المحتوي العلمي للمقررات الدراسية لجميع الشعب بقسم الهندسة الكهربائية والالكترونية

Description of Courses Content For All Sections in Electrical & Electronics Engineering Department

GE 241 Properties of Materials (3 Units): Prerequisite: GS 131, GS135

Introduction to materials science and engineering- Atomic structure and bounding- Ionic bounding, covalent bounding, secondary bounding, mixed bounding- crystals structure and crystal geometric- Electrical properties of materials- Electrical conduction in metals- Energy band model- Intrinsic semiconductors- Extrinsic semiconductors- Semiconductor devices- Microelectronics- Compound of semiconductors- Magnetic materials- Optical properties and superconducting materials.

EE 203 Circuit Theory I (3 Units): Prerequisite: GS 121, GS131

System of units - Types of circuits and circuit elements – Ohm's law – Kirchhoff's laws – Nodal analysis - Mesh analysis – source transformation- Thevenin's, Norton's and superposition theorems - Inductance and Capacitance- The sinusoidal forcing function- The phasor concept - Sinusoidal steady-state response- Phasor diagrams- Impedance- Admittance-Instantaneous, average, apparent and complex powers.

EE 230 Electronics I (3 Units): Prerequisite: EE 203, GE241

General Review, Brief semiconductor theory, PN Junction Diode, Diode Circuit Analysis, Diode Circuit Applications, Zener Diode & it's application in Regulations, Diode Capacitance, Schottky Diodes, Tunnel Diodes, Other Types of Diodes, Temperature Effects & Manufacturers Specifications, Bipolar Junction Transistor (BJT) Fundamentals (Operating Principles, Bias & Load Lines), Field effect Transistor (FET) Fundamentals (Operating Principles, Bias & Load Lines), Bias Stability.

EE 208 L Circuit Laboratory (1 Units): Prerequisite: EE 203

Selected experiments related to fundamental of electrical measurements, correlation of theoretical and experimental results with regard to basic direct and alternating current circuits, transient current circuits, network theorems, power measurements, transformers, poly-phase circuits.

EE 216 Circuit theory II (3 Units): Prerequisite: EE 203

Network theorems, quality Factor-Natural, and step response of RL, RC and RLC circuits. Series and parallel resonance- Magnetically coupled circuits – Balanced three-phase circuits- Poles and zeros and time response - Introduction to two–port parameters - Applications of Laplace transformation- Fourier series and applications.

EE 230 L Electronics Laboratory I (1 Units): Prerequisite: EE 241, EE 230

Selected experiments in electronics concerning diode, transistors (BJT & FET), amplifiers, differential amplifiers, operational amplifiers, oscillators.

GE 327 C++ (3 Units): Prerequisite: GS 228

Elements of C program, Pre-processor directives, I/O statements, Operators, Conditional Statements, Loops, Functions, Character I/O functions, String Processing functions, Math Functions, Array manipulations, Pointers, Structures, Files and their functions.

EE 317 Signals and Systems (3 Units): Prerequisite: EE 216

Classification and representations of signal. Signal analysis: Fourier series, Fourier transforms, Laplace transforms, introduction to z- transform, DFT, FFT System representation by block diagrams, transfer function, impulse response, and differential equations. Classification of systems, typical examples.

System analysis: time domain analysis, frequency domain analysis's- domain analysis, transmission over linear system. Two port parameters, network functions, (poles and zeros).

EE 313 Electromagnetic I (3 Units): Prerequisite: GS131, GS 223

Mathematical Fundamentals, Vectors and scalar quantities, scalar and vector fields, coordinate systems, curve linear coordinate system, Cartesian, cylindrical, spherical coordinate system.

Fundamental of electromagnetic: Concepts of electric and magnetic charges, and current densities, Integral form of Maxwell's equations in free space, Solution of Maxwell's equations. Gauss's Law for electric and magnetic fields, Ampere's circuital law, and Faraday's law.

Gradient of a scalar function, divergence and curl of vectors, Divergence & Stock's theorems, differential form of Maxwell's equations, Plane waves and fields in free space.

Fields in materials, Boundary conditions for electric and magnetic fields, Solution of Maxwell's equations. Plane waves and fields in materials.

Static and quasi-static electric fields and fields of finite chare distribution, Potential

Poisson's and Laplace equations and their solution, capacitors.

Static and quasi-static magnetic fields, magnetic circuit, Bio-Savart law, Induced e.m.f. and self and mutual inductance, induced of electromotive forces.

EE 333 Electronics II (3 Units): Prerequisite: EE 230

General Review, Large signal Amplifiers, Power Amplifiers (class A, class AB & class B class C Amplifiers), General Amplifier Concepts, Small Signal Amplifiers Using BJT (CE, CC, CB Amplifiers), Small Signal Amplifiers Using FET (CS, CD, CG Amplifiers), Multistage Amplifiers, Frequency Response of Amplifiers (Low frequency Response & High frequency Response).

EE 307 Electrical Measurement (3 Units): Prerequisite: EE 216

Measurement and error, in d.c. and a.c. ammeters and voltmeters, ohmmeters and millimeters, instruments in measuring power, R. F. energy, phase and frequency, oscilloscopes: construction, operation and use, d.c and a.c bridges, single generators, electronic analog and digital voltmeters, ammeters, ohmmeters and millimeters, counters, wave and spectrum analyzers, transducers and measurement of non-electrical quantities.

