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**COURSES DESCRIPTION FOR**

**Department of Electronic Engineering**

**College of Engineering**

**University of Diyala**

**2019-2018**

**First Year**

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| ***First Semester*** | | | | | ***Second Semester*** | | | | |
| ***Course Title*** | ***Credit***  ***Hours*** | ***Weekly hours*** | | | ***Course Title*** | ***Credit Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** | ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***Mathematics –I*** | ***3*** | ***3*** | ***1*** | ***-*** | ***Mathematics- II*** | ***3*** | ***3*** | ***1*** | **-** |
| ***Electronic Physics I*** | ***2*** | ***2*** | ***1*** | ***-*** | ***Electronic Physics II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***Workshop Skills- I*** | 1 | ***-*** | ***-*** | ***2*** | ***Digital Technique II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Digital Technique I*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Electrical Engineering Fundamentals I*** | ***4*** | ***3*** | 1 | ***2*** | ***Electrical Engineering Fundamentals II*** | ***4*** | ***3*** | ***1*** | ***2*** |
| ***Human Rights*** | ***1*** | ***1*** | ***-*** | ***-*** | ***Human Rights*** | ***1*** | ***1*** | ***-*** | ***-*** |
| ***Arabic Language*** | ***1*** | ***1*** | ***-*** | ***-*** | ***English Language*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Engineering Drawing I***  ***(Basic)*** | ***2*** | ***1*** | ***-*** | ***2*** | ***Engineering Drawing-II(AutoCAD)*** | ***2*** | ***1*** | ***-*** | ***2*** |
| ***Computer Science*** | ***2*** | ***1*** | ***-*** | ***2*** | ***Programming*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Engineering Mechanics-I***  ***(Statics)*** | ***2*** | ***2*** | ***1*** | ***-*** | ***Engineering Mechanics-II***  ***(Dynamics)*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***Total*** | ***21*** | ***16*** | ***4*** | ***10*** | ***Total*** | ***22*** | ***18*** | ***4*** | ***8*** |
| ***30*** | | | ***30*** | | |

**Course Number: U101**

**Course Name: Human Rights& Democracy I**

**Credit hours: (1-1-0-0)**

**Pre-requisite: None**

**Course Contents:** Introduction about human rights.The literal and linguistic definition of rights.The historic development of the human rights concept.The appearance of Islam and the basis of human right.Europe and human rights.The concept of human in the material civilization.The concept of human in Islam.The status of human in the modern civilization.The status of human in Jurisprudence.The features of human rights in the Islamic intellectuals.The main rules that organize human rights.Admitting of rights under the authority of the modern state of law.The intellectual base of the principle of rights and freedoms in Islam.Properties and the nature of rights and freedoms in Islam.The non-organized rights and freedoms in Islam.

**Course Number: U102**

**Course Name: Human Rights& Democracy II**

**Credit hours: (1-1-0-0)**

**Pre-requisite: None**

**Course Contents:** The social rights and freedoms.The individual rights in the state security as the right of getting job.The administrative corruption.The equality in Islam.The equality in Law.The equality in Judiciary and Employment.The financial corruption.The equality in the public costs and burdens.The rights of human in Iraqi law.The general rights of individuals especially those rights related to human morals.The individuals freedoms related to their material interest.The Arab chart for human rights.The articles from (1-40) of the universal Declaration.The articles from (1-40) of the universal Declaration.The articles from (1-40) of the universal Declaration

**Course Number: U103**

**Course Name: Computer Science**

**Credit hours: (2-1-0-2)**

**Pre-requisite: None**

**Course Contents:** Introduction: Windows Operating System, creates new folder, selecting folders, finding folders or files copying and moving files and folders. How to start any program shut Down, scandisk, arranging icon, run, help, etc.; Win Word, Excel and Power point: All facilities, Description of its features and use, the function of toolbars and menu items (File, Edit, View, Format, Tools); Introduction to computer system &computer architecture, Algorithms and flowcharts. A brief history / importance of C++, Simple program of C++, Constants & variables, Operators, Arithmetic, logical Assignment, Relation of Operator bitwise, Input & output statement (cin>> statement, cout<<statement), Control statements (if, switch).

**Course Number: E107**

**Course Name: Programming**

**Credit hours: (3-2-0-2)**

**Pre-requisite: None**

Review to C++ programming language (Constants & variables, Input & output statement, Control statements**),** Loops (for, while, do….while), subprograms (functions), Arrays (1-D arrays initialization, declaration storing, Multidimensional arrays initialization, Declaration application), pointers (Creating pointer, Declaration pointer, initialization pointer & variable types, Application on pointers), files, introduction to structure.

**Course Number: U104**

**Course Name: English**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents: *(New English course recommended by the Ministry council)*** *or*

This course is designed to enable the students to achieve academic oral and written communication to the standard required at university level. The course integrates all the language skills with emphasis on writing, and it stimulates students’ imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse academic disciplines. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as further readings and use of the Blackboard Suite.

**Course Number: U105**

**Course Name: Arabic languge**

**Credit hours: (1-1-0-0)**

**Pre-requisite: None**

**Course Contents:**Introduction : Arabic language –Origin, formal and slang , translations and usual mistakes. Basic Arabic writing skills and its major roles.Arabic dictionaries and how to use it. Sentences and their types in Arabic tongue. Arabic sentence structure and safe constructed sentence in Arabic language.How to write a paragraph. How to write a report using the wright Arabic sentences. Applications.

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**Course Number: E101**

**Course Name: Mathematics I**

**Credit Hours: (3-3-1-0)**

**Pre-requisite: None.**

**Course Content:** Inequalities: absolute value, greatest integer. Functions: domain and range operations on functions. (Algebraic functions), limits: definitions and its theorems, Continuity: definition and its theorems, Derivative: definition, rules of differentiation, chain rule, implicit differentiation, higher order derivatives, applications: related rates, maximum and minimum, concavity, graphs of functions, mean value and roll's theorems, Inverse function. Determents and matrices.

