Zarqa University

Faculty of Engineering Technology
Department of Electrical Engineering

جامعة الزرقاء

كلية الهندسة التكنولوجية
قسم الهندسة الكهربائية

Date: ……..……

التاريخ : 11/ 06/ 2024

Ninth: Course Description

Course Title [**A – B – C**]	**Course #:**	**Prereq.:**

A: Theoretical hrs
B: Practical hrs
C: Credit hrs

Engineering Mathematics [3 – 0 – 3]	Course #:0904201	Prereq.: 0300102
Vectors and the geometry of space: dot product, cross product. Lines and planes in space. Vector functions: derivatives and integrals. Function of two or more variables: partial derivatives, gradient, divergence, Curl. Multiple integral. Double integrals in polar coordinates; triple integrals; triple integrals in cylindrical and spherical coordinates; change of variables in multiple integrals;		
Electrical circuits (1) [3 – 0 – 3]	Course #:0904211	Prereq.: 0300122
Basic Electric Components and Equivalent Circuit. Kerchief's laws (KVL and KCL). Circuit analysis techniques: Nodal analysis, mesh analysis, superposition, source transformations. Thevenin' and Norton theorems, maximum power transfer. Unit step response of RL and RC circuit. Steady state sinusoidal circuit analysis using phasor techniques		
Electrical circuits (2) [3 – 0 – 3]	Course #:0904212	Prereq.: 0904211
Instantaneous power, average power, real power, reactive power, complex power, and power factor. Three-phase wye and delta connections. Power in three phase systems. Filters. Frequency response. Parallel and series resonance. Magnetically coupled circuits, mutual coupling. Linear and ideal transformers. Two-port networks.		
Electrical circuits lab [0 – 3 – 1]	Course #:0904213	Prereq.: 0904212*
DC circuits: Ohm's law; KVL and KCL; network theorems; transient analysis of RL; RC; and RLC circuits; impedance concept and techniques; power and P.F; series and parallel resonance; three phase circuits; Transformers; magnetically coupled circuits; filters; troubleshooting.		
Electronics (1) [3 – 0 – 3]	Course #:0904221	Prereq.: 0904211
Semiconductor materials; intrinsic, N-type and P-type semiconductors; carriers, conductivity and Drift current; diffusion current, PN junction; depletion region, Diode: Forward and reverse biasing. Diode circuits analysis. Basic diode applications, bipolar junction transistor (BJT): theory, DC biasing and basic amplifier, FET & MOSFET transistors (DC & small signal analysis).		

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Digital fundamentals [3 – 0 – 3]	Course #:0904234	Prereq.: ---
Logic levels and digital waveforms; number systems and their conversion. Basic gates and logic functions. Boolean algebra, Boolean expressions. Logic minimization techniques. VHDL basics. Combinational logic building blocks including decoders, encoders, multiplexers, demultiplexers, magnitude comparators. Digital arithmetic, adders, subtractors. Basics of sequential circuits. Basic latches and flip-flops. Timing parameters and diagrams. Counters, shift registers. Memory devices and systems including RAM, ROM, FIFO, LIFO and dynamic RAM.		
Digital fundamentals lab [0 – 3 – 1]	Course #:0904235	Prereq.: 0904234
Experiments on basic TTL and CMOS logic gates, including simulations to explore functionality and timing parameters. Experiments using both simulation and practical hardware implementation for combinational and sequential circuits including multiplexers, demultiplexers, decoders, encoders, shift registers, counters, latches and memory. Project on logic design using state machines.		
Electromagnetics (1) [3 – 0 – 3]	Course #:0904245	Prereq.: 0300122,0904201
Electrostatics: Coulomb's law, Gauss's law, electric potential, electric dipoles, resistance, capacitance, boundary condition. Magnetostatics: Biot-Savart law, Ampere's law, Magnetic forces. Magnetic boundary conditions. Time-varying fields: Faraday's Law, Maxwell's Equations.		
Signals and systems [3 – 0 – 3]	Course #:0904300	Prereq.: 0904211
Classification of signals and systems. Linear Time-Invariant (LTI) systems: convolution and impulse response. Fourier series and Fourier transform. Energy and power spectral densities. Laplace transform. Transfer function. Filters: LPF, HPF and BPF. Discrete time systems: convolution and impulse response.		
Probability and random variables [3 – 0 – 3]	Course #:0904303	Prereq.: 0904300
Probability principles and set theory. Discrete random variables. Continuous random variables. Multiple random variables. Probability density function. Special probability density functions, cumulative distribution function Joint distribution functions. Conditional distributions. Random process. Stationary and ergodicity. Spectral analysis of random signals. Response of linear systems to random signals.		
Numerical analysis [3 – 0 – 3]	Course #:0904304	Prereq.: 0905201
Error analysis. Solution of equations in one variable. Numerical solution of a set of linear and nonlinear equations. Curve fitting and interpolation. Numerical integration and differentiation. Numerical solution of ordinary differential equations.		
Electrical engineering software (1) [0 – 3 – 1]	Course #:0904305	Prereq.: 1501119
The MATLAB environment, Predefined MATLAB functions, Solutions to systems of linear equations, Symbolic mathematics, User defined MATLAB functions, Special topics in electrical engineering (signal processing, controls, electric circuits), Graphical user interface (GUI) building in MATLAB.		

