DEPARTMENT OF ELECTRICAL ENGINEERING

SYLLABI OF COURSES
FOR
B.E. (ELECTRICAL ENGINEERING)
DEGREE PROGRAMME

(APPLICABLE FROM BATCH 2010-2011)

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY,
KARACHI-75270 PAKISTAN

BACHELOR OF ELECTRICAL ENGINEERING
SCHEME OF STUDIES

FIRST YEAR - Spring Semester				
Sr. No.	**Course No.**	**Course Title**	**Credit Hours**	
			Theory	**Practical**
1	EE-113	Basic Electrical Engineering	2	1
2	PH-121	Applied Physics	2	1
3	HS-101	English	3	0
4	CE-105	Engineering Surveying	2	1
5	CS-105	Fundamentals of Computer Engineering	2	1
6	ME-105	Applied Thermodynamics	2	1
FIRST YEAR - Fall Semester				
Sr. No.	**Course No.**	**Course Title**	**Credit Hours**	
			Theory	**Practical**
1	EE-155	Engineering Drawing	2	1
2	CY-105	Applied Chemistry	2	1
3	MT-111	Calculus	3	0
4	ME-101	Engineering Mechanics	2	1
5	HS-105	Pakistan Studies	3	0
	HS-127	Pakistan Studies (For Foreigners)	3	0
SECOND YEAR – Spring Semester				
Sr. No.	**Course No.**	**Course Title**	**Credit Hours**	
			Theory	**Practical**
1	EE-211	Circuit Theory – I	2	1
2	EE-221	Instrumentation	2	1
3	EE-241	Electrical Machines – I	2	1
4	MT-222	Linear Algebra & Ordinary Differential Equations	3	0
5	CS-205	Logic Design & Switching Theory	2	1

SECOND YEAR – Fall Semester				
Sr. No.	**Course No.**	**Course Title**	**Credit Hours**	
			Theory	**Practical**
1	EE-262	Programming with C-Language	2	1
2	EE-281	Electromagnetic Fields	2	1
3	CS-208	Computer Architecture & Organization	2	1
4	EL-231	Electronic Devices & Circuits	2	1
5	MT-224	Complex Variables & Fourier Analysis	3	0
6	HS-205	Islamic Studies	3	0
	HS-206	Ethical Behavior	3	0
THIRD YEAR – Spring Semester				
Sr. No.	**Course No.**	**Course Title**	**Credit Hours**	
			Theory	**Practical**
1	EE-312	Circuit Theory – II	2	1
2	EE-315	Electric Filters	2	1
3	EE-353	Electrical Power Distribution & Utilization	2	1
4	EL-343	Power Electronics	2	1
5	MT-331	Probability & Statistics	3	0
THIRD YEAR – Fall Semester				
Sr. No.	**Course No.**	**Course Title**	**Credit Hours**	
			Theory	**Practical**
1	EE-342	Electrical Machines – II	2	1
2	EE-351	Electrical Power Transmission	3	0
3	EL-332	Integrated Circuits	2	1
4	TC-391	Communication Systems – I	2	1
5	HS-304	Business Communication & Ethics	3	0
6	EF-303	Engineering Economics	3	0

FINAL YEAR – Spring Semester				
Sr. No.	**Course No.**	**Course Title**	**Credit Hours**	
			Theory	**Practical**
1	EE-452	Power System Analysis	2	1
2	EE-454	Energy Conversion	2	1
3	EE-474	Feed back Control Systems	2	1
4	TC-492	Communications Systems – II	2	1
5	CS-410	Microprocessor & Assembly Language	2	1
6	EE-401	* Electrical Engineering Project	-	-
FINAL YEAR – Fall Semester				
Sr. No.	**Course No.**	**Course Title**	**Credit Hours**	
			Theory	**Practical**
1	EE-445	Electrical Machines Theory & Design	2	1
2	EE-455	Electrical Power System Protection	2	1
3	EE-493	Digital Signal Processing	2	1
4	MT-442	Numerical Methods	3	0
5	EE-401	Electrical Engineering Project	0	6

* Duration one academic year, required literature survey and preliminary work will be done during this semester.