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**Course Number: E102**

**Course Name: Mathematics II**

**Credit Hours: (3-3-1-0)**

**Pre-requisite: Mathematics I**

**Course Content:** Trigonometric functions and their inverse functions. Complex numbers and complex geometry, Integration: definite and indefinite integrals, rules of integration. Applications on definite integrals: area, volumes, length of a plane curves and the area of surface of revolution, the fundamental theorem of integral calculus, The functions ln(x), exp(x) and their inverse functions, Method of integration, improper integrals, Conic sections, translation and rotation of axes, Vectors in the plane, vector valued functions velocity and acceleration.

**Course Number: E104**

**Course Name: Engineering Drawing I**

**Credit hours: (2-1-0-2)**

**Pre-requisite: None**

**Course Contents:** Introduction to engineering drawing and its uses as engineering language in industry dimensioning symbols and terms used in drawing, metric system, Types of Engineering Tools and Their Uses, Engineering Operations, names and dimensions of lines used in drawings. Projections, The Conclusion Projected third Projection Stereo. Isometric Projection. Drawing various types of geometrical patterns (Traeery), Various methods of drawing ellipses, various types of tangents., Drawing according to scale, drawing various views of an actual object, rejections of all views necessary for a given object, projection of views using first and third angle projection methods. Freehand sketching proper and reasonable proportion.

**Course Number: E105**

**Course Name: Engineering Drawing II**

**Credit hours: (2-1-0-2)**

**Pre-requisite: None**

**Course Contents:** The use of CAD in engineering drawing. Description of menu Bar and toolbars. Drawing Ellipse, Rectangle, line, Ray, Circle, point, Arc, ---- etc.CAD Electrical, Mechanical/ Special features. A using of various layers. Drawing electrical symbols on simple architectural plans.

**Course Number: E106**

**Course Name: Workshop Skills I**

**Credit Hours: (1-0-0-2)**

**Pre-requisite: None**

**Course Content:** The workshop training program is designed to satisfy the following objectives Teaching safety rules and regulations on-site in an industrial environment Proper use of working tools, instruments, and machines, Introducing basic workshop practices, production, labor, and time-requirements of workshop operations. The students are introduced to training programs in nine workshops: electrical wiring, welding, forging, fitting, turning and milling, carpentry, plumbing auto-mechanics, and casting. The student is to spend 6 hours of training in every workshop

**Course Number: EE101**

**Course Name: Digital Techniques I**

**Credit Hours: (3-2-0-2)**

**Pre-requisite: None**

**Course Contents: System Numbers: (**Decimal , Binary , Binary arithmetic , Octal and Hexadecimal Numbers, Conversions of System Numbers, Arithmetic Operations with Signed Numbers, , **Digital Codes** : (Binary coded decimal [BCD]Exc-3 code, Graycodes, **Logic Gates**:(Boolean algebra , De’Morgan theorems , Simplification Using Boolean Algebra, Standard Forms of Boolean Expressions( SOP and POS form), The karnaugh Map (Three, Four and Five- Variable Kamaugh Maps), The universal property of the NAND and NOR gates.

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**Course Number: EE102**

**Course Name: Digital Techniques II**

**Credit Hours: (3-2-0-2)**

**Pre-requisite: Digital Techniques I**

**Course Contents: Functions of Combinational Logic:** Adders, Subtracters, Parallel Binary Adders, Magnitude comparators, Encoders, Decoders, Multiplexers, Demultiplexers, Parity Generators/Checkers, **Flip-Flops:**(Latches, Edge-Triggered Flip-Flops).

**Course Number: EE103**

**Course Name: Electrical Eng. Fundamentals I**

**Credit Hours: (3-2-1-2)**

**Pre-requisite: None**

**Circuit Variables and Circuit Element:** System of units, Charge and Current, Voltage, Power and Energy, Circuit Elements, voltage and current sources, dependent and independent sources, electrical resistance and conductance, Types of resistors. **Circuit Transformations** Series Resistors and Voltage Division, Parallel Resistors and Current Division, Wye-Delta Transformations, Source Transformations**. Basic Laws** Ohm’s Law, Nodes, Branches, and Loops, Planar and Non-planar circuits. **Techniques of Circuit Analysis** Basic terminology, Kirchhoff’s Laws , Mesh Analysis, Nodal Analysis, Superposition, Thevenin’s Theorem, Norton’s Theorem, Maximum Power Transfer.

**Course Number: EE104**

**Course Name: Electrical Eng. Fundamentals II**

**Credit Hours: (3-2-1-2)**

**Pre-requisite: Electrical Eng. Fundamentals I**

**Sinusoidal Alternating Current Fundamentals:** Generation of Alternating Voltages and Currents, Equations of Alternating Voltages and currents, Simple and Complex Waveforms, Basic terminologies, Root Mean Square (R.M.S.)Value, Average Value, Form Factor and Peak Factor, Circuit Elements **Vectors and Phasors :** Vectors and Phasors Representation of Alternating Quantities, Mathematical Operations on Vectors, AC Current through Various Circuit Elements, Operations with Complex Number, PhasorDiagram.**AC Power Calculations**: Active, reactive and apparent power, power in complex form, power triangle, power factor. Series and Parallel Combinations of AC Circuits: Series Combinations of Various Circuit Elements , Parallel Combinations of Various Circuit Elements. Resonance in AC Circuits: Frequency response of various circuit elements, resonance in series and parallel circuits, quality factor, Half-power Bandwidth of a Resonant Circuit, Bandwidth B at any Off resonance Frequency, Determination of Upper and Lower Half-Power Frequencies, Values of Edge Frequencies, Q-Factor of a Resonant Series Circuit **Circuit theorem in AC circuits:** Kirchhoff’s Laws, Mesh Analysis, Nodal Analysis, Superposition, Thevenin’s Theorem, Norton’s Theorem, Maximum Power Transfer. 11- Magnetic Circuits Magnetic Circuit, Definitions, Magnetic Field Strength (H), Magnetic Potential, Flux per Unit. **Magnetic Circuits** Magnetic Circuit, Definitions, Magnetic Field Strength (H), Magnetic Potential, Flux per Unit Pole, Flux Density (B), Absolute Permeability (m) and Relative Permeability (mr), Intensity of Magnetization (I), Susceptibility (K), Composite Series Magnetic Circuit, How to Find Ampere-turns , Comparison Between Magnetic and Electric Circuits, Parallel Magnetic Circuits, Series-Parallel Magnetic Circuits, Leakage Flux and Hopkinson’s Leakage coefficient Magnetization curves.