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Technical Writing and Communication Skills [2 – 0 – 2]	Course #: 0904306	Prereq.: 0200106
Writing style, editing, formatting, grammar and punctuations. Analyzing audience, determining purpose, and ordering ideas effectively for various written communications such as letters, memoranda, meeting agenda and minutes, proposals, instructions, policies and procedures, email-messages, and technical and business reports in the engineering environment. Participate in group work to give oral presentations.		
Electronics (2) [3 – 0 – 3]	Course #:0904328	Prereq.: 0904221
Multistage amplifiers. Differential amplifier. Amplifiers configurations and characteristics (BJT, FET). Small signal analysis of transistor circuits. Passive and Active filters. Amplifier Frequency response (for single stage, multistage and op-amp). Operational Amplifier. Applications of Op-Amps.		
Electronics lab [0 – 3 – 1]	Course #:0904329	Prereq.: 0904328*
Diode characteristics; half-wave & full-wave rectification; clipping and clamping; Zener diode and voltage regulation, BJT characteristic; BJT AC Amplifier, Darlington pair transistor & Current mirror circuit, Field Effect Transistor Characteristics.		
Electromagnetics (2) [3 – 0 – 3]	Course #:0904345	Prereq.: 0904245
Review of Maxwell's equations. Plane wave propagation in lossy media, free space, good conductors and lossl media. Reflection, refraction, and scattering. Pointing vector. Wave polarization. Transmission line (TL) equations and parameters: input impedance, SWR and power. Applications of TL charts. Matching in TL . Impedance measurement at high frequencies. Waveguides: TM, TE modes, and mode excitations. Introduction to antennas. Introduction to numerical techniques for radiation and scattering.		
Electrical machines (1) [3 – 0 – 3]	Course #:0904361	Prereq.: 0904245*, 0904212
Magnetic circuits; principles of electromechanical conversion, induced forces and voltages, single-phase transformers: types; construction; ideal and practical transformers; equivalent circuit; testing; voltage regulation and efficiency; three-phase transformers: construction and vector groups; direct current machines: construction and classification; elementary DC machine; excitation; torques and power relations; armature reaction and commutation; DC generators: DC motors: performance characteristics; starting; speed control and applications. Introduction to PM machines and BLDC machine.		
Electrical engineering software (2) [0 – 3 – 1]	Course #:0904403	Prereq.: 0904305, 0904459
Introduction to Simulink, Simulation of differential equation systems, Simulation of DC Motors , Simulation of single and three phase power transformers, Simulation of Single and three phase Induction Motors, Modelling of electric machines , Simulation of power electronic circuits, simulation of electric drives.		
Microprocessors and Embedded Systems[3 – 0 – 3]	Course #:0904410	Prereq.: 0904234
Basic Architectures of Microprocessors and Microcontrollers. The Assembly and C- languages of The PIC Microcontroller (Structured Commands Programming, Timer programming). PIC18 Serial Port Programming, Interrupt Programming, LCD and Keyboard Interfacing. ADC, DAC and Sensor Interfacing,		

