

## Course Description

### **110409201 Electrical Circuits (1)**

**3 C.H (3and0) Prereq. 110101102 and 110102102**

Units, definitions, independent sources, dependent sources, Ohm's law, Kirchhoff's laws, division rule. Nodal analysis, Mesh Analysis, Linearity and Superposition, Thevenin's and Norton's theorems. Inductance and capacitance, source free RL and RC circuits, unit-step forcing function, and RLC circuits.

### **110409203 Electrical Circuits (2)**

**3 C.H(3and0) Prereq. 110409201**

Sinusoidal steady-state response, phasor concept, A.C power analysis. Three phase circuits, magnetically coupled circuits, complex frequency, circuit analysis in s-domain, Bode plot, one-port and two-port networks, and passive filters.

### **110409221 Electromagnetic (1)**

**3 C.H(3and0) PreReq. 110101201 and 110102102**

Gradient, curl differential operators, vector analysis, Divergence and Stokes's theorem, electrostatic fields, Coulomb's law, unbound electric fields, electrostatic boundary-value problems, Magnetostatic fields, Maxwell's equations for static EM fields. Magnetic force, Torque, and Moment. Magnetic materials, magnetic devices. Faraday's law, Displacement current, Time varying potentials, and Maxwell's equations for time varying fields.

### **110409240 Electronics (1)**

**3 C.H(3and0) Prereq. 110409201or 110406229**

Introduction to semiconductor materials, pn- junction diode, DC analysis and models, zener diodes, Schottky diodes, diode circuits: rectifiers, regulators, clippers, clampers, and multiple diode circuits; BJT transistors: DC analysis, biasing, configurations, applications, The field-effect transistor: DC analysis, and JFET MOSFET, configurations, and applications. Simulation of some circuits using P-Spice.

### **110409300 Electrical Circuits Lab**

**1 C.H (0and3) Prereq. 110102103 and (110409203 or 110406229)**

Equipment familiarization. Measurements and DC circuits. Techniques of circuit analysis. Basic laws on AC circuits. Step response of first and second order circuits. Voltage and current relationship in R, L, C circuits. Passive filters. Delta-star three phase measurements, and RLC response.

**110409321 Probability and Random Processes****3 C.H (3and0) Prereq. 110101102**

Probability axioms, random variables, operations on one random variable, multiple random variables, operations on multiple random variables, random processes: temporal characteristics, and spectral characteristics, linear systems with random inputs, Markov chains, and queuing theory.

**110409322 Signals and Systems****3 C.H (3and0) Prereq. 110406260 or (110101152 and 110101203)**

Classification of signals and systems, time-domain representations of continuous time signals, time-domain analysis of continuous LTI systems, frequency-domain representations of continuous time signals, frequency-domain analysis of continuous LTI systems, system analysis, time domain representation of discrete time signals, time domain analysis of discrete LTI systems.

**110409324 Electromagnetic (2)****3 C.H (3and0) Prereq. 110409221**

Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane waves in free space, power and poynting vector, reflection of plane waves at normal incidence, reflection of plane waves at oblique incidence, transmission lines: parameters, equations, and applications. Smith chart. Waveguides: rectangular waveguides, TE and TM modes. Introduction to antennas.

**110409325 Analog Communication****3 C.H (3and0) Prereq. 110409322**

Review of continuous-time signals and systems, AM modulation and demodulation schemes, angle modulation (FM and PM) and demodulation, performance of analog communication systems under noise, sampling theorem, quantization, PCM and delta modulation systems, introduction to digital transmission, and scrambling techniques.

**110409326 Applied Electromagnetic****3 C.H (3and0) Prereq.110101201 and 110102102**

Review of vector analysis, coordinate systems, Divergence and Stokes's theorem - electrostatic fields, Coulomb's law, unbound electric fields, electrostatic boundary-conditions problems, Magnetostatic fields, Maxwell's equations for static EM fields. Magnetic force, Torque, and Moment. Magnetic materials, magnetic devices. Faraday's law, Displacement current, Time varying potentials, and Maxwell's equations for time varying fields. Boundary conditions, reflection and transmission of waves.

**110409341 Electronics (2)****3 C.H (3and0) Prereq.110409240**

Basic BJT amplifiers: amplifier configurations, multistage amplifiers, basic FET-amplifiers: amplifier configurations, multistage amplifiers; Frequency response of transistor amplifiers; Operational amplifier: characteristics, application; Differential amplifiers. Simulation of some circuits using P-Spice.

