وزارة التعليم
Ministry of Education

جامعة المستقبل
Mustaqbal University
أول جامعة أهلية بمنطقة القصيم

# كلية الهندسة وعلوم الحاسب

## قسم هندسة الإلكترونيات والاتصالات

# توصيف مقررات

## برنامج هندسة الإلكترونيات والاتصالات

**العام الجامعي** 1443 **هـ**

### EE 202 - Electric Circuits I

Circuit theorems: Superposition principle, Thevenin and Norton theorems, Maximum power transfer theorem. Techniques of circuit analysis: Nodal and mesh analysis, Sinusoidal sources and the concept of phasors in circuit analysis. Introduction to the concept of average, reactive and complex power, and power factor. Introduction to three phase circuits.
**Prerequisite:** Math 102, Phys 102

### EE 203 - Electric Circuit

Introduction to the Laplace Transform. Laplace transform in circuit analysis. Frequency response of RLC and selective circuit: concept of transfer function, resonance, bode plots, introduction to filters; Two-Port networks; Mutual inductance and transformers; Transient analysis of first and second order circuits.
**Prerequisite:** EE 202

### EE 204 – Engineering Electromagnetics I

Review to vector calculus; Electrostatic fields; Columb's law; Gauss›s law and divergence; Electric potential; Dielectrics and capacitance; Poisson›s and Laplace›s equations; Charge images; Current density and conductors; Magnetostatic fields; Biot-Savart and Ampere›s laws; Curl and Stoke›s theorem; Magnetic materials and circuits; Self and mutual inductances; Energy in static fields.
**Prerequisite:** Phys 102

### EE 205– Engineering Electromagnetics II

Time varying fields; Faraday›s law. Transformer and motional emfs; Displacement current; Maxwell›s equations and time harmonic fields; Wave equation; Power transfer and Poynting vector; Plane wave propagation in free space, in lossy dielectrics and in good conductors; Polarization; Reflection of plane wave at normal and oblique incidence; Transmission line Theory; Impedance matching.
**Prerequisite:** EE 205

### EE 206 - Electric Laboratory I

General introduction to the laboratory. Ohms law, Voltage, current, and power in DC circuits using Kirchoff's laws. Superposition, Thevenin›s, and Maximum power transfer theorems in DC circuits; Series and parallel AC circuits; Resonance in series and parallel circuit; The Oscilloscope and Function Generator, Sinusoidal AC Analysis Maximum power transfer theorem, Magnetically-coupled circuits; Electric Field and Potential Inside Capacitors. Capacitance and Inductance of Transmission Lines.
**Co-requisite:** EE 202

### EE 207 - Electric Laboratory II

Measurement of Inductance/Capacitance and its reactances, Thevenin's and maximum power transfer theorems in AC circuits. Transients in RL, RC and RLC circuits, Resonance in series and parallel RLC circuits, Three phase circuits. EM. Wave Transmission and Reflection, Magnetic Force on a Current Carrying Conductor. Power factor improvement in AC circuits
**Prerequisite:** EE 206

### EE 220- Electronics I

Introduction to semiconductor material properties; Semiconductor diodes: structure, Operation and circuit applications; Special diodes: Zener, LED, Solar cell and photodiode; Metal Oxide Field Effect Transistors (MOSFETs): Structure, operation, and Circuit applications; Bipolar Junction Transistor (BJT): Structure operation, and circuit applications. Thyristors: Structure and I-V characteristics.
**Prerequisite:** PHYS 102

### EE 221 – Electronics Laboratory I

Introduction to the lab tools, I-V characteristics of diode, clipping circuits using diodes, rectification using diodes, Zener diode and regulators, BJT DC biasing, CE BJT amplifier. MOSFET DC biasing, CS MOSFET amplifier, Simulation of Simple Circuits.
**Co-requisite:** EE 220

### EE 270 - Signal and System Analysis

Motivation and applications, Signal classifications, Signal operations, Singularity functions; Linear time-invariant systems and convolution; Correlation; Fourier series and transform for continuous and discrete time signals; Frequency response; Laplace transform and applications.
**Prerequisite:** EE 202

### EE 209 – Fundamentals of Electrical Systems (For Non-EE Students Only)

DC Networks: Resistance and Ohm's law, Series/parallel networks, Current sources, Multisource networks, Network theorems. AC Networks: Sinusoidal (AC) waveform, effective (RMS) values, average values, the R, L, C Elements, Phasors and Complex Numbers, series and parallel (AC) networks. Polyphase Systems and Resonance: Multisource (AC) Networks, Network theorems, Polyphase systems. Electromagnetism: Transformers. Generators and Motors: DC generators, DC motors, AC generators
**Prerequisite:** Math 102, Phys 102.