Relays and Optoisolators, Stepper Motor Interfacing, DC Motor Interfacing and PWM Motor Control with CCP, Servo Motor Interfacing, Light Dependent Resistor (LDR) Interfacing, Touch Sensor Interfacing, and Temperature Sensors Interfacing. Term Project.		
Microprocessors and Embedded Systems lab [0 – 3 – 1]	Course #:0904411	Prereq.: 0904410*
LED Interfacing Using Delay Times (Build-in and User-Defined) Programs, Seven Segment Display Interfacing, Timers Programming, LCD interfacing, ADC and DAC Interfacing, Stepper Motor Interfacing, DC Motor Interfacing, Servo Motor Interfacing, Light Dependent Resistor (LDR) Interfacing, Touch Sensor Interfacing, and Temperature Sensors Interfacing.		
Digital electronics [3 – 0 – 3]	Course #:0904420	Prereq.: 0904328
In this course the students will study the properties and definitions of Digital ICs, Propagation delay times, power dissipation, and noise margin, etc…, diodes, diode resistor logic, BJTs. The Ebers-Moll model, Introduction to Bipolar Digital Circuits, Resistor Transistor Logic (RTL), Diode-Transistor Logic(DTL), Transistor-Transistor Logic (TTL) gates, basic Emitter-Coupled Logic (ECL), MOSFET, Introduction to MOS Digital Circuits, Transmission Gates, Loaded NMOS Inverter, CMOS Combinational Logic Gates, Design of MOS and bipolar logic families, and BiCMOS. Combinational and sequential logic circuit design, interfacing Logic Families, Semiconductor memories RAM & ROM.		
Digital Electronics lab [0 – 3 – 1]	Course #:0904427	Prereq.: 0904420
Introduction to Proteus, PSpice and Orcad software packages. BJT as inverter. Diode-Resistor Logic (DRL) gates. Resistor-Transistor Logic (RTL) gates. Diode-Transistor Logic (DTL) gates. Transistor-Transistor Logic (TTL) gates. Emitter Coupled Logic (ECL) gates. NMOS and PMOS logic gates. CMOS logic gates. BiCMOS logic gates. ROM and RAM memories.		
Power electronics [3 – 0 – 3]	Course #:0904428	Prereq.: 0904221, 0904300
Introduction to PE, applications of PE, classification of Power conditioners; Power semiconductor devices: classification; V-I and switching characteristics; basic drive circuits and applications; line commutated converters; single-phase rectifiers: half-wave and full-wave rectifiers with freewheeling diodes; 3-phase half-wave and full-wave rectifiers; single-phase and 3-phase controlled and uncontrolled rectifiers; performance of rectifiers circuits; introduction to AC/AC controllers; phase voltage controller; Cycloconverters; basics of DC-to-DC converters (choppers). Basics of DC-to-AC converters (inverters).		
Power electronics lab [0 – 3 – 1]	Course #:0904429	Prereq.: 0904428
Power semiconductor devices (SCR, BJT, MOSFET, IGBT) and their characteristics. Converters (rectifiers, DC choppers, AC controllers).		