**110409342 Electronics Lab****1 C.H (0and3) Prereq. 110409300 and (110409341 or 110406320)**

Diode characteristics, diode applications, zener diode as a voltage regulator, BJT characteristics and DC biasing, operational amplifier characteristics, and applications, amplifier frequency response, multistage amplifier, and JFET amplifier.

**110409343 Digital Electronics****3 C.H (3and0) Prereq. 110409240and 110408220**

Diode and transistor models (Ebers-Moll model), Resistor-Transistor Logic (RTL), Diode-Transistor Logic (DTL), Transistor-Transistor Logic (TTL), Schottky TTL, Emitter-Coupled Logic (ECL), MOSFET digital circuits, resistor-loaded NMOS logic, CMOS logic, PLA and memory devices: ROM, PROM, EPROM, SRAM, and DRAM, waveform generation: monostable, a stable, and Schmitt trigger circuits, analog-to-digital and digital-to-analog conversion. Modeling and simulation using P-Spice.

**110409348 Introduction to Electronics****2 C.H (2and0) Prereq. 110406229**

Introduction to semiconductor materials, pn-junction diode, DC analysis and models, zener diode, schottky diode, diode rectifier, clipper, clippers, BJ Transistors, DC analysis.

**110409361 Electrical Machines (1)****3 C.H (3and0) Prereq. 110409221**

Introduction to machinery principles, magnetic field, Induced emf, transformers: Equivalent circuit, transformer tests, current transformer; DC machines: construction, armature windings, armature reaction. DC generators, DC motors, and three-phase induction motor.

**110409363 Principles of Electrical Machines****2 C.H (2and0) Prereq. 110406229**

Introduction to machinery principles, magnetic field, induced emf, transformers, equivalent circuits, DC-machines, construction, armature windings, and armature reaction.

**110409470 Electrical Machines and Electrical Power Systems Lab****1 C.H (0and3) Prereq. 110409461**

Transformers: open circuit test, short circuit test, autotransformers, three phase transformers and load characteristics. DC motors: shunt and series motors. DC generators: DC shunt generator. Induction motor: no-load test, locked-rotor test and load characteristics. Transmission line simulation and transmission line performance.

**110409400 Practical Training****Prereq. The Completion of (112) Credit Hours at least including 110400203 without the Courses from outside the curriculum**

The BSc degree in EE, requires 8 weeks of continuous training inside or outside Jordan. The training must be conducted within private or public sectors working in the EE fields, which requires the approval of the department. A final report and presentation are required.

**110409421 Communication Lab****1 C.H (0and3) Prereq. 110409432**

Introduction to spectrum analyzer operation. AM modulation/demodulation. FM modulation/demodulation. PM modulation/demodulation, Noise effect on AM, FM, and PM. Sample and hold, aliasing effect, pulse code modulation, delta modulation, signal to noise ratio, and signaling techniques: PSK, FSK, DPSK, QPSK, and MSK.

**110409422 Digital Signal Processing****3 C.H (3and0) Prereq. 110409322 or 110406370**

Analog to digital conversion and sampling theorem, Discrete-time signals and systems, z-transform, Fourier analysis, Discrete Fourier Transform (DFT) , Fast Fourier Transform ( FFT), design of Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters. Applications to speech, audio processing and image processing.

**110409424 Digital Communication Networks****3 C.H (3and0) Prereq. 110409432**

Review of digital data transmission, OSI model, TCP/IP model, switched networks (circuit, packet, frame relays, ATM), Local Area Networks (LAN): architecture and topologies, Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Optical Networks (SONET), Integrated Service Digital Networks (ISDN), wireless LANS, and performance analysis of a communication network. Assignments, projects design will be covered in this course.

**110409425 Optical Communication****3 C.H (3and0) Prereq. 110409325 and 110409324**

Review of wave propagation in medium space, wave guides and resonators, optical fiber, components of optical communication systems. Introduction to SONET and DWDM systems.

**110409428 Satellite Communications****3 C.H (3and0) Prereq. 110409432**

Orbits and related issues, baseband signals and quality of service, up/down link, intersatellite link and overall link performance, multiple access, Earth stations, and reliability of satellite communications.

**110409429 Antennas and Wave Propagation****3 C.H (3and0) Prereq 110409324**

Review of electromagnetic fundamentals, antennas and radio wave propagation. Antenna fundamentals, antenna radiation characteristics, Hertzian or short dipole, half wavelength dipole, monopole antenna, loop antenna, horn Antenna, patch antenna, antenna arrays, aperture antenna, friis transmission formula. Electromagnetic waves and its properties, propagation of waves, modes of propagation, waves attenuation and absorption, ground waves, sky waves space wave, radio VHF/UHF and microwave wave propagation, Wave guides. Terrestrial fixed links, and link budgets.