GE 346 Numerical Methods in Engineering (3 Units): Prerequisite: GS 222

Solution of linear equation (Gauss elimination methods, iterative methods, Solution of nonlinear equation (Iterative methods, the approximate method, Newton's – Raphson method). Interpolation (Difference tables, Newton's interpolation formula, Sterling's formula, Lagrange's method. Numerical differentiation (Approximation of derivatives, formulas for numerical differentiation), Numerical integration (Simpson's rules, Trapezoidal method, Romberg's integral) Numerical Solution of initial value differential equations (Euler's method, Picard's method, Rung-Kutta methods), Finite difference method for boundary value differential equations, elliptic equations and parabolic equations.

EE 310 Comm. Eng. I(3 Units): Prerequisite: EE 317

Introductory topics: Information and bandwidth, signal analysis, Fourier series, Fourier transform, convolution, correlation.

Amplitude Modulation: AM Fundamentals and analysis, AM generation, transmitter systems, receiver characteristics, detection, super heterodyne receiver, stereo broadcasting.

Single side band communication: SSB Characteristics, generation, filters, transmitters, demodulation, and receivers, DSB, VSB signal waveform, characterization and applications.

Frequency modulation: FM generation, amplifiers, limiters, discriminators, demodulator, phase locked loop modulator and modulator. Phase modulation (PM).Sampling Theory, natural sampling, ideal sampling, Flat top sampling.

Pulse Modulations: PAM, PPM, PWM, Introduction to PCM, Introduction to FDM&TDM.

EE 340 Electrical Machines I (3 Units): Prerequisite: EE 216, EE313

Review of magnetic circuits and magnetic materials, Properties of magnetic materials, AC excitation, Permanent magnets and its applications. Transformer (single-phase Transformer only), Introduction to transformers, No-load conditions ideal Trans, Equivalent circuits, Trans. Testing (open-and short –circuit tests), Trans analysis. Electromechanical Energy Conversion Principles, Forces and Torques in magnetic field system, Energy balance, Energy and Force in single excited magnetic field systems, co energy, multiply excited magnetic field systems Dynamic equations. Introduction to AC and DC machines, Elementary synchronous, induction and dc machines, MMF of concentrated and distributed windings for AC/ dc machines, magnetic field in machines with uniform and non-uniform air gaps , Rotating MMF waves for single phase and polyphaser winding, Generated voltage, Torque in non-salient-Pole machines (coupled circuit, magnetic field viewpoints.

EE 340L Basic Machines Lab (1 Unit): Prerequisite: EE 208L, EE313

Selected experiments in DC Machines and transformer and evaluate their performance.

EE 360 Digital I (3 Units): Prerequisite: EE 230

Combinational logic: Numbering systems and codes, binary number representation, 2's complement and 1's complement, logic gates AND, OR, NOT, EX-OR/NOR, universal logic gates NAND/NOR, Boolean algebra (Rules and laws), De-Morgan's theorem, simplification and expressions, Karnaugh mapping for logical statement minimization.

Applications of combinational logic, Full adder/subtractor, carry look ahead adder, simple decoders and encoders, design of simple multiplexer, parity checking, use of digital simulator.

Sequential logic: Derivation of the basic RS latch; design of T, D, JK flip-flops, including truth tables, characteristic equations, master-slave operation/edge triggering, timing diagrams, brief discussion of race conditions.

Applications of Sequential logic, Design of counters, operation of parallel/serial

Input/output shift register, feedback shift register circuits.

Introduction to digital computer: Memory organization.

EE 360 L Digital Laboratory (1 Units): Prerequisite: EE 360

Selected experiments to supplement theory of digital networks and computer systems, fundamental logic devices and circuits, machine language programming of microprocessor.

EE 310 L Communication Lab I (2 Units): Prerequisite: EE 317, 230L

Selected experiment in the area of communication, solid-state electronics, control, and computers, electromagnetic waves and acoustics.

المحتوي العلمي للمقررات الدراسية الخاصة بشعبة الإلكترونيات والاتصالات
Description of Courses Content For Electronic and Communications Section

EE 414 Electromagnetic II (3 Units): Prerequisite: EE 313

Plane waves: Wave equation, propagation of uniform plane waves, normal incidence of plane waves reflection and refraction on multi regions, oblique incidence of parallel and perpendicular polarized waves. Solution using reflection coefficient and wave impedance concept, Solution using Smith chart, standing waves,.

Poyintings Theorem, power, complex Poyinting's vector, average Poyintings vector, average power. Rectangular wave-guide, TE, TM, TEM modes, propagation waves in wave-guide, cutoff frequencies, wave Impedance, power, wall losses.

Transmission Lines. Non sinusoidal waves on transmission lines. Microwave components. Phasor Analysis of refractive transmission lines, Modes of propagation in transmission lines, sinusoidal steady state, transmission line constants and distributed parameters, lossy lines, power. graphical solution using Smith chart, standing waves, wave impedance concept in transmission lines, standing waves on transmission lines, line impedance matching.