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Communication (1) [3 – 0 – 3]	Course #:0904456	Prereq.: 0904300
Review of Fourier transform and filters. Amplitude modulation (AM, DSB, SSB, VSB). Angle modulation (FM, PM). Sampling, Quantization, PCM, DPCM, DM. Multiplexing. Line coding. Baseband channel and ISI. Digital modulation (PSK, ASK, FSK, and M-ary). Power spectra of digital signals. Synchronization.		
Electrical machines (2) [3 – 0 – 3]	Course #:0904459	Prereq.: 0904361
Rotating magnetic field; MMF and flux distribution; synchronous generators: classification; construction; equivalent circuit; power and torque relationships; parallel operation; performance and characteristics; synchronous motors: principles; power flow and efficiency; starting; power factor correction and V-curve; 3-phase induction motors: types; construction and basic concepts; equivalent circuit; power and torque relations; power flow and performance characteristics; starting; speed control; single-phase induction motors:. Construction; classification; starting; equivalent circuit; and performance characteristics; Introduction to universal motors, reluctance motors, stepper motors.		
Electrical machines lab [0 – 3 – 1]	Course #:0904460	Prereq.: 0904459*
Single phase transformers tests: open circuit, short circuit tests and load tests; Three phase transformer tests; DC motors shunt and series; Blondel Theorem; Single phase induction motors; 3-phase induction motors: squirrel cage and wound rotor motors; Automatic control of motors: start on off, star-delta; 3-phase motor speed control; VFD motor control.		
Electrical power system analysis [3 – 0 – 3]	Course #:0904462	Prereq.: 0904361
Power system components and single line diagram. Phasors, analysis of three phase balanced power systems, power factor correction. per-unit system; transmission lines: short; medium and long; equivalent circuits and RLC parameters; cables; sequence networks of synchronous machines and power transformers; load flow; symmetrical components; symmetrical and asymmetrical fault analysis		
Control theory [3 – 0 – 3]	Course #:0904470	Prereq.: 0904300
Control Systems: Terminology and Basic Structure. Feedforward and feedback control theory. Electrical and Mechanical mathematical models of systems. Laplace transform and transfer functions of control systems (electrical; mechanical; hydraulic and pneumatic systems). Systems block diagrams and signal flow graphs (Mason's gain formula). Block diagram reduction techniques. Sensitivity of open and closed loop control systems. Time response analysis of control systems. Design, and effects of basic control actions: proportional, integral, and derivative. Routh-Hurwitz stability criterion. Steady-state error coefficients. Frequency response analysis: Bode diagrams and Nyquist stability criterion. Gain and phase margins. Design of PID controllers and tuning methods.		

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Control lab [0 – 3 – 1]	Course #:0904471	Prereq.: 0904470*
Feedback control systems implementation and reduction in Matlab. Block diagrams and signal flows in Matlab. Linear control stability tools verification using machine speed and position control. Time and frequency domain analysis evaluation. PID controllers. Lead and lag compensator design.		
Communication (2) [3 – 0 – 3]	Course #:0904478	Prereq.: 0904456,0904303
Representation of white and narrow-band noise. Behavior of continuous wave modulation (AM, DSBSC, SSB, and FM) in the presence of additive white Gaussian noise. Quantization noise. Noise analysis in PCM and DM systems. Matched filter receiver. Error probability analysis for baseband digital transmission. Behavior of digital communication systems in the presence of noise: ASK, PSK, DPSK, FSK and QAM. Signal space representation. BER for M-ary digital signals Introduction to Information Theory. Spread Spectrum Communication. Introduction to Error control coding.		
Communication lab [1 – 0 – 3]	Course #:0904479	Prereq.: 0904478*
AM modulation. FM modulation transmission and reception, single sideband communication (SSB) communication technique. Pulse code Modulation (PCM). Delta modulation, DPCM. Sampling. Quantization. PSK, QPSK, and QAM. SNR measurement. BER calculation. Eye diagram. Channel coding. Optimum receiver.		
Programmable Logic Control (PLC) [3 – 0 – 3]	Course #:0904484	Prereq.: 0904470
Introduction to programmable logic controllers (PLC). PLC's internal architecture, and operating principles. Processor units and memory. Number Systems and Codes. Logic concepts and gates. Symbols and schematic diagrams. Input-output devices: relays, contactors, motor starters, and sensors. I/O processing. Ladder and functional block programming.		
Programmable Logic Control (PLC) lab [0 – 3 – 1]	Course #:0904486	Prereq.: 0904484*
Ladder diagram , programming PLC using statements list ,PLC programming for practical applications and industrial automation using timers , counters , mathematical and logic functions, and data operations such as move , rotate , INC , DEC and others. Practices include Sequential processes, motor control stations, traffic control schemes and other similar activities.		
Communication electronics [3 – 0 – 3]	Course #:0904524	Prereq.: 0904456,0904328
Mixers. Oscillators, voltage-controlled oscillators (VCO); Phase-locked loops (PLL) and their applications in communication systems. Frequency synthesizers. AM and FM modulator and demodulator circuits. RF/IF tuned amplifiers. Power amplifiers. Design of low noise amplifiers. AGC circuits. Case studies: design communication circuit project.		