**110409431 Special Topics in Communication and Electronics Engineering****3 C.H (3and0) Prereq. Dept. Consent**

Recent topics in communication and Electronics engineering covered by a visiting professor or a department faculty member. Assignments, projects design will be covered in this course.

**110409432 Digital Communications****3 C.H (3and0) Prereq. 110409325and 110409321**

Review of signals. Source coding techniques: Huffman coding, Shannon-Fano algorithm, Lempel-Ziv algorithm. Digital bandpass modulation: Amplitude Shift-Keying (ASK), Frequency Shift-Keying (FSK), Phase Shift-Keying (PSK), Quadrature Amplitude Modulation (QAM). Introduction to information theory, channel capacity and channel coding.

**110409433 Wireless Communication Systems****3 C.H (3and0) Prereq. 110409432**

Introduction to wireless communication systems and standards, principles of wireless communications, cellular concept, North American cellular system, GSM, spread spectrum, system design fundamentals (grade of service, channel capacity), mobile radio propagation (path loss models), fading and multipath, equalization and diversity, modulation performance in fading and multipath channels. A term project including a final report and a presentation are required. Assignments, projects design will be covered in this course.

**110409444 Analog Filter Design****3 C.H (3and0) Prereq. 110409341**

Filter Fundamentals, classification of filters according to frequency range, order, characteristics, active-and passive- filters, active-filters using op-amps, second-order and high-order filter realizations, Effect of op-amp, Characteristics on the performance of active-Filters, Active-filters using other types of active elements: OTA-C filters, CC-Based Active filters MOSFET-C active filters.

**110409445 Electronics (3)****3 C.H (3and0) Prereq. 110409341**

Power amplifiers: classifications, operation, and conversion efficiencies; Feedback amplifiers. Oscillators, timing circuits, active filters: low-pass filters, high-pass filter, band-pass filters and band-stop filters. Simulation of some circuits using P-Spice.

**110409448 Microwave Electronics Systems****3 C.H (3and0) Prereq. 110409341 and 110409324**

Waveguides: modes and cutoff frequency, group and phase velocity, impedance matching, power coupling, striplines and microstrips. Passive components: Microwave solid state devices: Transistors, Gun devices, IMPATT diodes, PIN diodes, Varactor diodes, Yttrium-Iron Garnet, dielectric resonators. Microwave tubes, Microwave antennas, Radar, Doppler radar, and Transponders.

**110409461 Electrical Power Systems****3 C.H (3and0) Prereq. 110409361**

Fundamentals of power systems generation, transmission, and distribution. Transformer principles, synchronous machines, transmission line parameters and calculations. Types of conductors, series resistance, series inductance of three-phase transmission lines and capacitances. Short, medium and long models of transmission lines. Introduction to the Jordanian code of practice for construction in terms of internal lighting and electrical wiring and constructions will also be covered.

**110409464 Electrical Machines (2)****3 C.H (3and0) Prereq. 110409361**

Poly-phase rotating machines, A.C winding, induction machines, gage winding, slip-rotor winding, motor starting, torque, motor speed, synchronous generator, synchronous motor, speed control.

**110409466 Power System Analysis****3 C.H (3and0) Prereq. 110409461**

Admittance model and network calculations, Y-bus build up and modification, power flow solutions: Gauss Seidel, Newton Raphason, fast decoupled method, power flow studies and analysis in design and operation and short circuit calculations. Simulation assignments are required. Introduction to the Jordanian code of practice for construction in terms of internal lighting and electrical wiring and constructions will also be covered.

**110409470 Electrical Machines and Electrical Power Systems Lab****1 C.H (0and3) Prereq. 110409461**

Transformers: open circuit test, short circuit test, autotransformers, three phase transformers and load characteristics. DC motors: shunt and series motors. DC generators: DC shunt generator. Induction motor: no-load test, locked-rotor test and load characteristics. Transmission line simulation and transmission line performance.

**110409520 Communications Electronics****3 C.H( 3and0) Prereq: 110409325 and 110409341**

Analysis and design of various analog and digital communication circuits including RF amplifiers, oscillators and mixers. AM transmitters and receivers, AM suppressed carrier circuits, FM transmitters and receivers, TV transceiver, A/D and D/A converters, sample and hold circuits, quantizers, and encoders.

**110409521 Advanced Wireless Communications****3 C.H (3and0) Prereq. 110409433**

Modulation performance in Cellular communication , diversity techniques in wireless communications , effects of interference in cellular communications , GSM in wireless communication , CDMA techniques in wireless communication, General capacity comparison of cellular systems , fixed and dynamic allocation , hard and soft handoffs.