TEM waves on two conductors' transmission lines, characteristics impedance transmission line distributed parameters, line constants, wave equation.

EE 411 Comm. Eng II (3 Units): Prerequisite: EE 310

Noise representation, linear filtering of white Gaussian noise, Narrowband Gaussian noise representation. Noise in base band, noise and performance of linear and nonlinear modulation systems. Quantization noise in PCM and DM systems. Error rate in

base band digital modulation systems. Optimum filter and correlation receivers. Digital carrier modulation schemes: ASK, FSK, PSK, DPSK. performance and comparism. Introduction to other digital modulation schemes MSK, QPSK and QAM, Basic concept of information theory, Introduction to coding.

EE 411L Communication Lab II (2 Units): Prerequisite: EE 310 L

Selected experiment in the fields of communication, electromagnetic and digital electronic systems.

EE 480 Control I (3 Units): Prerequisite: EE 317

Introduction and definitions, Models of Physical Systems, Feedback Control System Characteristics, The Performance of Feedback Control Systems, Stability Analysis, Root Locus Analysis & Design, Frequency Response Analysis, Stability in frequency Domain, Feedback Control System Design & Compensation. With Examples are Simulated and Programmed using MATLAB.

EE 461 Microprocessor I (3 Units): Prerequisite: EE 360

Introduction to microprocessor, microprocessor instruction set, memory and addressing modes, 8086/8088 microprocessor, assembly programming, memory interface, I/O interface, the programmable peripheal interface, programmable interval timers, the programmable keyboard/display interface, interfacing ADC and DAC, programmable communication interface, interrupts, direct memory access and DMA controlled I/O.

EE 461L Microprocessor I Lab(2 Units): Prerequisite: EE 360

Software: Assembly language using the micro-assembler, Use of DEBUG program for memory address segment and offset calculation , bits, bytes, registers, segments, control using DEBUG commands, Use of ASCII code table with DEBUG program, Running DEBG program commands, writing and running DEBUG assembly programs with A, G command.

Hardware: Use of the training 8086 Development & Training System (DATS) for the 8086 CPU and its commonly used peripherals and how can be liked to a host PC with serial port input, Use of the 8051 Development and Training System available with the DATS board, some control applications for inputting data, outputting data, inputting and outputting data to microprocessor system.

interface, I/O interface, the programmable peripheal interface, programmable interval timers, the programmable keyboard/display interface, interfacing ADC and DAC, programmable communication interface, interrupts, direct memory access and DMA controlled I/O.

EE 418 Active Networks & Filters (3 Units): Prerequisite: EE 317

Two port network: Parameters, interconnections. Operational amplifier: Terminals, voltages, currents, circuits, model. Passive filter circuits, Active filter circuits. Butterworth and Chebyshev (design and realization). Passive network synthesis.

EE 434 Electronics III (3 Units): Prerequisite: EE 333

Difference Amplifiers, Operational Amplifiers & its Applications, Feedback Amplifiers & Oscillators, Thyristors & Unijunction Transistor, Optoelectronic Devices (Photoconductive Cells, Photodiodes, Phototransistors, Solar Cells, LED, etc.), Voltage Regulations, Communication & Interface (PLL, VCO, D/A, A/D, etc.), Switching circuits for Digital Logic (Transistor as a Switch, Logic Families, Multivibrators).

EE 419 Wire Communication Systems (3 Units): Prerequisite: EE 411

Review of analogue and digital modulation schemes- Multiplexing techniques (FDM, TDM) emphasizing on: concept, hierarchy, standards, specifications and implementations- User equipment (FAX, data terminals and TV) with emphasis on principles of operation, characteristics, types, standards and implementation- Telephone transmission: cables, properties of cable conductors, transmission parameters, signal distortion and conditioning, subscriber loop design. Data transmission over telephone cables- Voice band modems: types, characteristics and standards. Telephone network distribution in buildings.

Coaxial cable systems: cable construction, characteristics, system and repeater design, thermal and intermodulation noise consideration. Fiber optic cable systems: construction and characteristics, transmission parameters, TX\RX, repeater system, design parameters and system design.

EE 434 L Electronics Laboratory II (2 Units): Prerequisite: EE 333

Selected experiments in electronics concerning diode, transistors (BJT & FET), amplifiers, differential amplifiers, operational amplifiers, oscillators.

EE 465 Digital II (3 Units): Prerequisite: EE 360

Combination logic: Review of simple functions and techniques; parallel adder; carry propagation carry look-ahead; subtraction; logic functions; shifting; ALU; multiplication; serial, parallel and carry save methods.

Synchronous systems: Review of counters, finite state machine; races and hazards; state assignment; synthesis of synchronous system; implementation methods; memory and combination logic; design of control unit; micro program; PLA; examples of implementation of controllers and algorithms.

Asynchronous system: Timing; edge triggering; implementation of a flow chart; simple description of the relationship between synchronous and asynchronous control.

EE 581 Control II (3 Units): Prerequisite: EE 480

Introduction and definitions, State Variable Models, System Analysis in State Space, Time Response & Methods of Solution of State Equations, Stability of Multivariable Systems (Liapunov Stability Analysis), Controllability & Absorbability, Feedback Control Methods, Modern Control Design, Discrete-Time & Sampled Data Systems, Analysis & Design of Digital Control Systems, Nonlinear System Analysis, Introduction to Optimal & Adaptive Control Systems. With Examples are Simulated and Programmed using MATLAB.