EE-113 BASIC ELECTRICAL ENGINEERING

Electrical Elements and Circuits : Energy and energy transfer, Electric Charge, Electric current, potential difference and voltage, Electric power and energy, Electric circuit sources and elements, resistance, Ohm's law, Inductance, capacitance, fundamental circuit laws, Kirchhoff's Laws, direct application of fundamental laws to simple resistive networks, introduction to node voltage and loop current methods.

Steady State AC Circuits: An introduction to periodic functions, RMS or effective Average and maximum values of current and voltage for sinusoidal signal wave forms. The Phasor method of analysis an introduction, application of phasor methods to simple AC circuits, power and reactive power, maximum power conditions.

Magnetic Circuits and Transformers : Magnetic effects of electric current, magnetic circuit concepts, magnetization curves, characteristics of magnetic materials, magnetic circuits with DC excitation, magnetically induced voltages, self inductance magnetic circuits with AC excitation, hysteresis and eddy current losses, introduction to transformer, The ideal transformer.

Electromechanical Energy Conversion : Basic principles, Generated voltage, Electromagnetic torque, Interaction of magnetic fields, alternating current generators, commutator actions, DC machine, direct current generators, electric motors, losses and efficiency, Machine application considerations.

Electronic Devices : The nature of Electronics, electron devices, semiconductors, charge flow processes, junction diode, characteristics of junction transistors, biasing of junction transistors, rectification, half wave and full wave rectifiers simple treatment, elementary concept of amplification with transistor used as amplifier in common emitter configuration.

The practical work will be based on the above course.

EE-155 ENGINEERING DRAWING

Mechanical Drawing: Drawing equipment and the use of instruments. Basic drafting techniques and standards, Geometrical curves including plan curves, Cycloid, Hypocycloid and the Involute. Intersection at various positions of geometrical bodies, such as pyramids, Cylinders and Cones, Development of surfaces, Freehand sketch of machine and engine components, locking arrangement, foundation bolts, stuffing box, shaft couplings, foot step bearing, Engine connecting rod, Concepts of working drawings of components and parts of machine and engines, dimension and specifications.

Section of Machines and Engine Components: Orthographic projections and standard practices, Isometric views with particular reference to piping and ducting.

Civil Drawing : Plan, Elevations (front, left and right) and details of buildings such as Bungalows, Flats, Offices, Workshops school and market etc., Elements of Perspective drawings.

Electrical Drawing : 11 KV Electric substation building plan including equipment layout, Trenches (for cabling etc.) Manholes, Doors, Windows, Ventilators etc.

Cable and Earth continuity conductors plan including the size and specifications. Cable laying in trenches, directly in ground, in pipes while crossing the roads etc. Details of plate type and Rod type, Earthing Electrodes.

Schematic Diagrams of substations, lighting and power distribution boards, Electrical Symbols and One line diagrams of a typical power system.

The practical work will be based on the above course.

ME-101 ENGINEERING MECHANICS

Statics of Particles: Forces in a plane: Newton's First Low, Freebody diagram, Forces in space (rectangular components), Equilibrium of a particle in space.

Kinematics of Particles: Rectilinear and curvilinear motion of particles, Components of velocity and acceleration, Motion relative to a frame in translation.

Kinetics of Particles: Newton's Second Low, Dynamic equilibrium, Rectilinear and curvilinear motion, Work and energy, Kinetic energy of particle, Principle of Work and Energy, Conservation of energy, Impulse and momentum, Impulsive forces and conservation of momentum, Impact, direct and oblique, Conservation of angular momentum.

Rigid Bodies: Equivalent systems of forces, Principle of transmissibility, Moment of a force, Couple, Varignous Theorem. Centre of gravity of a three-dimensional body and centroid of a volume. Moments of inertia, radius of gyration, parallel axis theorem.
Equilibrium of Rigid Bodies: Free-body diagram, Equilibrium in two and three dimensions, Reaction of support and connections, Equilibrium of two-force and three-force bodies.