**110409540 Opto-Electronics****3 C.H (3and0) Prereq. 110409341**

Interaction of optics, lasers, mechanics, electronics, and programming. Design methodology; team dynamics. Review of optical detection, modulation, light sources, and detectors. Selected optoelectronic devices and applications such as CD-players, DVD, display systems, laser printers, barcode scanners, digital cameras. A term project including a final report and presentation are required. Assignments, projects design will be covered in this course.

**110409541 Solid State Electronics****3 C.H (3and0) Prereq. 110409341**

Energy bands and carrier transport in semiconductors. Generation and-recombination. Breakdown. Physical principles of p-n junction devices. Bipolar junction and MOS transistors. FETs. Gunn diodes, and Light emitting diodes. Semiconductor lasers. Device modeling.

**110409560 Power Electronics****3 C.H (3and0) Prereq. 110409341**

Power semiconductor devices: Diodes, Thyristors, Controllable switches such as GTO, MOSFETS, protection of devices and circuits, single-phase and three-phase uncontrolled and phase-controlled rectifiers, dc-dc switch mode convertor, and dc-ac inverters.

**110409561 Renewable Power Generation****3 C.H (3and0) Prereq. 110409461**

Power and energy units and energy carriers, power and energy sources, renewable energy sources and solar spectrum, direct sun power. Major topics spans: photovoltaic Power (potential of solar radiation, pn-junction, pn junction solar cell under illumination , current voltage characteristics of solar cells, equivalent circuit of solar cell , technologies of solar cells, modules, photovoltaic system and Hybrid systems); Solar thermal power (solar collectors, pipes, thermal storage, and solar thermal systems ); Indirect sun power (wind power utilization , various wind energy



systems, wind turbine generator technology, electrical power systems concepts and grid integration techniques ).

**110409562 Power System Reliability**

**3 C.H (3and0) Prereq. 110409561**

Reliability definition and measures. Probability concepts and Markov chains. Failure models and availability models. Generator system reliability. Loss of load probability method. Evaluation of transmission network reliability.

**110409563 Smart Grid Technology**

**3 C.H (3and0) Prereq . 110409561**

Modernizing electric power transmission and distribution; energy independence, storage and security; Improving electrical grid efficiency, communications, reliability, and resiliency; integrating new and renewable energy sources. Applications involve remote power, district power and critical loads protection.

**110409564 Power System Stability**

**3 C.H (3and0) Prereq. 110409461**

Small- and large- signal stability problem of power systems, synchronous generator rotor dynamics, swing equation and its solution (analytical and numerical), park's transformation, d-q decomposition of synchronous generator, detailed dynamical model of synchronous generator for stability studies, AVR and TG models and their effects on power system stability.

**110409565 Special Topics in Power Engineering**

**3 C.H (3and0) Prereq. Dept. Consent**

Recent topics in power engineering covered by a visiting professor or a department faculty member. Assignments, projects design will be covered in this course.

**110409566 Advanced Smart Grid Technology**

**3 C.H (3and0) Prereq. 110409561 and 110409433**

The aim of this course is to study advanced topics in the subject of smart grid technology. This course includes: Fundamentals of power line communications, communication technologies enabling a smart grid, Integration of communications, control and protection with a smart grid, Improving electrical grid efficiency and reliability, integrating renewable energy resources with existing grid infrastructure, and more applications on loads protection devices.

**110409567 Power System Protection****3 C.H (3and0) Prereq.110409461**

Protection principles relays; directional power protection, differential, distance and pilot protection. Protection of power system elements including: generator transformer, bus, motors, and. Earth fault zero sequence, capacitors, reactors, and fuses. System grounding, low impedance grounding protection principles, and synchronization principles. Assignments, projects design will be covered in this course.

**110409568 Electric Drive****3 C.H (3and0) Prereq. 110409361 and 110409560**

Introduction , element of a drive system , electric power supply , DC-drive , system model , speed control , motor mechanism dynamics , closed loop speed control , single-phase rectifier with DC-motor, and AC-drive system.

**110409581 Graduation Project (1)****1 C.H (0and3) Prereq. The Completion of (120) Credit Hours Successfully without the Courses from outside the curriculum and Department Consent**

A group of students apply their theoretical knowledge gained throughout their study to design and build a certain circuit/device to perform a specific function under the supervision of one of the instructors at the department. A final report and presentation are required.

**110409582 Graduation Project (2)****2 C.H (0and6) Prereq. 110409581**

Continuation of project (1), the student has to interpret the application in real time, design and simulation to examine the project design. Project (2) is applied to various applications to electrical engineering options.