EE 520 Wireless Communication Systems (3 Units) : Prerequisite: EE 411,414

High frequency communication systems- line of sight (LOS) communications systems at VHF, UHF & Microwaves. (HF) Satellite communication systems DBS, VSAT. Introduction to mobile communications. In all these systems stress is on: subsystems design consideration, link equations and performance.

EE 563 Computer Communications (3 Units): Prerequisite: EE 461,EE411

Basic concepts, asynchronous communications, serial and parallel-Transmission, modems and interface standard, principles of protocols layering. Data link layer: framing, bit and byte oriented frames, error detection. Multi-access channels such as Ethernet and token rings, principles of reliable transmission over unreliable channels, sliding window routing.

Network layer: packet switching and routing. High-level protocols: internetworking, transport level protocols, TCP/IP, data security.

EE 515 Antenna and Wave Propagation (3 Units): Prerequisite: EE 414

Introduction to Antennas: definition, types of antennas, radiation mechanism. Fundamental parameters of antennas: radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, beam width, band width, polarization, input impedance, antennas radiation efficiency, antenna equivalent length and areas , Friis and radar range equations, antenna temperature.

Radiation integrals and auxiliary potential function: vector potential A& F, Electrical fields for electric (J) and magnetic (M) current sources. Solution of the inhomogeneous vector potential equation, far field radiation.

Linear wire Antennas: Infinitesimal dipole, Small dipole, finite length dipole, half wave dipole, ground effects.

Loop antennas: Radiation fields, power density, radiation intensity, radiation resistance and directivity for, infinitesimal, small circular loop, circular of constant currents, Polygonal loop antennas. Ground and earth effects for circular loop.

Array Linear planner Antennas: two elements, N elements arrays, end fire and phase arrays, Design of antennas.

Traveling wave and wide band antennas: V antennas, rhombic antennas, Yagi-Uda antennas, microwave antennas: horn antennas, reflector antennas

EE 527 Microwave Eng. (3 Units): Prerequisite: EE 414

Microwave circuits & theorems: equation of voltage and currents, impedance description of waveguide circuits, fosters reactance theorem, n-port circuits, two-port junctions, s-matrix formulation and properties, illustrative problems. Impedance matching: impedance matching concepts, quarter wave transformers, theory of small reflections, single and multi-sections, binomial and chebyshev transformers. Passive microwave components: introduction to power dividers and couplers-t junctions and willkinson power dividers, analysis and design of directional couplers- Bethe hole, multi hole couplers, quadrature hybrids, faraday rotation, s-matrix of directional couplers and T-junctions, gyrator, isolator, circulator- applications.

GS 528 Complex Analysis (3 Units): Prerequisite: ---

Complex numbers, the topology of the complex plane, the extended complex plane and its representation using the sphere. Complex functions and their mapping properties, their limits, continuity and differentiability, analytic functions, analytic branches of a multiple- valued function. Complex integration, Cauchy's theorems, Cauchy's integral formulae. Taylor's series, zeroes of analytic functions. Isolated singularities and their classification, Laurent's series, Cauchy's residue theorem, the argument principle.

EE 523 Signal Processing (3 Units): Prerequisite: ---

Advanced digital filter design techniques : Multiple band optimal FIR filters – design of filters with simultaneous constraints in time and frequency response, optimization methods for designing IIR filters, comparison of optimum FIR filters and delay equalized elliptic filters. Multirate DSP : The basic sample rate alteration – time – domain characterization, frequency – domain characterization : Cascade equivalences, filters in sampling rate alteration systems, digital filter banks and their analysis and applications, multi-level filter banks, estimations of spectra from finite – duration observation of signals. linear prediction and optimum liner filters : forward and backward linear prediction, AR Lattice and ARMA lattice – ladder filters, Wieners filters for filtering on prediction. DSP Algorithms : The Goertzel algorithm, the chirp – z transform algorithm the Levinson – Durbin algorithms, the Schur algorithm, and other algorithms, computations of the DFT, concept of tunable digital filters. Signal Processing Hardware: Multipliers, dividers, different forms of FIR Hardware, multiplexing, DTTR, TDM to FDM translator, realization of frequency synthesizer, FET hardware realization, different FFT architectures, special FFT processors, Lincoln laboratory FDP and the compatible.

EE 526 Info. Theory & Coding (3 Units): Prerequisite: ---

Review of probability theory, entropy, mutual information, data compression, Huffman coding, information theory is concerned with the fundamental limits of communication. The ultimate limit to data compression. Coding theory is concerned with practical techniques to realize the limits specified by information theory Source coding converts source output to bits. ¾ Source output can be voice, video, text, sensor output. Channel coding adds extra bits to data transmitted over the channel ¾ This redundancy helps combat the errors introduced in transmitted bits due to channel noise.