Kinematics of Rigid Bodies: General Plane motions, Absolute and relative velocity and acceleration.

Plane Motion of Rigid Bodies: Force and acceleration, Energy and momentum, Conservation of linear and angular momentum.

Friction : Lows of dry friction, Angles of friction, Vedges, Square- threaded screws, Journal and thrust bearings.

Analysis of Structures: Internal forces and Newton's Third Law, Simple and space trusses, Joints and sections, Frames and machines, Forces in cable.

ME-105 APPLIED THERMODYNAMICS

Thermodynamic Properties : Introduction, Working substance, System, Pure substance, PVT surface, Phases, Properties and state, Zeroth Law, Processes and cycles, Conservation of mass.

Energy and its Conservation : Relation of mass and energy, Different forms of energy, Internal energy and enthalpy, Work, Generalized work equation, Flow and

non-flow processes, Closed systems, First Law of Thermodynamics, Open systems and steady flow, Energy equation of steady flow, System boundaries, Perpetual motion of the first kind.

Energy and Property Relations : Thermodynamics equilibrium, Reversibility, Specific heats and their relationship, Entropy, Second Law of Thermodynamics, Property relations from energy equation, Frictional energy.

Ideal Gas : Gas laws, Specific heats of an ideal gas, Dalton's Law of Partial Pressure, Third Law of the Thermodynamics, Entropy of an ideal gas, Thermodynamics processes.

Thermodynamics Cycles : Cycle work, Thermal efficiency and heat rate, Carnot cycle, Stirling cycle, Reversed and reversible cycles, Most efficient engine.

Consequences of the Second Law : Calusius's inequality, Availability and irreversibility, Steady flow system.

Two-phase Systems : Two-phase system of a pure substance, Changes of phase at constant pressure, Steam tables, superheated steam, Compressed liquid, Liquid and vapour curves, Phase diagrams, Phase roles, Processes of vapours, Mollier diagram, Rankine cycle, boilers and ancillary equipment.

Internal Combustion Engines : Otto cycle, Diesel cycle, Dual combustion cycle, Four-stroke and two-stroke engines, Types of fuels.

Reciprocating Compressors: Condition for minimum work, Isothermal efficiency, Volumetric efficiency, Multi-stage compression, Energy balance for a two-stage machine with intercooler.

CE-105 ENGINEERING SURVEYING

Basics of Surveying: Definition, Evolution of Surveying, Types and Classes of Surveys, Plane Table Survey, Surveying Instrumentation, Survey References, Units of Measurement, Location Methods, Accuracy and Precision, Errors and Mistakes, Accuracy Ratio, Stationing, Field notes, Field management.

Measurement of Horizontal Distances: Methods of Linear measurement, Types of Measurement, Chains, Tapes, Standard conditions for use of Steel tapes, Taping Accessories and their use, Systematic Taping Errors and Corrections, Random Taping Errors and Mistakes in Taping, Field notes for Taping, Conventional and Electronic Field books.

Leveling: Definitions, Theory of Differential Leveling, Effects of Curvature and Refraction, Types of Levels, Automatic Level, Digital Level, Adjustment of Levels, Types of Leveling Staff, Leveling Operations, Techniques of Leveling, Benchmark Leveling (Vertical Control Survey), Profile and Cross-section Leveling, Reciprocal Leveling, Peg test, Errors in Leveling, Contours and their characteristics, Various methods of Contouring.

Angles and Directions: Horizontal and Vertical Angles, Meridians, Types of Horizontal angles, Azimuths, Bearing, Relationship between Bearings and Azimuths,

Reverse Directions, Azimuth and Bearings computations, Magnetic Declination, Types of Compasses.