**Course Number: EE105**

**Course Name: Engineering Mechanics I (Statics)**

**Credit Hours: (2-2-1-0)**

**Pre-requisite: None**

**Course Content:** Static: Force system, unit system, parallelogram law, force + components, Result of Coplanar force components of force in space, moment of A force, moment of couples, Equilibrium: free body diagram, coplanar system, analysis of trusses, friction nature of friction, theory of friction, coefficient of friction, centurions & center of gravity, centurions of area, Centurions determined by integration, moment of inertia: parallel Axes Theorem, 2nd moment of area by integration, radius, moment of inertia of Composite area. Strength of materials :Hooks law, tension and compression stress thin – walled cylinders and spheres, combined stress (Mohr's circle) shear and normal stress, stresses in beams (initial principal).

**Course Number: EE106**

**Course Name: Engineering Mechanics II (Dynamics)**

**Credit Hours: (2-2-1-0)**

**Pre-requisite: Engineering Mechanics I (Statics)**

**Course Content:** Dynamics: Kinetics of particle, rectilinear motion, curvilinear motion, rectangular components of curvilinear motion, normal and tangential component of Acceleration, kinetics: force, mass and acceleration, kinetics of particle Newton's 2nd law. Thermodynamics: Introduction, Active materials & their specification, work and heat in ideals gasses and steam 1st law thermodynamics practical law in steam and gasses, 2nd law of thermodynamics practical law in steam and gasses.

**Course Number: EE107**

**Course Name: Electronic Physics I**

**Credit Hours: (2-2-1-0)**

**Pre-requisite: None**

**Energy Levels and Atomic Structure:** The atom, model, wave nature of light **,**Dual nature of matter, wave function, Energy – band theory of metals, insulators and semiconductors Crystal structure, ionic, covalent and metallic bonding, energy hand of crystals. Internal structure of materials cell, packing miller indices Crystal planes and direction, brags law and x- ray diffraction, electronic ballistics**. Electrical conduction in metals:** Mobility and conductivity, The energy distribution of electrons, Fermi level, work function. **Semiconductors**: Semiconductor materials (SI, GE and compound semiconductors), Extrinsic semiconductors, Fermi – level in semiconductor diffusion and carrier lifetime Hall effect.

**Course Number: EE108**

**Course Name: Electronic Physics II**

**Credit Hours: (2-2-1-0)**

**Pre-requisite: Electronic Physics I**

**Semiconductor P-N junction:** P-N junction in equilibrium, current–voltage characteristics Charge–control description of a diode transition and diffusion capacitance diode switching times diode models, Small- signal model and load line concept introduction to hetero junctions and double heterojunctions. **Types of semiconductor diodes:** Varactor diode, tunnel diode, photo diode photovoltaic (solar) cell, light emitting diode, Principle and operation of semiconductor laser, metal, electronic palasilics semiconductor diode

**Second Year**

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| ***First Semester*** | | | | | ***Second Semester*** | | | | |
| ***Course Title*** | ***Credit***  ***Hours*** | ***Weekly hours*** | | | ***Course Title*** | ***Credit Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** | ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***Advance Mathematics –I*** | ***3*** | ***3*** | ***1*** | ***-*** | ***Advance Mathematics- II*** | ***3*** | ***3*** | ***1*** | **-** |
| ***Electronics I*** | ***3*** | ***2*** | ***1*** | ***2*** | ***Electronics II*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***Electric Circuits Analysis I*** | ***2*** | ***2*** | ***1*** | ***-*** | ***Electric Circuits Analysis II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***Advanced Programming*** | ***2*** | ***1*** | ***1*** | ***2*** | ***Measurement &Instruments*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Electro-Magnetics I*** | ***2*** | ***2*** | ***1*** | ***-*** | ***Electro-Magnetics II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***Digital Electronic I*** | ***3*** | ***2*** | ***1*** | ***2*** | ***Digital Electronic II*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***Machines (DC)*** | ***3*** | ***2*** | ***1*** | ***2*** | ***Power and AC Machines*** | ***4*** | ***3*** | ***1*** | ***2*** |
|  |  |  |  |  | ***Entertainment & Culture Activity*** | ***-*** | ***-*** | ***-*** | ***1*** |
| ***Total*** | ***18*** | ***14*** | ***7*** | ***8*** | ***Total*** | ***19*** | ***16*** | ***6*** | ***7*** |
| ***29*** | | | ***29*** | | |

**Course Number: E201**

**Course Name: Advance Mathematics I**

**Credit hours: (3-3-1-0)**

**Pre-requisite: None**

**Partial Differentiation:** 1- Function of two or more variables 2- Partial derivatives 3- Directional derivative. 4- Gradient, divergence and curl. 5- Tangent plane and normal line. 6- Maxima, minima & saddle point.  **Ordinary Differential Equations**) First order (variable separable, homogeneous, linear-Bernoulli and exact).ii) Second order (Homogeneous and nonhomogeneous).iii) Higher order differential equation. **Laplace Transform(L.T. ) :**A) 1- Unit step function 2- Gamma function 3- Definition of L.T. 4- Properties. B) Inverse Laplace Transform. 1- Properties. 2- Partial fractions. 3- Solution of differential equations using Laplace turns form .C) Applications (orthogonal trajectories and electric circuit). **Vectors cont.**1- Equations of line and planes 2- Product of three or more vectors 3- Vectors function & motion, velocity and acceleration 4- Tangential vectors 5- Curvature and normal vector.

**Course Number: E202**

**Course Name: Advance Mathematics II**

**Credit hours: (3-3-1-0)**

**Pre-requisite: Advance Mathematics I**

**Sequences and series**

i) Sequences :convergence ,test of monotone ii)- Series : geometric series , nth partial sum , test of convergence , alternating series. iii) Power and Taylor's series.  **Fourier Series:**1-Periodic functions 2- Fourier series – Euler formulas 3- Even and odd functions (Half – Range expansion) 4- Applications in electrical engineering. **Multiple Integrals :**1-Double integral 2-Areas and volumes 3-Double integral in polar coordinates 4-Evaluation of volume and triple 5-Evaluation of surface &surface integral. **Matrices cont:**1-System of liner equations (gauss elimination) 2- Rank of matrix 3- Eigen values Eigen vectors .