EE 537 VLSI (3 Units): Prerequisite: ---

This course provides an introduction to the design and implementation of VLSI circuits for complex digital systems. The focus is on CMOS technology. Issues to be covered include deep submicron design, clocking, power dissipation, CAD tools and algorithms, simulation, verification, testing, and design methodology. The course includes a computer lab component in which you will design and lay out a small 4-bit microprocessor.

المحتوي العلمي للمقررات الدراسية الخاصة بشعبة القوى
Description of Courses Content For Power Section

EE 444 Electrical Machine II (3 Units): Prerequisite: EE 340

DC Machines: Construction of general principles, dc machine winding, simple lap and simple wave windings Distribution Factor. DC magnetic circuit (magnetization curve), EMF equation, types of DC Machines , External characteristics of DC generators, Build-up of voltage in shunt generator, Effect of armature reaction, commutation problems associated with commutation, Method of improving commutation(brush shift, Interpoles, compensating windings) Analytical fundamentals "electrical circuit aspect" Analytical fundamentals " magnetic circuit aspects" steady state performance , dc motor starting . 3-Φ Induction Motor, MMF of distributed winding and rotating MMF waves in AC machine Current and flux in I.M, Induction motor equivalent circuit, Analysis of the equivalent circuit and motor performance, performance calculation form NO-load and Blocked-rotor tests. Deep bar and double cage rotors, double cage motor equivalent circuit, starting of I.M.

EE 450 Power Distribution Systems (3 Units): Prerequisite: EE 216

Feeders and distributors (AC and DC) - Radial and ring distribution systems– load characteristics - Three–wire distribution systems - Multiphase circuits- Methods of measuring power in 3-phase circuits - Phasor diagrams of 3-phase (balanced and unbalanced) power systems –Per unit system, Fault and distributor system- Electric power cables - Towers and insulators. Substations- protection of distributor system.

EE 461 Microprocessor I (3 Units): Prerequisite: EE 360

Introduction to microprocessor, microprocessor instruction set, memory and addressing modes, 8086/8088 microprocessor, assembly programming, memory interface, I/O interface, the programmable peripheal interface, programmable interval timers, the programmable keyboard/display interface, interfacing ADC and DAC,

programmable communication interface, interrupts, direct memory access and DMA controlled I/O.

EE 461L Microprocessor I Lab(1 Unit): Prerequisite: EE 360L

Software: Assembly language using the micro-assembler, Use of DEBUG program for memory address segment and offset calculation , bits, bytes, registers, segments, control using DEBUG commands, Use of ASCII code table with DEBUG program, Running DEBG program commands, writing and running DEBUG assembly programs with A, G command.

Hardware: Use of the training 8086 Development & Training System (DATS) for the 8086 CPU and its commonly used peripherals and how can be liked to a host PC with serial port input, Use of the 8051 Development and Training System available with the DATS board, some control applications for inputting data, outputting data, inputting and outputting data to microprocessor system.

interface, I/O interface, the programmable peripheal interface, programmable interval timers, the programmable keyboard/display interface, interfacing ADC and DAC, programmable communication interface, interrupts, direct memory access and DMA controlled I/O.

EE 480 Control I (3 Units): Prerequisite: EE 317

Introduction and definitions, Models of Physical Systems, Feedback Control System Characteristics, The Performance of Feedback Control Systems, Stability Analysis, Root Locus Analysis & Design, Frequency Response Analysis, Stability in frequency Domain, Feedback Control System Design & Compensation.

With Examples are Simulated and Programmed using MATLAB.

EE 451L Electrical Power lab I (2 Units): Prerequisite: EE340

Selected experiment on transmission lines, voltage regulation, network analysis, power electronics, ac machines and transformers.

EE 445 Electrical Machine III (3 Units): Prerequisite: EE 444

AC machine windings: (Lap, wave, spirel windings) half coil wttaler coil, windings groups (60° & 120° groups), winding distribution fractional slot winding, winding factors

Synchronous Generators: (steady state) synchronous Generators construction ,speed of rotation, the internal generated voltage, the equivalent circuit, measuring synchronous Generators, model parameters (open and short circuit characteristics, power angle characteristics, operating characteristics, (compounding curves, capability curves), effect of salient poles (flux and MMF waves, phasor diagrams, powers-angle characteristics), parallel operation of synchronous Generators.

Synchronous Motors: Basic Principles of motor operation , steady state synchronous, motor operation (effect of load changes on a synchronous motor, effect of field current

changes, synchronous motor and Power factor correction, synchronous condenser), starting of synchronous motors.

Fractional HP motors: Single phase I.M, starting and running performance of S.P.I (Split phase, capacitor-type, shaded pole, self starting reluctance, hystesis motors), Double revolving field theory, unbalanced operation of symmetrical 2-phase machines, universal motors, stepper motors (variable reluctance, permanent magnet stepper motors).

EE 452 Power Systems Analysis I(3 Units) : Prerequisite: EE 450

Power system representation. Single line diagram representation. Impedance diagram, Reactance diagram. Per unit system representation. Per unit impedance of a single phase transformer, three phase transformer. Per unit impedance of three winding transformer. The Advantage of the per unit computation. The Bus Admittance and impedance matrices. Direct determination of Y-bus. Direct determination of Z-bus. Computer application.