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Project (1)	Course #:0904541	Prereq.: 115 cr.hr
Project (2)	Course #:0904542	Prereq.: 0904541 , 0904444
Communication systems [3 – 0 – 3]	Course #:0904556	Prereq.: 0904478
Transmission Media. Propagation of RF Waves: ground wave, sky wave, troposphere propagation, multipath channel, microwave Links. Noise in Communication Systems. Multiplexing Techniques. Wireless technology: Bluetooth, ZigBee, WiMax, WiFi, Infrared wireless and near-field communications. Satellite Communications and multiple–access techniques. Mobile phone generation technologies.		
Electrical installation [3 – 0 – 3]	Course #:0904468	Prereq.: 0904361
Electrical system design for residential; commercial and industrial plants: lighting and power distribution; Design circuit breakers motor branch feeders and controllers; switchboards; unit substation; earthing; light; photometry; electrical lighting systems, light sources; electrical lamps; load estimation methods; testing and maintenance; codes, symbols and standards. Projects design.		
Power system distribution and transmission [3 – 0 – 3]	Course #:0904563	Prereq.: 0904462
Basic principles; distribution systems layout; distribution transformers: types; connections; harmonics; transmission line and insulators; Towers, distribution equipment: circuit breakers and lightning protection; distribution station and substations units, voltage drop over distribution feeders, voltage regulation, faults and testing.		
Electrical drive [3 – 0 – 3]	Course #:0904565	Prereq.: 0904459, 0904428
Elements of electric drive systems; the mechanical system torque equation and steady-state stability; classification of load torques; braking; gear and belt drive; classification of motors and converters; selection of converters and motors ratings and types. DC motor drive using controlled rectifiers; DC motor drive using choppers; induction motor drives: soft starters; control strategies; analysis and characteristics; synchronous motor drives: control strategies; analysis and characteristics		
Power system protection [3 – 0 – 3]	Course #:0904581	Prereq.: 0904462
Principles, elements, and requirements of power systems protection; Voltage & Current transformers; electromechanical; static and numerical relays; over current and earth fault protection; differential and distance protection; protection of power system elements: Generator; transformer; bus-bars; lines and motors; testing and maintenance of protection components, PV system protection.		

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Power system analysis and protection lab [0 – 3 – 1]	Course #:0904586	Prereq.: 0904462 , 0904581*
Equivalent circuits of transmission lines; voltage regulation; reactive power compensation; line losses; various types of loads. Power system simulators; equivalent circuits of power system components; control of real and reactive power; Practical relay protection of generators transformers and transmission lines.		
High voltage engineering [3 – 0 – 3]	Course #:0904567	Prereq.: 0904462
H.V generation for testing purposes; H.V. measurements; breakdown in gasses; cathode processes and secondary effects; streamers and Kanal mechanism; Paschen's law; partial discharges and corona; break down in solid insulation; over voltages caused by dart leaders: strokes to towers and to earth wires; attraction of lightning flashes to lines; shield angle; over-voltage limitations; surge deviators; arrestors and arcing horn; external insulation; Insulators function and types; clearance; creepage distance and contamination, insulation coordination , troubleshooting in high voltage engineering.		
Special topics In power engineering [3 – 0 – 3]	Course #:0904568	Prereq.: 0904462
The content of this course is in the areas of interest in power engineering. The specific content is given in detail and approved by the department council at least one semester in advance of that in which it is offered.		
Power plants [3 – 0 – 3]	Course #:0904569	Prereq.: 0904462
Introduction to power generation systems; steam power plants; boilers, steam generators and turbines; diesel power plant; gas turbine power plant; nuclear power plants; hydro-electric power plant; electrical generation systems: generators, excitation system, power plant economics, unit commitment, economic dispatch.		
Antennas and wave propagation [3 – 0 – 3]	Course #:0904546	Prereq.: 0904345
Introduction to antennas: Principles of radiation, antenna parameters. Wire antenna including monopole, dipole and loop antennas. Antenna array analysis by array factors. Aperture antenna including rectangular and conical horn. Reflector antenna. Micro-strip antennas. Introduction to smart antennas. Antenna design using computer software.		
Microwave engineering [3 – 0 – 3]	Course #:0904549	Prereq.: 0904345
Review of Maxwell's equations. General concept of transmission lines (TLs) for microwave frequencies. Waveguides and resonant cavities. Scattering Parameters. Microwave passive devices: filters, microstrip, planer microwave elements (directional copular, circulators). Microwave oscillators, detectors, transistor amplifiers, and microwave mixers.		