**Course Number:EE201**

**Course Name: Electronic I**

**Credit Hours: (3-2-1-2)**

**Pre-requisite: None**

**Diode Circuit Applications: Rectification**, Clipping, Clamping, Voltage Multipliers, Diode Switching Circuits, Zener Diode Characteristics and Applications. **Bipolar Transistor Circuits :** Construction, Operation, Configurations and Characteristics, Operating Regions, Load–Lines, The Transistor as an Amplifier, DC Biasing Circuits and Stability, Power Dissipation, Switching Transistors.  **BJT Small-Signal Analysis :**Transistor Equivalent Circuits, Voltage and Current Gain, Input and Output Impedance, analysis of CE, CB and CC configurations.

**Course Number:EE202**

**Course Name: Electronic II**

**Credit Hours: (3-2-1-2)**

**Pre-requisite: Electronic I**

**FET Transistor and Circuits:** Construction and Characteristics of JFET, MOSFET Construction and Characteristics, CMOS, DC Biasing Circuits. **FET Small-Signal Analysis:** Amplifier JFET / MOSFET, Small Signal Model Analysis, analysis of CS, CG and CD configurations.  **Multistage Amplifiers:** Analysis of Multistage Amplifiers (voltage gain, current gain, ect…), types of multistage amplifier, Cascade and cascode amplifier's, Darlington amplifier.  **Tuned Amplifiers :**Transformer-coupled Amplifiers, single tuned amplifiers, tapped and double-tuned amplifiers. **Introduction to Four-Layer Devices :**Description and operation of silicon controlled rectifier, DIAC, thyristor, GTO, and TRIAC.

**Course Number: EE203**

**Course Name: Electric Circuits Analysis I**

**Credit Hours: (2-2-1-0)**

**Pre-requisite: None**

1- Three – Phase Networks:

Three phases voltage source, phase sequences, line and phase quantities, balanced and

unbalanced systems, analysis of YY, YD, DY, DD connected circuits for balanced and

unbalanced systems, power calculations and measurements in three phase circuit

2- Two – Port Networks:

Definitions and terminologies, analysis of two port parameters sets (z, y, h, g, ABCD, and

abcd), relationships between parameters, interconnection of networks

3- Magnetically Coupled Circuits:

The concept of self and mutual inductances, analysis of magnetically coupled circuits, polarity

and the dot convection rules, energy in magnetically coupled circuits, coupling coefficient,

linear transformers, ideal transformer, ideal auto-transformer, conductively coupled equivalent

circuits

4- Frequency Response:

Transfer function, the decibel scale, bode plot, locus diagrams of simple series and parallel

circuit.

**Three – Phase Networks:** Three phases voltage source, phase sequences, line and phase quantities, balanced and unbalanced systems, analysis of YY, YD, DY, DD connected circuits for balanced and unbalanced systems, power calculations and measurements in three phase circuit. **Two – Port Networks:** Definitions and terminologies, analysis of two port parameters sets (z, y, h, g, ABCD, and abcd), relationships between parameters, interconnection of networks. **Magnetically Coupled Circuits:** The concept of self and mutual inductances, analysis of magnetically coupled circuits, polarity and the dot convection rules, energy in magnetically coupled circuits, coupling coefficient, linear transformers, ideal transformer, ideal auto-transformer, conductively coupled equivalent circuits. **Frequency Response:** Transfer function, the decibel scale, bode plot, locus diagrams of simple series and parallel circuit.

**Course Number: EE204**

**Course Name: Electric Circuits Analysis II**

**Credit Hours: (2-2-1-0)**

**Pre-requisite: Electric Circuits Analysis I**

**Electric Filters**  Types of electrical filters, analysis of simple passive filters, low – pass, high – pass, band –pass and band-stop filters, scaling. **Non – Sinusoidal Waves** The Fourier series, Fourier coefficients, analysis of circuits with non – sinusoidal waves, illustrative applications, active power calculations with periodic functions, rms value of periodic function. **Electric Transients (Classical Method)** Analysis of RL, RC and RLC transient in dc and ac circuits.  **Electric Transients (Laplace Method)** Applications of laplace transform in transient analysis, circuits elements in the S- domain, laplace equivalent circuits.

**Course Number: EE205**

**Course Name: Advance Programming**

**Credit hours: (2-1-1-2)**

**Pre-requisite: None**

**Programming by MATLAB**A: brief history / importance of MATLAB, Simple program of MATLAB, Variable, numbers, operations, functions, plots in matlab , plots of points, axes label, graph title, drawing multi point in the same graph, Basic program control (for) statement, nesting loop, (if) statement, (if …..else) statement, Arrays, 1-D arrays initialization, 2D- arrays, matrix operations in matlab. introduction to similink tools, Application of Matlab in Electrical circuit.

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**Course Number: EE206**

**Course Name: MACHINES (DC)**

**Credit hours: (3-2-1-2)**

**Pre-requisite: None**

**DC MACHINES,** Basic concepts, construction, winding. **DC Generators,** Principle of operation, construction, types of dc generators, emf equation, total loss and efficiency, armature reaction, commutation problems and their minimization, Characteristics, parallel operation, applications. **DC Motors,** Principle of operation, construction, types, torque equation, characteristics, losses and efficiency, starting speed control, applications.

**Course Number: EE207**

**Course Name: Power and AC MACHINES**

**Credit hours: (4-3-1-2)**

**Pre-requisite: None**

**Electrical Power:** ( Power definition, Power in 1-cct, Power in 3-cct, Power plant over head transmission line, Conductor material, Material design sag tension relationship) **Single Phase Transformer,** Principle of working, construction, equations, types, equivalent circuits, losses and efficiency. **Single Phase Induction Motors,** types, principle of operation, characteristics, applications. **Stepper Motors,** types, principle of operation, characteristics, applications. **Universal Motors,** types, principle of operation, characteristics, applications. **Brushless Motors,** types, principle of operation, characteristics, applications. **Synchronous Motors,** types, principle of operation, characteristics, applications.