Power Flows: Direct solution to linear algebraic equations: Gauss Elimination, Iterative solution to Linear algebraic equations: jacobi and Gauss Seidel solution. Iterative solution to Nonlinear Algebraic Equations: Newton Raphson. Power flow solution by Gauss-Seidel Method, Power flow solution by Newton Raphson, Control of power flow. Regulating transformer. Computer application.

EE 431 Power Electronics (3 Units): Prerequisite: EE 333

Rectifying Devices: The Diode, The thyristor, Gate characteristics, Gate firing circuits (DC signals, Pulse and AC signals), Series and parallel operation of SCRs, The TRIAC, Gate turn-off thyristor, the power Transistor, other devices.

Rectifying Circuits: Commutating diode, single-phase half wave, Bi-phase half wave, Single-phase bridge (Uncontrolled, Fully half-controlled), Tree-phase half wave, three-phase bridge, six-phase half wave.

DC line commutation: parallel capacitance, resonant turn-off, coupled pulse

Frequency Conversion: single-phase center tapped and bridge inverter, three-phase bridge inverter, Constant-voltage source inverters, constant current source inverter.

Some Applications: Contactor, Heating, voltage multipliers, stand by inverters, HVDC transmission.

EE 453 Power Transmission Lines (3 Units): Prerequisite: EE 450

Introduction: advantages of transmission lines, types of conductors and conductor's materials. Parameters of transmission lines: physical and electrical; conductance, resistance. Inductance and inductive reactance: internal inductance, external inductance, single-phase two wire line, flux linkages of one conductor in a group of conductors, inductance of composite conductor lines, use of tables, inductance of three-phase line with (symmetrical and unsymmetrical spacing), bundled conductors, skin effect. Capacitance and capacitive reactance: electric field of a straight conductor, potential difference between two points due to charge, single-phase line, use of tables, capacitance of three-phase line with (equilateral and unsymmetrical spacing), effect of earth, bundled

conductors, Ferranti effect. Transmission line models: short line, medium line (T and π); and the long line. Type's of insulators, calculation of voltage distribution. Mechanical characteristics: calculation of line tension and sag, line supports (poles and towers). Environmental impact.

EE 551L Electrical Power lab II (2 Units): Prerequisite: EE 451 L

Selected experiment in protection, symmetrical and unsymmetrical faults studies, special type machines and high voltage testing and insulation.

EE 554 Energy Economics (3 Units): Prerequisite: EE 444, 452

Short term load forecasting, base load classification and estimation, fuel cost, start up cost, shut down cost, economic load distribution between units, calculation of loss coefficients and penalty factor, transmission loss, computer methods for economic distribution, economic investment of electric energy.

EE 555 Renewable Energy (3 Units) Prerequisite: ---

Introduction to energy utilization – Energy resources – Problems of conventional energy – Importance of recent renewable energy – Renewable energy supply – Principles of solar radiation - Photovoltaic-cell converters – Principles of wind energy – Aerodynamics of wind turbines – Different applications of wind energy - Geothermal energy – Availability of geothermal energy– Waste-combustion energy – Air pollution control facilities - Ocean energy resources – Wave motion power and converters – Ocean currents - Thermal ocean power plant – Tidal energy.

EE 555 Power Systems Analysis II(3 Units) : Prerequisite: EE 452

Symmetrical Faults: Series R-L Circuit transient, three phase short circuit unloaded synchronous Machine, Bus Impedance Matrix Application, Power system three-phase short circuit. Circuit breaker and fuse selection. Computer application

Symmetrical Components: Definition of symmetrical components. Sequence networks of series impedance. Sequence networks of three phase lines. Sequence networks of Rotating machines. Per unit sequence, models of three phase two winding transformers. Per unit sequence impedance of three phase three winding transformer

Unsymmetrical Faults: system representation, Single line to ground faults, Line to Line faults, double line to ground faults. Sequence bus impedance Matrices. Computer applications

Transient Stability: The Swing Equation. Simplified Synchronous Machine model and system equivalent. The equal Area criterion. Numerical equations of the Swing equation. Multi-machine Stability. Design methods for Improving transient stability. Computer application

EE 551 High voltage Engineering (3 Units): Prerequisite: EE 450

Introduction: insulation co-ordination, H.V. levels, elements of H.V. network. Generation of high alternating voltages: single-step-up transformer, transformer in cascade, series resonant circuits. Performance of H.V. test transformer. Construction of test transformers: Cast Resin, oil tank, oil insulated enclosure. Characteristic Parameters of impulse voltage waves: full wave, chopped wave, and switching surge. Impulse voltage generator circuits: single-stage impulse voltage circuit and multi-stage impulse generator circuit. Generation of high direct voltages: properties of H.V. rectifiers, half-wave and full-wave rectification (Cockcroft-Walton type). Measurement of H.V: peak voltage measurements with spark gaps, peak voltage measurement using measuring capacitors (Chubb and Fortescue), measurement of r.m.s. values using electrostatic voltmeters. Measurement of impulse voltages: resistive voltage divider, capacitive voltage dividers, mixed resistor ,capacitive voltage dividers. Surge arrestors. Introduction to partial discharges. Electrical Breakdown in Gases: Corona, theory of corona information, calculation of disruptive and visual critical voltages, calculation of corona power loss. Natural inorganic insulating materials: natural gases, quartz and mica. Synthetic inorganic insulating materials: sulphur hexafluoride, glass, ceramic. Natural organic insulating materials: mineral oil, paper. Environmental impact.