### EE 301 Probability Theory and Random Processes

Mathematical Modeling: deterministic and probability models. Basics of probability:, random experiments, discrete and continuous sample space, conditional probability, Baye's rule, independence of events, synthesizing randomness. Single random variable: distribution and density functions, function of random variable, Markov and Chebyshev Inequality, important types of discrete and continuous random variables, computer generation of random variables. Characterization of random variable: mean, variance and moments, transform methods, characteristic function, moment generating theorem. Sum of random variables: central limit theorem. Electrical engineering applications of random variables. Random Process: definition and characterization of random process. Auto-correlation and auto-covariance of random process. Gaussian random process. Linear systems with random inputs: Spectral characteristics of system response. Engineering applications of random processes.
**Prerequisite:** STAT 219

### EE 302 Modeling and Simulation Laboratory

Introduction to modeling and simulation techniques; Continuous-time and discrete-time systems; Simulation of differential equations; Dynamic system modeling; Optimization Techniques; Dynamic errors; Simulation acceleration and real-time simulation; Modeling and simulation applications of electrical engineering systems; The lab prepares the students to the capstone design project, by working on a lab project on modeling and simulation.
**Prerequisite:** EE 270

### EE 320 –Electronics II

Op-amp applications: Inverting and non-inverting amplifiers, Integrator, Difference amplifier. Differential amplifier. Current Mirror. Negative and positive feedback. NMOS and CMOS inverters, CMOS and pseudo NMOS logic gates, Pass-transistor logic, Dynamic logic. BJT digital circuits: TTL, and ECL logic.
**Prerequisite:** EE 220

### EE 321 – Electronics Laboratory

PSPICE simulation of electronic circuits; Linear applications of op-amp; Wein-bridge oscillator; Active filters: LPF, and HPF. Schmitt trigger and astable multivibrator. Differential amplifier using BJT; CMOS and TTL inverters.
**Co-requisite:** EE 320

### EE 330 - Communication Principles

Overview and basic elements of communication systems; Transmission through systems and channels; Modulation; AM; Frequency conversion; FM and PM; Superhetrodyne Receiver; FDM; Stereo Broadcasting; Sampling; Pulse Modulation (PAM, PWM, PPM); TDM; Pulse Code Modulation (PCM); DPCM and DM; Regenerative Repeaters; Advantages of digital communication; Line coding (Binary Signaling); Introduction to digital modulation (ASK, FSK, PSK).
**Prerequisite:** EE 270

### EE 331 - Communications Laboratory

AM and FM modulation and detection; PCM and delta modulation; Bit error rate measurements; TDM; ASK; FSK; Synchronization; Software defined radio systems
**Prerequisite:** EE 330

### EE 350 - Automatic Control

Review of mathematical background (complex variables, Laplace, Diff. equations); System representation (block diagram, transfer functions, signal flow graph), Modeling of electric and mechanical systems; State variable analysis; Stability; Time domain analysis; Root locus; Frequency domain analysis; Introduction to PID control.
**Prerequisite:** EE 270

### EE 351 - Control and Instrumentation Laboratory

Experiments to support control theory using physical processes (e.g. water level, temperature control, light intensity control, etc); Control system simulation using Matlab; Modeling of physical (experimental) equipment; Static performance; Transient analysis; Measuring devices; Two-position control; Proportional control; PID control; Introduction to Electrical Instrumentation and Measurements.
**Co-requisite:** EE 350

### EE 370 - Digital Signal Processing

Characterization and classification of discrete-time (DT) signals and systems; Typical DT signal processing operations; Linear time-invariant (LTI) - DT systems; Linear constant-coefficient difference equations; Frequency-domain representation of discrete-time signals and systems; Discrete Fourier Transform (DFT); Fast Fourier transform (FFT); Z-transform; Linear phase transfer functions; Digital filter structures; Finite-Impulse Response (FIR) Digital Filter Design; Infinite-Impulse Response (IIR) Digital filter design; Digital processing of continuous-time signals; Fundamentals of multirate digital signal processing; Applications.
**Prerequisite:** EE 270

### EE 380 – Electric Energy Engineering

Power system components and representation. Transmission line and cable parameters. Three Phase Systems. Grounding systems. Protection system. Transformers (construction, operation of single-phase transformers, equivalent circuit, voltage regulation and efficiency, auto-transformer, three-phase transformers), AC machinery fundamentals, small AC motors (single-phase induction motors, reluctance and hysteresis motors, universal motors, servo motors, stepper motors.
**Prerequisite:** EE 203

### EE 420 - VLSI Circuit Design

Basic fabrication sequence of NMOS and CMOS ICs. Design rules and layout. Combinational and sequential circuits. Memories and registers. Introduction to full custom and semi-custom ICs, standard cells, gate arrays, FPGAs and PLDs etc. CAD tools for design of ICs. Introduction to high level design of ICs using VHDL. Introduction to low power IC design.
**Prerequisite:** EE 320