**Course Number: EE208**

**Course Name: Electro-Magnetics I**

**Credit hours: (2-2-1-0)**

**Pre-requisite: Fundamentals’ of Elect. Eng. II, Mathematics II**

**Course Contents:** Vector analysis: scalars and vectors, vector algebra, the Cartesian coordinate system, vector component and unit vector, the vector field, the dot product, the cross product, circular cylindrical coordinate system, spherical coordinate system, the transformation between coordinate system, differential elements (volume, surface, and line), Coulomb's law and electric field intensity: the experimental law of Coulomb, electric field intensity, field of n point charges, electric fields due to continuous charge distributions (line charge, surface charge and volume charge distributions), steam line and sketches of fields, Electric flux density, Gauss's law-electric flux density, gauss's law, some symmetrical charge distribution, application of gauss's law; divergence, Maxwell's first equation (for electrostatics), the vector operator and the divergence theorem, Energy and potential-energy expended in moving a point charge in an electric field, the line integrals, potential difference and potential, the potential field of a point charge, the potential field of a system of charges, conservative property, potential gradient, the dipole energy density in the electrostatic field, conductors, Dielectrics and capacitance-current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, the method of mages, semiconductors, the nature of dielectric materials, boundary conditions for perfect dielectric materials, capacitance, capacitance of some useful configuration, capacitance of a two wire line, Poisson's and Laplace's equations-Poisson's and Laplace equations, uniqueness theorem, solution of Laplace’s equation in certain situation, solution of Poisson's equation in certain situation, product solution of Laplace’s equation.

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**Course Number: EE209**

**Course Name: Electro-Magnetics II**

**Credit hours: (2-2-1-0)**

**Pre-requisite: Electro-Magnetics I**

**Course Contents:** The steady of magnetic field, biot- savart law, the curl, stocke's theorem, ampere's circuit law, application of ampere's law, magnetic flux and magnetic flux density, the scalar and vector magnetic potential, derivation of steady magnetic field laws, Magnetic forces, materials and inductance-force on a moving charge, force on a differential current element, force between differential current elements, force and torque on a closed circuit, the nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, the magnetic circuit, potential energy and forces on magnetic materials, inductance and mutual inductance, time varying fields and Maxwell's equations-faraday's law, displacement current, Maxwell’s equations in point form, Maxwell’s equations integral form, the retarded potentials.

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**Course Number: EE210**

**Course Name: Digital Electronic I**

**Credit Hours: (3-2-1-2)**

**Pre-requisite: Digital** **Technique I, Digital Technique II**

**Synchronous Sequential Logic:** (Review of: Latch, R-S, D, J-K and T Flip-flop), Master / Slave JK Flip Flop), **Monostable** multivibrator (one-shot), 555 A stable Multivibrator. **Registers:** Shift Register, Serial In /Serial out, Serial In /Parallel out, Parallel In /Serial out and Parallel In/ Parallel out Shift Register, Register with Parallel Load, **Johnson Counter, Ring Counter,** Shift Register Application. **Counters:** Asynchronous (Ripple) Counters**,** BCD Ripple Counter**,** Synchronous Counters, Design of Synchronous Counter, Counter Applications.

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**Course Number: EE211**

**Course Name: Digital Electronic II**

**Credit Hours: (3-2-1-2)**

**Pre-requisite: None**

**Memory and Storage**: Memory Address and Capacity, Basic Memory Operations, The Write and Read Operation, **RAMs and ROMs,** RAM Family. **Digital-to-Analog Converter Methods, Analog-to-Digital Converters Methods, Programmable logic Device**: introduction and classification of: SPLDs, CPLDs, and FPGA**, Integrated Circuit Technologies,** Diode RTL, CMOS and TTL Logic gates.

**Course Number: EE212**

**Course Name: Measurement and Instruments**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Systems of Units and Standards of Measurement, Systems of units, International system of units, electrical standard, time and frequency standards, IEEE standards. Measurement and Error: Definitions, accuracy, precision, resolution, composition of measuring system, selection factors and trends, types of error: gross, systematic, random, and limiting errors. Statistical Analysis of Data, Instruments for Measuring Basic Electrical Parameters, Bridges and their Applications, Oscilloscopes, Transducers: Position, pressure, velocity, acceleration, force, torque, temperature, Photosensitive transducers. Data Recording Instruments, Noise: Limits to sensitivity, accuracy & speed in both analog and digital systems. S/N enhancement techniques, Computer-based Instrumentation and Measurement

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**Course Number: EE213**

**Name: University Culture Activity**

**Credit hours: (0-0-0-1)**

**Pre-requisite: None**

**Course Contents:** These courses are designed to give the student the required skills in human development such as preparing engineering report, presentation to a large gathering of people, team cooperation, preparing and participation of some university activities, and everything that might be needed in successful and modern life style. Culture Connect: Experience the cultures of the world (samples), To expose students to the life ways of a diversity of cultures around the world. To help students understand that all people need the same basic things and use what they have available in their environment to obtain those things. To teach students to respect cultural differences.

**Third Year**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***First Semester*** | | | | | ***Second Semester*** | | | | |
| ***Course Title*** | ***Credit***  ***Hours*** | ***Weekly hours*** | | | ***Course Title*** | ***Credit Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** | ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***Digital Signal Processing I*** | ***2*** | ***2*** | ***1*** | ***-*** | ***Digital Signal Processing II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***Advanced Electronics I*** | ***3*** | ***2*** | ***1*** | ***2*** | ***Advanced Electronics II*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***Communication Systems I*** | ***3*** | ***2*** | ***1*** | ***2*** | ***Communication Systems II*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***Microprocessor and Microcontroller: Hardware*** | ***3*** | ***2*** | ***1*** | ***2*** | ***Microprocessor-Based System: Programming*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***Engineering Analysis I*** | ***2*** | ***2*** | ***1*** | ***-*** | ***Engineering Analysis II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***Antenna*** | ***3*** | ***2*** | ***1*** | ***2*** | ***Engineering Administration*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***Elective I*** | ***2*** | ***2*** | ***1*** | ***-*** | ***Elective II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***Total*** | ***18*** | ***14*** | ***7*** | ***8*** | ***Total*** | ***17*** | ***14*** | ***7*** | ***6*** |
| ***29*** | | | ***27*** | | |

