IIR). Filter design techniques.

**Prerequisite: EE 370**

**EE 411 Senior Design Project**

**(1-6-3)**

A course that integrates various components of the curriculum in a comprehensive engineering design experience. Design of a complete project including establishment of objectives and criteria, formulation of design problem statements, preparation of engineering designs. The design may involve experimentation, realization and/or computer project. Team design projects, where appropriate, are highly encouraged.

**Prerequisite: Senior standing**

**EE 417 Communication Engineering II**

**(3-0-3)**

Noise in telecommunication systems. Representation of white and narrowband noise. Performance of continuous wave modulation in the presence of additive white Gaussian noise. Noise effects and probability of error in digital communication systems. Signal detection and optimum receivers in digital communications. Bit error rate performance analysis. New trends in digital communications: Spread spectrum, OFDM, etc.

**Prerequisites: EE 315 and EE 370**

**EE 418 Introduction to Satellite Communications**

**(3-0-3)**

Overview of satellite systems. Orbits and launching methods. Communication satellite subsystems. Modulation schemes and satellite multiple access (FDMA, TDMA, and CDMA). Space link analysis. Satellite antennas. Applications of satellites.

**Prerequisites: EE 340 and EE 370**

**EE 420 – Optical Fiber Communications**

**(3-3-4)**

Optical fiber waveguides: ray and mode theories. Step-index and graded-index fibers. Transmission characteristics of optical fibers: losses and dispersion. Methods of manufacturing optical fibers and cables. Connections of optical fibers. Measurements of attenuation, dispersion, refractive index profile, numerical aperture, diameter and field. Optical sources: semiconductor lasers and light emitting diodes. Optical detectors. Optical fiber systems. Digital and analog systems. Design of a simple optical fiber communication link.

**Prerequisites: EE 340 and EE 370**

**EE 421 Wireless Design Laboratory**

**(1-6-3)**

An overview of Bluetooth and wireless communications technology, The Bluetooth packet structure, link types and protocol, Bluetooth application examples, test equipment training, transmitter measurements, receiver

measurements, team project introduction, taking the ethics challenge, antenna propagation tutorial, open for team project activity, Team project oral presentations; final written reports.

**Prerequisites: EE 370**

**EE 425 Wireless Communication**

**(3-0-3)**

Wave propagation mechanism. Antenna type. Channel models. Large and small scale fading. Performance of digital modulation over fading channels. Diversity. Link budget analysis. Multiple access techniques (TDMA, FDMA, CDMA). Cellular systems (frequency planning, capacity, handoff, sectorization). Modern wireless communication technologies and standards.

**Prerequisite: EE 315 and EE 370**

**EE 431 Wireless Software Engineering**

**(2-3-3)**

Introduction: main operating systems, common hardware architectures, software engineering singularities for wireless computers. Infrastructural support: software tools. Requirements analysis and design: design methodologies, user interface, embedded system design, database design, file organization. Implementation: C/C++ review, APIs, event handling, memory and power consumption minimization. Communication technologies. Software Testing. Testing principles for mobile devices.

**Prerequisites: CSE 103, EE 370**

**EE 432 Digital Control Systems**

**(3-3-4)**

Introduction to digital control and discrete transform (z-transform). Discrete and hybrid Signal Flow Graphs (SFG)s. Solution of discrete-time state space. Modified z-transform. Time-response and characteristic equations. Stability concepts in discrete-systems. Root locus, Nyquist method and Bode plot applied to discrete systems. Digital lead lag compensators applied to digital systems. Introduction to design.

**Prerequisite: EE 380**

**EE 433 Applied Control Engineering**

**(3-3-4)**

Introduction to process control. Feedback and feed forward control configurations. Modeling of dynamic systems: time delays, high order systems, multivariable systems. Process identification. Controller performance analysis and design. PID controller tuning. Process interaction and decoupling control.

**Prerequisite: EE 380**

**EE 434 Industrial Instrumentation**

**(2-3-3)**

Introduction to measurements systems and basic definitions. Sensors (temperature, humidity, light, piezoelectric , hall effect, pressure, flow and strain gauges) and, signal conditioning circuits (bridge, instrumentation amplifier, scaling circuits, comparators, A/D and D/A, 555 timer). Remote control. Ultrasound systems. Measurements techniques (temperature and humidity measurements, level and displacement measurement, pressure and flow measurement). Introduction to foundation field bus.