Theodolites / Tacheometers: Introduction, Types of Theodolites, Repeating, Directional and Electronic Theodolites, Temporary adjustments, Measurement of Horizontal and Vertical Angles, Prolonging a Straight Line, Permanent Adjustments, Use of Tachometers in computation of Horizontal and Vertical Distances.

Traverse Surveys: Open and Closed Traverses, Latitude and Departures, Computation of Error of Closure, and the accuracy of a Traverse, Traversing with Total Station Instruments, Rules of Adjustment, Effects of Traverse Adjustments on the original data, Computation of Omitted Measurements, Area of Closed Traverse Methods, Use of computer programs.

An Introduction to Geomatics and Global Positioning System: Geomatics defined, Branches of Geomatics, Remote Sensing, Techniques of remote sensing, Background information on global positioning, receivers, Satellites, Errors, GPS Surveying techniques and applications**.**

The practical work will be based on the above course.

CY-105 APPLIED CHEMISTRY

Gases : Gas Laws, Kinetic Gas Equation, Van Der Vaal's Equation, Critical Phenomenon, Liquidification of gases, Specific heat (molar heat capacity)

Properties of Solution and Liquids : Surface Tension, Viscosity, Osmosis, Osmotic Pressure, pH-Buffer Solution, Spectrophotometry, Basic concepts of Colloidal Chemistry, Classification purification (dialysis).

Theromochemistry : Chemical Thermodynamics, Hess' Law, Heat of reaction, Relation between H and U measurement of heat reaction, Bomb Calorimeter.
Electrochemistry : Laws of Electrolysis, E.M.F. series, corrosion (Theories, inhibition and protection).

Water and Sewage : Sources of water, impurities, hardness, Water softening, Purification of water for potable and industrial purposes, electrodialysis. Introduction to environmental pollution, main sources and effects. Sewage treatment.

Fuels : Types of fuels, Classification of fossil fuels.

Metals and Alloys : Properties w and General composition of metals and alloys such as Iron, Copper, Aluminum, Chromium, Zinc, Used in engineering field.

Engineering Materials : Inorganic Engineering materials, Cement, Glass, Organic Engineering Materials, Polymers, Rubbers, Plastics, Paints, Semiconductors and Dielectric materials.

Practicals : Determination of total alkalinity of a given sample, Determination of total acidity of a given sample, Determination of the amount of ferrous ion in a given sample, Determination of total hardness of a given sample of water, Determination of surface tension of a given sample, Determination of coefficient of viscosity of a given

sample, Determination of chloride ion in a given sample, Determination of Bicarbonate and Carbonate ions in a given sample, Determination of turbidity in a given sample by precipitation, Determination of turbidity in a given sample by spectrophotometer, Plotting of titration curve and determination of total alkalinity in a given sample, Plotting of titration furve and determination of acidity in a given sample, Plotting a calibration curve and determination of ions present in a given sample.

The practical work will be based on the above course.

MT-111 CALCULUS

Set and Functions: Define rational, irrational and real numbers; rounding off a numerical value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, DeMorgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions). Graph of some well-known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

Propositional Logic: Definition of Proposition, Statement and Argument, Logical Operators, Simple and Compound proposition, various types of connectives, Truth table, tautology, Contradiction, Contingency & Logical equivalence.

Boolean Algebra: Definition, Boolean function, duality, some basic theorems & their proofs, two valued Boolean algebra, Truth functions, Canonical sum of product form, Digital logic Gates & Switching circuit designs.

Complex Number: Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions)

Differential Calculus: Differentiation and Successive differentiation and its application; Leibnitz theorem, Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series, Taylor and Maclaurin series, L` Hopitals rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, exact differential and its application in computing errors, extreme values of a function of two variables with and without constraints. Solution of non-linear equation, using Newton Raphson method.

Integral Calculus: Indefinite integrals and their computational techniques, reduction formulae ,definite integrals and their convergence, Beta and Gamma functions and their identities, applications of integration. Centre of pressure and depth of centre of pressure.