**Course Number: EE301**

**Course Name: Digital Signal Processing I**

**Credit hours: (2-2-1-0)**

**Pre-requisite: None**

**Introduction** :*basic elements of digital signal processing systems, advantage of digital over analog signal processing, and continuous versus discrete time signals*. **The concept of frequency in continues time and discrete time signals**: *analog to digital and digital to analog conversion, sampling of continuous time signals, sampling theorem , and aliasing and signal reconstruction*. **Digital signals and systems:** *common digital sequences, generation of digital signals, classification of digital sequences, some manipulation of discrete time signal (shifting, scaling, and multiplication of sequences).* **Discrete time Systems:** *Input – output system representation, classification of discrete time systems(Linearity versus nonlinearity, causality versus non-causality, time variance versus time invariance, static versus dynamic, and stable versus unstable systems*. **Block diagram representation of discrete time systems:** *an adder constant multiplier, a signal multiplier, a unit delay element, a unit advance element, and interconnection of discrete time systems*. **Discrete time systems as difference equation:** *difference equation and impulse responses, format of difference equation.* **Linear convolution and signal comparison**: *method of linear convolution of discrete time sequences, signal comparison (correlation).***Circular convolution of discrete time sequence. Numerical Computation of Fourier Transform:** *discrete Fourier transform (DFT), Invers of Discrete Fourier transform (IDFT), application of Discrete Fourier Transform, fast Fourier transform (FFT), inverse of Fast Fourier transform (IFFT).*

**Course Number: EE302**

**Course Name: Digital Signal Processing II**

**Credit hours: (2-2-1-0)**

**Pre-requisite: Digital Signal Processing I**

**Discrete time system analysis using Z-transform:** *Z-transform of linear time systems, direct Z-transform, region of convergence of Z-transform, properties of Z-transform, rational Z-transform (the z-Plane Pole-Zero Plot and Stability poles), inverse of Z-transform.* **Digital Filters:** *Basic Types of Filtering ( Finite impulse response (FIR )) , (Infinite impulse response (IIR) digital filter techniques) .***Realization of Digital Filters**: *realization of digital FIR filters (Direct form structure) , realization of digital IIR filters (Direct form I realization), (Direct form II realization).* ***Analog Filter design:*** *(Butterworth filter design (LPF, HPF, BPF, and BSF)), (Chebyshev filter design (LPF, HPF, BPF, and BSF)).***Digital filter design :**(**Finite Impulse Response Filter Design**): *Fourier Transform Design, applications (Noise Reduction), design of FIR filters using windows. Infinite Impulse Response Filter Design: bilinear Transformation Design Method, analog to digital filter transformation*. **Application of digital filters. Introduction to adaptive filtering. Application of adaptive filtering.**

**Course Number:EE303**

**Course Name: Communication System I**

**Credit hours: (3-2-1-2)**

**Pre-requisite: *none***

**Communication system elements (Signal analysis):**Signal classification of periodic and non periodic signals, classification of systems**,** power spectral Density and correlation  **Noise:** Power calculation, thermal white Gaussian noise (AWGN), band-limited noise (base band and band pass) noise through linear systems. **Liner modulation (AM):** An AM\DSB-SC,AM/DSB-LC,AM/SSB-SC,AM/VSB, frequency division multiplexing (FDM)Commercial receivers (TRF and super heterodyne), and noise in AM systems.

**Course Number:EE304**

**Course Name: Communication System II**

**Credit hours: (3-2-1-2)**

**Pre-requisite: Communication System I**

**Angle modulation :** NBFM, NBPM, WBPM ,WBPM**,** Noise in angle modulation systems. **Digital communications:** Nyquist sampling theorem, pulse modulation : PAM, PPM, Time division multiplexing (TDM), noise in pulse modulation, pulse code modulation PCM\TDM**,** Delta modulation (DM), quantization noise in PCM and DM. Signaling format (unipolar, bipolar, &split-phase Manchester),Sinusoidal digital modulation ASK, PSK, FSK , and Mary. Noise in ASK, PSK, FSK (error probability using coherent matched filters and no coherent detection)**.**

**Course Number: EE305**

**Course Name: Microprocessor and Microcontroller: Hardware**

**Credit hours: (3-2-1-2)**

**Pre-requisite: None**

**Introduction to Microprocessor and Single-chip Microcontroller. Microprocessor Architecture and Microcontroller Systems, General definitions, Internal Architecture of Microprocessor. (**BIU, EU**)** (pin Diagram, Memory ( program, data and stack memory), Registers ( Accumulator, Flage (Sign,Zero, Cary..), General Registres, Stack pointer, program counter), Addressing mode (direct add., register add., register indirect add., Immediate add). **address space and data organization, Segment registers and memory segmentation,** Input output Devices, Review: Logic devices for interfacing**. Memory Interface,** Memeory segment. **Interfaceing I/O Devices,** Basic interfacing concepts, interface output displays, interface input devices, memory mapped I/O. **Programmable** Interface Devices: 8155 I/O and Timer, 8279 Keyboard/Display Interface. **General Propose Programmable** Interface Peripheral Devices**, 8255A, 8253 Programmable** Interface Timer, 8259A **Programmable** Interrupt Controller, Direct Memory Access and 8237 DMA Controller.Introduction to 8051 microcontroller; Pin diagram, architecture, features & operation, Ports, memory organization, SFR’s, Flags, Counters/Timers, Serial ports.

**Course Number: EE306**

**Course Name: Microprocessor-Based System: Programming**

**Credit hours: (3-2-1-2)**

**Pre-requisite: Microprocessor-Based System: Hardware and Interface**

**Introduction to Assembly Language, Data transfer operation**, Arithmetic Operation, Logic Operation, Branch Operations, **Writing Assembly Language Program**. Programming Techniques with Additional Instructions, Looping, Counting, and Indexing.**Additional Data Transfer and 16-bits Arithmetic Instructions**, Arithmetic Operation related to memory, **Logic Operation**: Rotate, Compare. Counters and Time Delays. Stack and subroutines, conditional and unconditional Calling and Returning.