**Prerequisites: EE 200, EE 303**

**EE 437 Electrical Installation**

**(2-3-3)**

Distribution system. Load characteristics. Conductors and cables. Installation methods. Design of electrical systems for residential, commercial, and industrial installations. Electrical safety. Grounding. Protection equipment. Voltage drop calculations. Electrical drawing.

**Prerequisite: EE 360**

**EE 445 Industrial Electronics**

**(3-3-4)**

555 timers. Power switches (power transistors, SCR, Triac, UJT, PUT). Structure and application in power control. Instrumentation amplifier. Opto electronic sensors. LCD and 7 segment interface. Ultrasonic transistors and

applications. Voltage regulators (series, shunt, 3 terminals, switched mode). Power inverter and its applications. Introduction to microcontroller industrial applications.

**Prerequisite: EE 303**

**EE 446 Programmable Logic Controllers and Applications (3-3-3)**

Basic concepts of microcontrollers. The structure of programmable logic controllers: I/O, relays, counters and timers. Ladder diagram concepts. PLC's intermediate and advanced functions. PLC's data sets and data manipulations. PLC's industrial applications in the process control. Concepts of PLC's communications.

**Prerequisite: Senior Standing**

**EE 457 Analog and Digital Communication Electronics (3-3-4)**

Functional blocks of analog and digital communication systems. Functional blocks of analog monochrome and color TV receivers. Design of S/H circuits, A/D and D/A converters, and timing (clock generator) circuits. Circuit design using PLL, VCO, and multipliers. Design of PAM, PPM, PWM and PCM transmitters and detectors. Special circuits for phase shift keying.

**Prerequisites: EE 303, EE370**

**EE 460 Power Electronics and Power Quality (3-3-4)**

Power electronic devices. DC and AC power electronics converters. Fundamental of power quality and system harmonics effects and mitigation. Power quality standards.

**Prerequisite: EE 360**

**EE 462 Electric Machines and Drives (3-3-4)**

AC/DC machines dynamics. Fractional horsepower and special type machines. Integration of electric machines and control systems. AC/DC electric drives. Speed / position control. Computer simulation.

**Prerequisite: EE 360 and EE 380**

**EE 463 Power System Analysis (3-0-3)**

The basic concepts: representation, equivalent circuits. Per unit system. Power low analysis. Short circuit analysis. Stability Analysis. Use of power system simulation packages.

**Prerequisite: EE 360**

**EE 464 High Voltage Fundamentals and Applications (3-3-4)**

Introduction to High Voltage engineering, Generation of testing voltages. High Voltage measurements. High Voltage insulation. Electric fields and electric breakdown. High Voltage Insulators. Circuit breakers. Switchgears. Industrial applications.

**Prerequisite: EE 360**

**EE 465 Power Transmission and Distribution (3-0-3)**

Fundamentals of overhead transmission lines and underground cables. Transmission line parameters and constants. Transmission Line Steady State and Transient Operations. Natural loading and reactive compensation. Fundamentals of distribution system. Load characteristics. Substation safety and Grounding. Standards.

**Prerequisite: EE 360**

**EE 466 Power System Protection (3-3-4)**

Introduction to power system fault calculations. Introduction to protective relaying. Relay operating principles. Current and potential transformers. Differential protection of generators, motors, transformers, and busbars. Over-current, distance and pilot protection of transmission lines. Digital relays. Relay coordination.

**Prerequisite: EE 360**

**EE 467 Power System Planning & Operation (3-0-3)**

Short and long term demand forecasting. Expansion of generation and transmission systems. power generation cost, economic dispatch and unit commitment. Power system state estimation. Load frequency control.

**Prerequisite: EE 360**

**EE 468 Renewable Energy**

**(3-0-3)**

Electric energy from renewable energy sources including solar, wind, and fuel cells. Characteristics of direct conversion, energy conversion and storage systems. Issues related to integration of small scale energy sources into electricity grid. Smart grids.

**Prerequisite: EE 360**

**EE 499 Special Topics in Electrical Engineering**

**(3-0-3)**

The contents of this course will be in the areas of interest in electrical engineering. The specific contents of the course will be given in detail before the start of early registration for the semester in which the course is offered.

**Prerequisite: Senior standing or consent of instructor**