Solid Geometry: Coordinate Systems in three dimensions. Direction cosines and ratios, vector equation of a straight line, plane and sphere, curve tracing of a function of two and three variables, Surfaces of revolutions, transformations (Cartesian to polar & cylindrical).

PH-121 APPLIED PHYSICS

Introduction: Scientific notation and significant figures. Types of errors in experimental measurements. Units in different systems. Graphical Techniques (Log, semi-log and other non-linear graphs)

Vectors: Review of vectors, Vector derivatives. Line and surface Integrals. Gradient of a scalar.

Mechanics: The limits of Mechanics. Coordinate systems. Motion under constant acceleration, Newton laws and their applications. Galilean invariance. Uniform circular motion. Frictional forces. Work and Energy. Potential Energy. Energy conservation. Energy and our Environment. Angular momentum

Electrostatics And Magnetism: Coulombs Law. Electrostatic potential energy of discrete charges. Continuous charge distribution. Gauss's Law. Electric field around conductors. Dielectrics. Dual trace oscilloscope with demonstration.
Magnetic fields. Magnetic force on current. Hall effect. Biot-Savart Law. Ampere's Law. Fields of rings and coils. Magnetic dipole. Diamagnetism, Paramagnetism and Ferromagnetism.

Semiconductor Physics: Energy levels in a semiconductor. Hole concept. Intrinsic and Extrinsic regions. Law of Mass Action. *P-N* junction. Transistor. Simple circuits.

Waves And Oscillations: Free oscillation of systems with one and more degrees of freedom Solution for Modes. Classical wave equation. Transverse modes for continuous string. Standing waves. Dispersion relation for waves. LC network and coupled pendulums. Plasma oscillations.

Optics And Lasers: Harmonic traveling waves in one dimension .Near and far fields. Two-slit interference. Huygens Principle. Single-slit diffraction. Resolving power of optical instruments. Diffraction Grating.

Lasers. Population inversion. Resonant cavities. Quantum efficiency. He-Ne, Ruby and CO_2 lasers. Doppler effect and sonic boom.

Modern Physics : Inadequacy Of Classical Physics, Planck's Explanations Of Black Body Radiation Photoelectric Effect, Compton Effect. Bohr Theory Of Hydrogen Atom, Atomic Spectra, Reduce Mass, De-Broglie Hypothesis Braggs Law, Electron Microscope, Uncertainty Relations Modern Atomic Model, .Zeeman Effect, Atomic Nucleus, Mass-Energy Relation, Binding Energy, Nuclear Forces And Fundamental Forces, Exponential Decay And Half-Life. Radioactive Equilibrium In A Chain, Secular Equilibrium, Nuclear Stability, Radiation Detection Instruments, Alpha Decay, Beta Decay, Gamma Decay Attenuation Nuclear Radiation Hazards And Safety, Medical Uses Of Nuclear Radiation. Fission, Energy Release. Nuclear Reactors. Breeder Reactor. Nuclear Fusion.

The practical work will be based on the above course.

CS-105 FUNDAMENTALS OF COMPUTER ENGINEERING

Number Systems, Historical evolution of computers, Structure and organization of computers and computer systems, computer peripherals, Introduction to software development process, introduction to common software packages and their applications, programming languages and their comparative study. High and low level languages, introduction to operating systems and data communications, Computer networking fundamentals, Introduction to Databases and information systems.

The practical work will be based on the above course.

HS-101 ENGLISH

Study Skills: Reading, dictionary, library skills, speed reading, writing outlines, note taking.
Oral communication: confidence building, class discussions, speeches, verbal interaction.
Advanced reading comprehension: using texts dealing with science, literature and human rights.
Précis writing: rules of précis writing, practice précis.
Controlled & guided writing: pre writing (planning, information gathering, preparing to write). Writing, search for topic sentences, developing a theme, following up ideas and arguments, outline plans etc.
Essay writing: Types of writing – narrative, descriptive, expository, argumentative etc.. Using guided writing to organize essays, Including human rights as essay topics
Writing short reports: short background of report and its importance, memo report, brief reports on events seen / experienced like visit to an exhibition etc.
Letter writing: format and layout, formal letters, types of letters – invitations (acceptance and refusals), condolence, thanks, congratulations, to the editor, chairman class advisor, dean, vice chancellor etc.
Applied Grammar: morphology, types of sentences, sentence analysis, tenses, jumbled sentences, question tags, homonyms and homophones and their use in sentences, punctuation – sentences and paragraphs, use of idioms