EE 556 Power System Protection (3 Units): Prerequisite: EE 452

Classification of relays; protective relays, monitoring relays, programming relays. (design criteria, reliability, speed selectivity) Technical tools; Phasors, polarity, symmetrical components

Basic relay Units; Electromechanical units, solid state units, logic and IC units. International Transformers; Current transformers, equivalent circuit, estimation of CT performance; Formula method, excitation curve method, current transformer accuracy, DC saturation.

Voltage transformer and coupling capacitance: Generator Protection; Fault detection, ground fault protection backup protection, over load protection, over speed protection-less of excitation, field ground protection. Motor Protection; Fault detection, ground fault protection locked rotor protection, thermal relays, overload protection, low voltage protection,[negative sequence protection

Line and circuit protection: Over current relays, Radial system protection, recloser and fuses, directional relays.

- Protection of two sources system with directional relays

- Zones of protection:

- Line protection with impedance (Distance relays)

- Differential Relays

- Station bus Protection with differential Relays

Transformer Protection: Differential relays for transformer protection, General guide line for transformer differential relaying

- Pilot Relaying principles and application

- Digital Relays principles and application

GS 528 Complex Analysis (3 Units):

Complex numbers, the topology of the complex plane, the extended complex plane and its representation using the sphere. Complex functions and their mapping properties, their limits, continuity and differentiability, analytic functions, analytic branches of a multiple- valued function. Complex integration, Cauchy's theorems, Cauchy's integral formulae. Taylor's series, zeroes of analytic functions. Isolated singularities and their classification, Laurent's series, Cauchy's residue theorem, the argument principle.

المحتوي العلمي للمقررات الدراسية الخاصة بشعبة التحكم الالي
Description of Courses Content for Automatic Control Section

EE 465 Digital II (3 Units): Prerequisite: EE 360

Combination logic: Review of simple functions and techniques; parallel adder; carry propagation carry look-ahead; subtraction; logic functions; shifting; ALU; multiplication; serial, parallel and carry save methods.

Synchronous systems: Review of counters, finite state machine; races and hazards; state assignment; synthesis of synchronous system; implementation methods; memory and combination logic; design of control unit; Micro-program; PLA; examples of implementation of controllers and algorithms.

Asynchronous system: Timing; edge triggering; implementation of a flow chart; simple description of the relationship between synchronous and asynchronous control.

EE 480 Control I (3 Units): Prerequisite: EE 317

Introduction and definitions, Models of Physical Systems, Feedback Control System Characteristics, The Performance of Feedback Control Systems, Stability Analysis, Root Locus Analysis & Design, Frequency Response Analysis, Stability in frequency Domain, Feedback Control System Design & Compensation.

With Examples are Simulated and Programmed using MATLAB.

EE 581L (Modern Control Theory Lab) (2 Units): Prerequisite: EE 581

MATLAB basics, state and variable representation, mathematical modelling of physical systems, control systems characteristics, control systems performance, control system stability, control system design, robust control systems.

EE409 Electronic Measurements (3 Units): Prerequisite: EE 307

Measurement Errors: Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution and Significant figures, **, Transducers** ,Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers and LVDT, Piezoelectric transducer, photoelectric transducer, Photovoltaic transducer, Semiconductor photo devices, Temperature transducers-RTD, Thermocouple , **Display devices:** Digital display system, classification of display, Display devices, LEDs, LCD displays

EE 461 Microprocessor I (3 Units): Prerequisite: EE 360

Introduction to microprocessor, microprocessor instruction set, memory and addressing modes, 8086/8088 microprocessor, assembly programming, memory interface, I/O interface, the programmable peripheal interface, programmable interval timers, the programmable keyboard/display interface, interfacing ADC and DAC, programmable communication interface, interrupts, direct memory access and DMA controlled I/O.

EE 461L Microprocessor I Lab(2 Units): Prerequisite: EE 360

Software: Assembly language using the micro-assembler, Use of DEBUG program for memory address segment and offset calculation , bits, bytes, registers, segments, control using DEBUG commands, Use of ASCII code table with DEBUG program, Running DEBG program commands, writing and running DEBUG assembly programs with A, G command.

Hardware: Use of the training 8086 Development & Training System (DATS) for the 8086 CPU and its commonly used peripherals and how can be liked to a host PC with serial port input, Use of the 8051 Development and Training System available with the DATS board, some control applications for inputting data, outputting data, inputting and outputting data to microprocessor system.

interface, I/O interface, the programmable peripheral interface, programmable interval timers, the programmable keyboard/display interface, interfacing ADC and DAC, programmable communication interface, interrupts, direct memory access and DMA controlled I/O.

EE 581 Control II (Modern Control Theory) (3 Units): Prerequisite: EE 480

Introduction and modern control theory, state estimation, physical system representation in state space, state diagram, state space representation State estimation for differential equations, state decomposition, relation between state and transfer function representation analysis in state space, Time response for state equations, stability for multivariable System, controllability and observability, Feedback Control Methods non-linear system analysis, Examples using MATLAB simulator program.