**Course Number:EE307**

**Course Name: Engineering Analysis I**

**Credit hours: (2-2-1-0)**

**Pre-requisite: None**

**Matrix Analysis:** Review of matrix theory , linear transformation , Egin values &Egin vectors, laplace transform of matrices, application of matrices to electric cct. **Fourier Series:** Fourier series, Fourier integral, Electrical circuits applications using Fourier series. **Fourier transform:** Properties, convolution theorem, power spectral density and correlation, signals and linear system, applications. **The Z- transform:** Region of convergence, properties of Z-transform, Z-transform pairs, the inverse of Z-transform, analysis and discrete- time systems, applications. **Numerical Analysis:** i) Solution of non-linear equations (Iteration, bisection and Newton – Raphson). ii) Finite differences. iii) Numerical differentiation and Integration. iv) Numerical Solution of 1st order ordinary differential equations.

**Course Number: EE308**

**Course Name: Engineering Analysis II**

**Credit hours: (2-2-1-0)**

**Pre-requisite: None**

**Complex Variable Theory:** Function of complex variable, complex differentiation, analytic function & its properties, integration in the complex plane, Cauchy's theorem, Cauchy's integral, Taylor's theorem, Laurent series, the residue theorem. **Solution of differential equations, by power series:** Legendre's equations, Legendre’s polynomials, Bessel function of the first and second order kinds, Bessel function properties. **Partial differential equation:** Wave equation, Laplace's equation, solution of boundary condition problems, general solution, solution by separation of variables. **Statistics:** Definition, frequency distribution (relative & commutative, mean, standard deviation). **Probability:** Definition, mutually exclusive & conditional probability, permutations & combinations, probability distribution, normal & Poisson distributions.

**Course Number: EE309**

**Course Name: Advance Electronic I**

**Credit hours: (3-2-1-2)**

**Pre-requisite: Electronic I, Electronic II**

**Analog Electronic Circuit Analysis(Review);** Transistor equivalent circuit, voltage gain, current gain, ZilpandZolpfor Lf& Hf. **Frequency Response Characteristics;** Frequency small signal models of: JFETs&BJTs, frequency response of various amplifier configurations. **Millers Theorems & Its dual;** dividing, shunt impedance, series impedance, input and output impedances terminal, analysis of transistor circuit using simplified h- parameter. **Amplifier Frequency Response;** Frequency response concepts, transistor at high frequency, multi stage at low & high frequency, FETs &BJTs amplifiers at low &high frequency. **Feedback Amplifier;** Feedback concept, types, effects & topologies, feedback analysis, voltages series, voltage shunt, current series and current shunt, feedback stability & response of feedback amplifier

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**Course Number: EE310**

**Course Name: Advance Electronic II**

**Credit hours: (3-2-1-2)**

**Pre-requisite: Advance Electronic I**

**Operational Amplifier Design;** Op-Amp characteristics and structure, difference amplifier :(dc& ac analysis), dc level shifting stage. **Operational Amplifier Applications**; Inverting and non-inverting Amplifiers, Integrator, Differentiator, Adder, Subtract, Comparator, Precision diode, Rectifier, Precision clamps, Sample and hold circuit, and peak detector. **Oscillator: Oscillator** concept, RC oscillator, LC oscillator, Crystal oscillators. **Power Amplifier:** Class A, Class B, Class AB, Push-pull amplifiers & Class C. **Active Filters:** Filters concept, types, approximations, Active RC design, Ladder design, and GIC. **Integrated and fabrication circuit design:** An introduction for fabrication and integrated circuit design, such as for BJT, FET, IC categories.

**Course Number: EE311**

**Course Name: Antenna**

**Credit hours: (3-2-1-2)**

**Pre-requisite: None**

**Isotropic antenna and point radiator with reflector and radiation pattern**: Analysis radiative field of the hertizian dipole and its pattern of electric field and power density Short antenna, Gain, Directivity and beam width, Antenna and its pattern of field and radiation resistance and polarization. **Practical Antenna** The loop antenna and its field Radiation, resistance and pattern receiving antenna and effective area of antenna, Antenna above ground and monopole Pattern, Folded antenna, Point radiator arrays and multi antenna arrays and their gain, pattern sstacked antenna, Yagi antenna, Slot antenna. **Microwave antenna** Horn and parabola, Microwave losses, Helical antenna and helix antenna.

**Course Number: EE312**

**Course Name: Engineering Administration**

**Credit hours: (2-2-1-0)**

**Pre-requisite: None**

**Administration:** Definition, management tools, and management duties, scientific management, administration and other sciences, marketing, marketing activities, product through buying, selling, advertising, transportation, warehouses, goods, finance and risk. **Production**: Factors of production, markets, types of production, revenue, costs of production. **Plant site selection and planning of the factory. Industrial Performance,** Theoretical foundations to assess the industrial performance, functionality and industrial facility, the concept of evaluation of performance efficiency, types of performance assessment, foundations and stages of evaluating the efficiency of performance, indicators of industrial performance evaluation.  **Quality Control:** The concept of quality control, integrated control of the quality and functions of quality control costs for quality control, testing methods, quality control schemes, types of quality control schemes. **Work Study.** Important, the study of the performance mode, the areas of application performance study, the application stages, to be provided during the application in the reserves, steps study methods of performance, measurement of work, study time, General requirements for the use of measurement methods for work, human engineering.**Feasibility study for engineering projects, Maintenance and replacement.**

**Fourth Year**

**حسب النظام السنوي**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Fourth Year** | | | **1st Semester**  **Hours/Week** | | | **2nd Semester**  **Hours/Week** | | |
| **Code** | **Subject** | **Units**  **(36)** | **Theo.** | **Tuto.** | **Prac.** | **Theo.** | **Tuto.** | **Prac.** |
| **EE 401** | Engineering Project | 4 | 1 | 1 | 2 | 1 | 1 | 2 |
| **EE 402** | Power Electronics | 4 | 2 | 1 | - | 2 | 1 | - |
| **EE 403** | Communication Systems | 6 | 2 | 1 | 2 | 2 | 1 | 2 |
| **EE 404** | Digital System Design | 4 | 2 | 1 | - | 2 | 1 | - |
| **EE 405** | Microelectronics | 4 | 2 | 2 | - | 2 | 2 | - |
| **EE 406** | Microwave | 4 | 2 | 1 | - | 2 | 1 | - |
| **EE 407** | Control Engineering | 6 | 2 | 1 | 2 | 2 | 1 | 2 |
| **EE 408** | Elective Subject  (Digital Image Processing) | 4 | 2 | 1 | - | 2 | 1 | - |
| **Total** | | **36** | **15** | **9** | **6** | **15** | **9** | **6** |
| **Total Hours per Week** | | | **30** | | | **30** | | |