HS-105 PAKISTAN STUDIES

Historical and Ideological Perspective of Pakistan Movement
Two nation theory: Definition, Significance.
Creation of Pakistan: Factors leading to the creation of Pakistan, Quaid-e-Azam and the demand for Pakistan.

Land of Pakistan:
Geo-physical conditions, Geo-political and strategic importance of Pakistan, Natural resources, water and power.

Constitutional Process
Early efforts to make a constitution-problems and issues, Constitution of 1956 and its abrogation, Constitution of 1962 and its abrogation, Constitutional and Political crisis of 1971, Constitution of 1973, Subsequent constitutional developments.

Contemporary Issues in Pakistan

A brief survey of Pakistan's Economy: Agricultural and industrial development in Pakistan, Internal and external trade, Economic planning and prospects

Social issues: Literacy & education in Pakistan, State of science & technology with special reference to IT education, Pakistan society and culture.

Environmental issues: Hazards of atmospheric pollution, Other forms of environmental degradation, their causes & solutions, Pakistan's role in preservation of nature through international conventions/efforts.

Foreign Policy: Relations of Pakistan with neighbours, Relations with Super powers, Relations with Muslim world.

Human Rights

Conceptual foundations of Human Rights: What are Human rights? Definition, significance and importance, Comparative analysis of Islamic and western Perspectives of Human rights.

UN System for Protection of Human rights - an over-view: UN Charter, International Bill of Human Rights, Implementation mechanism.

Other important international treaties and conventions: The convention on the elimination of all forms of discrimination against woman, International Convention on the rights of child (CRC), Convention against torture (CAT), Refugee Convention.

Pakistan's response to Human rights at national and international level: Constitutional Provisions, Pakistan's obligations to international treaties and documents, Minority rights in Pakistan, Pakistan's stand on violation of Human rights in the international perspective.

HS-127 PAKISTAN STUDIES FORIGN STUDENTS (ALTERNATE COURSE)

Land of Pakistan: Land & People, Strategic importance, Important beautiful sights, Natural recourses.

A brief Historical Background: A brief Historical survey of Muslim Community in the sub-continent, British rule & its impacts, Indian re-action, Two nation theory-Origin development, Factors leading towards, Factors leading towards the demand of a separate Muslim state, Creation of Pakistan.

Government & Politics in Pakistan: Constitution of Pakistan- A brief outline, Governmental structure-Federal & Provincial, Local Government Institutions, Political History- A brief account.

Pakistan & the Muslim World: Relation with the Muslim countries.

Language and Culture: Originals of Urdu Language, Influence of Arabic & Persian on Urdu Language & Literature, A short history of Urdu literature.

EE-211 CIRCUIT THEORY- I

Introduction to Circuit Concepts: Basic two terminal circuit elements, Linear time invariant resistor, Linear time invariant capacitor, Linear time invariant inductor, energy concepts in two terminal elements, energy dissipated in a resistor, energy stored in an inductor and capacitor, ideal independent voltage and current sources.

Kirchhoff's Law: Basic definitions of branch, loop and node, statements of Kirchhoff's voltage and current laws, linearly independent KCL and KVL, equation

of KVL and KCL laws, series and parallel conceptions of two terminal one port circuit elements. Thevenin's theorem, Norton's theorem, Maximum power transfer theorem and Reciprocity theorem.

Elementary Transient Analysis: Differential and integral forms of circuit equation, Initial voltage on a capacitor, initial current in an inductor, first order circuits, solution of single first order differential equations, particular and total solution of second order linear time invariant differential equations.