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Special topics in communication engineering [3 – 0 – 3]	Course #:0904551	Prereq.: 0904478
The content of this course is in the areas of interest in communication and electronics engineering. The specific content is given in detail and approved by the department council at least one semester in advance of that in which it is offered.		
Mobile communications [3 – 0 – 3]	Course #:0904552	Prereq.: 0904478
Introduction to telephony and traffic theory. Cellular system design concepts: Channel planning, Link control, Handoff, Traffic Capacity, Power control. Propagation modeling. Diversity and Fading. Modulation Techniques. Link budget analysis. Multiple Access Techniques: FDMA, TDMA, CDMA. Voice coders and compression formats. Examples of current wireless systems standards.		
Optical communications [3 – 0 – 3]	Course #:0904557	Prereq.: 0904478
Light propagation. Theory of dielectric optical waveguides: Step and graded index optical fibers. Multimode and single mode optical fibers. Waveguide propagation attenuation and dispersion. Coherent (LASER) and incoherent (LED) optical sources and modulation techniques. Optical detectors: photodiodes and receiver circuits. Sources of Noise. Simple optical fiber Link Design. Optical transmission technologies (SONET, and Ethernet). Project.		
Information theory and coding [3 – 0 – 3]	Course #:0904558	Prereq.: 0904478
Information concept: Entropy and source Coding. Lossless data compression. Channel capacity theorem and bandwidth-efficiency diagram, Gaussian channel, capacity of band-limited channels. Error control coding: Block codes, Syndrome decoding, and Viterbi decoding, Cyclic Codes; Convolutional Codes. Turbo codes.		
Digital signal processing and filters [3 – 0 – 3]	Course #:0904559	Prereq.: 0904300
Discrete Time signals and systems. The Z-Transform. Modeling and implementation of discrete time system. Discrete and Fast Fourier transform (FFT). FIR, IIR, Recursive and non Recursive Filters. spectrum analysis using the DFT. Design Techniques for digital Filters, software-based applications.		
Engineering Project Management [3 – 0 – 3]	Course #:0904564	Prereq.: 100 hours
This course presents the principles and techniques of managing engineering projects from the initiation phase, through planning, execution, control and closeout. Students will develop the analytical skills and awareness necessary on the management side of engineering projects. Topics include project initiation, estimating, budgeting, developing work plans, scheduling, tracking work, resource allocation, project coordination, quality management, leadership, managing teams, conflict, negotiations, ethics, and professional responsibility.		

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Sensors and measurements [3 – 0 – 3]	Course #:0904570	Prereq.: 0904428
Types of sensors and the physical principles behind different sensing mechanisms, data handling, practical aspects of measuring and limitations and error sources. Methods of sensing, physical principles of sensors operations, practical designs, and interface electronic circuits. Design and selection of best suited sensors for a specified problem, regarding range, accuracy, dynamic behavior, environment requirements etc. Necessary calculations regarding the sensor characteristics, performance and the required signal processing.		