### EE 421 - VLSI Design Laboratory

Low level and high level design and implementation of digital circuits targeted to FPGAs: Design entry using schematic editor, functional simulation, design entry using VHDL editor, VHDL Synthesis, Functional simulation, Compilation of design, design verification and study of reports. CMOS inverter layout (Step by step process), Layout design of digital circuits using layout tools, Lab. Project.
**Co-requisite:** EE 420

### EE 430 - Digital Communications

Basic elements of communications systems; Review of probability theory; Base-band pulse transmission (matched filters, inter-symbol interference); Eye pattern, Nyquist criteria; Equalization; Digital Pass-band transmission: Coherent PSK, FSK, QPSK, MSK, M-ary frequency& phase modulations, MQAM; Non-coherent orthogonal modulation; Power spectra and bandwidth efficiency of binary and quaternary modulation schemes; Channel capacity; Source coding; Error control coding (channel coding).
**Prerequisite:** EE 330

### EE 431- Wave Propagation and Antennas

Wave-guides and cavities; Radiation and antennas; Antenna parameters; dipoles and loop antennas; traveling wave antennas; Aperture and patch antennas; Linear and planar antenna arrays; Basic propagation modes; Free-space propagation; Ground wave propagation; Sky wave propagation; Space (terrestrial) wave propagation; Introduction to Propagation models in mobile radio systems.
**Prerequisite:** EE 205

### EE 432 – Optics and Microwave Engineering Laboratory

Transmission lines; Gunn oscillator characteristics; RF impedance measurements; Matching; Antenna patterns and gain measurements; Polarization absorption and path loss. Introduction to optical communication systems. Characteristics of LED and laser sources; Photodetectors; Optical fiber attenuation measurements; numerical aperture measurements.
**Co-requisite:** EE 431

### EE 423 - Optoelectronic Devices and Systems

Photonic Semiconductor Materials. Optical sources: Light-emitting diode (LED), Laser diode. Photo-detectors: PIN diode, Avalanche photo diode (APD). Optical waveguide basics. Optical fiber principles. Optical amplifiers. Introduction to Optoelectronic Systems with applications.
**Prerequisite:** EE 320

### EE 424 - Power Electronics

Classification of power electronics converters, Power semiconductor devices: terminal characteristics; Power converters: ac-ac converters, rectifiers, inverters, dc-dc converters and resonant converters; Applications in power systems.
Textbook: D. W. Hart, «Introduction to Power Electronics», Prentice-Hall, 2008.
**Prerequisite:** EE 320

### EE 433 - Wireless Communications

Basic concepts of wireless communications; The cellular concept; Cell splitting & sectoring; Cell coverage; Mobile radio propagation; Path loss models; Shadowing; Statistical fading models; Capacity of fading channels; Digital modulation Performance in fading channels; Equalization, diversity and channel coding; Speech coding; Multiple access techniques; Wireless networking; Modern wireless systems and standards.
**Prerequisite:** EE 205 and EE 330

### EE 434 - Satellite Communications

Introduction to satellite communication; Basic orbit maneuver; Satellite orbit geometry and types (LEO, MEO and GEOs); Orbit characteristics; Telemetry, Tracking and Command; Propagation characteristics; Frequency bands; Channel modeling, Satellite antennas and patterns; Earth stations; Modulation and multiple Access techniques; Satellite uplink and downlink: analysis and design; Frequency plan; Carrier and transponder capacity, Single carrier and multi-carrier transponder; VSAT; Modern satellite systems and applications.
**Prerequisite:** EE 205 and EE 330

### EE435 - Optical Communications

Optical propagation; Optical waveguides; Optical fibers: structure, attenuation, dispersion; Light sources; Light detectors; Optical Amplifiers; Optical Modulators; Digital optical communication systems: analysis and design; WDM and DWDM system and its components; Optical Switching; Optical networking: SONET, SDH, Wavelength routed networks; Ultrahigh capacity networks; Nonlinear effects; Optical Measurements: OTDR; eye patterns, optical spectrum analyzer.
**Prerequisite:** EE 205 and EE 330

### EE450: Automatic Control Application

Introducing and practicing the engineering standards in control components selection and design. Fundamentals of industrial transducers and actuators are given. Problem definition and techniques for stimulation of ideas are given. Students learn the analysis and design of different control problems with special emphasis on concepts and design creativity. They acquire the basic skills of how to approach and deal with different requirements to analyze and to design real time applications.
**Prerequisite:** EE 350

### EE 429 - Selected Topics in Electronics

Topics of current interest will be offered.

### EE 439 - Selected Topics in Communications

Topics of current interest will be offered

### EE 498 – Capstone Design Project-1

This is the first part of the capstone design project.
**Prerequisite:** Successful completion of 125 credit hours of the plan.

### EE 499 – Capstone Design Project-2

This is the second part of the capstone design project.
**Prerequisite:** EE 491

### EE 999 – Practical Training

Practical training over a period of 8 weeks in companies or establishments accepted by the department. The student's performance is evaluated by the coordinators of both the training company and the department.
**Prerequisite:** Successful completion of 110 credit hours.