Sinusoidal Steady State Analysis: Network response to sinusoidal driving functions, complex impedance and admittance functions, development of concept of phasors, power consideration, complex power, maximum power transfer, tuned circuits, series and parallel RLC tuned circuits, definition of quality factor.

Exponential excitation and Transformed Network: Representation of excitations by exponential functions, single element responses, forced response with exponential excitation, introduction to the transformed network, driving point impedance and admittance.

Nonsinusoidal Periodic Analysis: Fourier Series and it's use in Circuit Analysis, Evaluation of Fourier Coefficients, Waveform symmetries, exponential form of Fourier series, Steady state response to periodic signals.

Magnetically Coupled Circuits : Mutual inductance, Dot conventions, energy considerations, the linear transformer and ideal transformer.

The practical work will be based on the above course.

EE-221 INSTRUMENTATION

General Theory : Classification, performance and characteristics, absolute and secondary instruments, indicating, recording and integrating instruments, controlling balancing and damping, static and dynamic characteristics.

Ammeter and Voltmeter : Classification, moving iron, moving coil, thermal, electrostatic and induction type, errors extension of ranges, CTs and PTs their burden and accuracy.

Power and Energy Meters : Wattmeter types, Active and Reactive power measurement, Max. demand indicator, Calibration, Classification of energy meter, KWH meter and KVARH meters, p.f. meter.

Electronic Instruments : Electronic and digital voltmeters, counters, digital frequency meter, time interval measurement, RLC meter, Power and energy meter, oscilloscope and its use.

Basic Concepts : Basic concepts of measurement, measurement of resistance, inductance and capacitance, potentiometer and bridge methods.

Magnetic Measurement : Measurement of field strength flux, permeability, B-H curve and hysteresis loop, magnetic testing of materials.

Transducers : Variable, resistance and inductance transducers, linear variable differential transformer (LVDT), capacitive, photoconductive, and piezo-electric transducers, thermo electric transducers. Filtering, Instrument amplifiers, A/D conversion.

Measurement of Non-electrical Quantities : Measurement of temperature, pressure, flow, strains, thermal conductivity, motion, speed and vibrations, thermal and nuclear radiations.

High Voltage measurement : Measurement of dielectric strength of insulators, high voltage surges.

The practical work will be based on the above course.

EE-241 ELECTRICAL MACHINES - I

DC Machines: Construction, Simple lap and wave windings, equalizing connections and dummy coils, elementary concept of armature reaction and commutation, Cross and demagnetizing ampere turns. DC Generators, Types, emf equation, Losses, Efficiency, Performance curves, characteristics, Critical resistance and speed and effect of armature reaction of OCC, Internal and external characteristics from OCC neglecting and accounting armature reaction. Calculation of series ampere turns for level and over compounding. Motors, Principle, Back EMF, Torque, speed and speed regulation. Types, characteristics, performance curves, losses and efficiency. Speed and torque problems involving magnetization curve, charging and ignition circuits of automobiles.

AC Synchronous Machines: Construction, stator single layer, double layer and concentric windings, damping windings. Coil span factor, distribution factor, leakage and armature reaction, synchronous impedance. Alternators, types, emf equation, speed and frequency, losses and efficiency, alternator on load, voltage regulation by synchronous impedance method. Synchronous Motors, types, principle of working, Vector diagram on load and its analysis for stator current, power factor, torque and mechanical output, Effect of Variation and excitation, Losses and efficiency.

AC Induction Machines: Induction Motors, Construction, Types, Rotating field theory, principle of working, slip and its effect on motor current quantities. Losses, efficiency and performance curves. Starting, full load and maximum torque relations, torque slip characteristics

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Transformers: Construction, principle of working, Emf equation, Transformation ratios, No load working and vector diagram, magnetizing current, Vector diagram on load, Equivalent circuit, Open circuit and short circuit tests, losses, efficiency and performance curves, all day efficiency, Percentage and per unit R, X and Z. Voltage regulation and Kapp's regulation diagram. Transformer as a mutually inductive circuit.