EE 465 Microprocessor II (3 Units): Prerequisite: EE 361

To understand the benefits of using an RTOS (Real-Time Operating System) on a microcontroller. They will also learn about the architecture of ARM cortex M based processors. Students will learn the basic components of an RTOS including both background and event threads, thread scheduling algorithms, inter-process communication, thread priority, and synchronization/mutual exclusion via semaphores. Students will also learn how to design embedded C software driver libraries for peripherals such as I2C RGB LEDs drivers and a resistive, pixel-based touchscreen. Students will conclude the course by interfacing with a CC3100 Wi-Fi chip to create an IoT application. Students may also learn artificial intelligence (AI) and deep neural network (DNN) techniques and apply these techniques into embedded and IoT domain. Students may use an Audio Signal Processing Booster Pack Plug-In Module (BOOSTXLAUDIO) to take voice commander to control the developed IoT systems, with the help from embedded AI algorithms.

EE 484 Industrial Electronics (3 Units): Prerequisite: EE 333

It is introduced to various electronic components and systems used in modern industry. Operational amplifier principles and applications including comparators (zero and non-zero crossing detectors), voltage followers, inverting and non-inverting amplifiers. Subtraction, summing (mixer), difference and compound amplifiers and active filters. Operational amplifiers circuits are configured to make up complex analog circuits. Examples of these include the temperature controller and the pulse width modulation technique of DC motor speed control. The importance of digital computers used in modern industrial processes is stressed. Thyristors, photosensitive devices, optically coupled devices, and timer control circuits and various transducers are introduced. Three hours lecture, three hours laboratory per week.

EE 588 Industrial Control Systems (3 Units): Prerequisite: EE 581

A study of the operating principles of electric motors and discrete control systems with an introduction to process control. Topics will include methods of controlling, protecting and specifying motors and their controls. Components covered will include: starters, sensors, timers, programmable logic controllers and analog controllers with emphasis on industry applications

EE 585 Digital Control (3 Units): Prerequisite: EE 581

Introduction to digital control theory, solution of deferential equations, theory of the Z- transform, Inverse of z-transform, partial fraction method, solution of state equation, Sampled data systems, data reconstruction, open loop systems, digital filters, closed loop systems, analysis and design of digital control systems, discrete system stability, mapping S-plane to z-plane, Root locus, Bode diagram, steady state accuracy, design of digital control systems, phase lag, phase lead design, digital PID controller, non-linear systems analysis, some simulation examples using the MATLAB simulator program.

EE 586 Computer Control Systems (3 Units): Prerequisite: EE 581, EE585

System models: State-space forms and the solution of the state-space equation in discrete and continuous time. Sampling. Transfer functions and transfer operators. Model transformations from transfer functions to state-space models and vice versa.

System properties: Controllability and observability. Static gain. Step and impulse responses in discrete and continuous time. Frequency domain properties (connection to sampling). Stability in discrete and continuous time; asymptotic stability, bounded-input bounded-output stability, the Nyquist criterion.
Controller design: Pole placement in state-space form. State feedback with observer. PID controllers. Stability margins. Sensitivity functions. The notion of robustness. Computer implementation (sampling, aliasing).

EE583 Nonlinear Control System (3 Units): Prerequisite: EE 581

Input-Output and Input-to-State stability of nonlinear systems, Stability of interconnected nonlinear systems: small gain theorem, Zero dynamics of nonlinear systems, Control Lyapunov functions. Global stabilization and tracking for nonlinear systems in normal form, Backstepping techniques. Semi-global stabilization of nonlinear systems in normal form, the peaking phenomenon.

EE587 Programmable Logic Controllers (3 Units): Prerequisite: EE 581, 582

Course Description: This course provides students the basic knowledge of Programmable Logic Controllers (PLC's) and their application in industry today. This is a hands-on study of PLC programming applications such as sequencing, timers, counters, hydraulic and pneumatic actuators, indicator lamps and motor controls. At the completion of the course, students will be able to program and troubleshoot a PLC for typical industry applications (using Allen-Bradley Control Logix software).

EE 582 Adaptive Control (3 Units): Prerequisite: EE 581

Introduction to adaptive control systems, Advanced Stability Theory, Simple Adaptive Systems - identification, control, State Variables Accessible - identification, Regression, Linear regression , Least-squares estimate (LSE), LSE and Singular Value Decomposition, Output Feedback Adaptive Control, Parameter Convergence, Persistent Excitation, Robust Adaptive Control - disturbances, Robust Adaptive Control - time varying parameters, Robust Adaptive Control - Un-modeled dynamics, Improving Transient Response in Adaptive Control, Adaptive Control of Nonlinear Plants, time-delay systems, Applications of Adaptive Control, some examples using the MATLAB simulator in adaptive control examples.

EE 591 Stochastic Processes (3 Units):

Many systems evolve over time with an inherent amount of randomness. The purpose of this course is to develop and analyse probability models that capture the salient features of the system under study to predict the short and long term effects that this randomness will have on the systems under consideration. The study of probability models for stochastic processes involves a broad range of mathematical and computational tools. This course will strike a balance between the mathematics and the applications.