**EE 401 Engineering Project**

*Theoretical or experimental investigation of a problem of applied nature in electronics engineering or related areas under the supervision of the department staff. The student should present a report about the project at the end of the year.*

**EE 402 Power Electronics**

*Introduction, Material Type, Diode, Transistor type, Bipolar thyristor characteristic ,Classification requirements, Switching on switching off of thyristor, Darlington-type transistor, VMOS transistor, High power diode, Thyristor Operation Methods, Thyristor Cooling, Inverter, Single phase, Two and three-phase, hexa plus, Dual conductor for steering free current generated in inverters, Compound angle (general equations for fully –controlled inverters), Invertors, Silicon controlled rectifiers (SCR), SCR's for single phase circuits, SCR's for 3- phase circuits, SCR's converter A.C supply to D.C and inverting D.C supply to A.C. , Pulsed Wave Modulation, D.C. Chopper, Wave Changer, Uninterrupted power supply, UPS drives, thermal insulators, Thyristor Applications.*

**EE 403 Communication Systems**

*Information Theory, Self information , sourse entropy and sourse entropy rate ,mutual information, channel model BSC and nonsymmetric discrete channels, Optimum threshold setting, Coding of Discrete Sources Efficiency and redundancy of a code ,fixed length codes, variable length codes, fano code, huffiman code, Shannon code. Nonbinary source coding . Source extention for higher coding efficiency, Channel Coding, Even and odd parity error detecting codes, prob of undetected errors. Error correcting codes , linear block codes (generator and parity check matrices),hamming distance, hamming weight bound, and error correction capabilities, Decoding of linear block codes (syndromes).*

**EE 404 Digital System Design**

*Simplification of Boolean Function using K-map and Tabulation, Digital Circuit Design using Logic Circuits (LSI, SSI, MSI), Design using Programmable Logic Circuits (ROM, PLA, PAL), Synchronized Sequential Circuits (Analysis and Design), ASM Diagrams, Analysis and Design of Sequential Circuits using ASM Diagrams, Asynchronous Circuits, Luminescent pulse phenomenon in logic circuits (Static and Dynamic), Microprocessors-Component and Architecture, Microprocessors Hardwer, 4-, 8-, 16- and 32-bit Microprocessors, Single Chip Microcomputer 8085, 8088, MPU details.*

**EE 405 Microelectronics**

*Energy Band Theory, PN Junction, MS (Metal-Semiconductor) Junction, MOS (Metal-Oxide-Semiconductor) Junction, Electronic Devices Fabrication Technology, IC Fabrication Step, Thin Film Fabrication, Thick Film Fabrication, MOSFET Transistor MOS Inverter Analysis, NMOS Gate Circuit Analysis, CMOS Inverter Analysis, CMOS Gate Circuit Analysis, TTL Gate Circuit Analysis, Photo-Electronic-Light Detection, Light Source, Microwave Devices, Tunnel Diode, IMPATT Diode, BARITT Diode.*

**EE 406 Microwave**

*Electromagnetic Theory: Review, Transmission Lines in Microwaves, Microwave Network Analysis Using S-Parameters, Passive Components in Microwave, Microwave Filters, Design & Analysis of Ferromagnetic Components in Microwave, Active Microwave Circuits, Microwave Tubes, Diode & Transistors in Microwaves, Microwave Amplifier Design, Microwave Oscillator Design. Microwave Integrated Circuits, Applcation of Microwave in Communication Systems, Radar System.*

**EE 407 Control Engineering**

*Basic Definition, Transfer function, Transfer functions of electrical system, mechanical system & servo system, Block Diagram Algebra, Signal flow graph & mason's rule, Time Domain Response, Typical test signals & types of the systems, The steady-state error due to step, ramp & parabolic inputs, Transient Response of Second Order Systems, Stability of control system, Routh criterion, Root locus, Frequency Response, Introduction to Nyquist plot, Nyquist plot, Phase margin, Gain margin, Introduction to Bode plot, Compensation, Lead, Lag, Lead-Lag, Three-term Controller (PID), State Space Analysis, State equation for dynamic system (electrical system), Solving state equations, Analogue Computer Simulation, Nonlinear Control System, Describing Function Approach.*

**FOURTH YEAR-Elective Courses**

**EE 408 Artificial Intelligence (Elective Subject)**

*Basic introduction to neural networks & fuzzy logic, development and implementation. It includes; neural versus conventional computing. Learning processes, the preceptor. The back propagation learning algorithm. self-organization feature maps. applications.*

*introduction to fuzzy theory, Fuzzy logic, fuzzy logic in engineering. fuzzy logic is a tool that can be applied to ambiguous, complicated, complex, or nonlinear systems or problems, which cannot easily solved by classical techniques. This course, also, discusses the fundamental of fuzzy set theory and fuzzy logic. in addition, this course also introduces applications of fuzzy logic in several areas such as fuzzy control and fuzzy decision making.*

**EE 408 Digital Image Processing (Elective Subject)**

*Introduction to Digital Images, Components of Imaging System, Types of Digital Images, Image Sampling and Quantization, Digital Image File Format, Relationship Between Pixels, Neighborhood, Connectivity, Adjacency and Distance Measure, Arithmetic & Logic Operations, Image Zooming, Shrinking, Translation & Rotation, Image Enhancement, Some Basic Gray Level Transformations, Histogram Processing, Spatial Filtering, Linear Spatial Filtering, Nonlinear Spatial Filtering, Image Transforms, Discrete Fourier Transform, Discrete Cosine Transform, Wavelet Transform, Image Compression, Image Compression Concepts, Image Redundancy, Lossless Compression Methods, Lossy Compression Methods, Image Restoration, A Model of Degradation/Restoration, Noise Models, Color Image Processing Color Models, pseudo Image Processing, True Image Processing, Color Model Conversion, Image Segmentation.*