Magnetic Circuit of the DC Machine: Laws, Units, MMF, Permeability, Magnetization curves, magnetic circuit of DC machine, flux distribution, field form, effect of saturation, reluctance of air gap with slotted armatures, with ventilation ducts, ampere turn calculations for air gap, teeth armature core, pole and yoke.

DC Motors: Characteristics of series, shunt and compound motors, starters, calculation of starter step resistance by analytical and graphical methods for shunt and series motors.

Speed Control of DC Motors: Speed control methods for series, shunt and compound motors, series parallel control for traction motors, Multivoltage control, regulex control, plugging dynamic braking, testing efficiency and temperature rise, losses determination of losses, direct and indirect test, estimation of temperature rise of armature commutator and field winding, efficiency.

The practical work will be based on the above course.

EE-262 PROGRAMMING WITH C-LANGUAGE

The Turbo C Programming environment : Setting up the Integrated Development Environment, File used in C program Development, using the Integrated Development Environment, the Basic Structure of C programs, Explaining the print f ( ) Function.

C Building Blocks : Variables, Input/ Output, Operators, Comments.

Loops : The for Loop, The while loop, The do while loop.

Decisions : The if statement, the if-else statement: the else-if construct. The switch statement, the Conditional operator.

Functions : Simple Functions, Functions that return a value, using arguments to pass data to a function, using more than one functions, external variables, prototype versus classical K and R, Preprocessor directives.

Arrays and strings : Arrays, Referring to individual Elements of the Array, String.

Pointers : Pointer Overview, Returning data from functions, pointers and Arrays, Pointers and Strings, Double Indirection, Pointers to Pointers.

Structures, unions, and ROM BIOS.

Turbo C Graphics Functions : Text-mode Functions Graphics - Mode Functions. Text with Graphics.

Files : Types of Disk I/O, Standard, Input/ Output Binary Mode and Text mode, Record, Input/ Output, Random Access, Error Conditions, System-Level Input/ Output, Redirection.

Advanced Variables : Storage Classes, Enumerated data type, Renaming data type with typedef, Identifiers and Naming classes, type conversion and casting, labels and goto statement.

C++ and Object Oriented Programming : Object Oriented Programming, some useful C++ features classes and objects, constructors and memory Allocations, Inheritance, Function Overloading, Operator Overloading.

The practical work will be based on the above course.

EE-281 ELECTROMAGNETIC FIELDS

Vector Analysis : scalars and vectors, vector algebra, the Cartesian coordinate system, vector components and Unit vectors, the vectorfield, the dot product the cross product, other coordinate systems, circular cylindrical coordinates, the spherical coordinate system, transformations between coordinate systems.

Coulomb's Law and Electric Field Intensity : The experimental law of coulomb, Electric field intensity, field of a point charge, field due to a continuous volume charge distribution, field of a line charge, field of a sheet of a charge, stream-lines and sketches of fields.

Electric Flux Density Gauss's Law and Divergence: Electric flux density, Gauss's law, application of Gauss's law, some symmetrical charge distributions, differential volume element, divergence, Maxwell's first equation, electrostatics, the vector operator and the divergence theorem.

Energy and Potential: Energy expanded in moving a point charge in an electric field, the line integral, definition of 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.

Conductor Dielectrics and Capacitances: Current and current density continuity of current metallic conductors, conductor properties and bounded conditions, semi conductors, the nature of dielectric materials, capacitance, several capacitance examples, of a two wire lines. Curvilinear square, physical modules, current analogies, fluid flow maps the iteration method.

Poission's and Laplace's Equations: Poison's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, examples of the solution of poison, product solution of Laplace's equation.

The Steady Magnetic Field : Biot Savart's Law, Amperes circuit law, curl, stoke's theorem, Magnetic flux and magnetic flux density, the scalar and vector magnetic potentials, 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 element, 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 equation in point form, Maxwell's equation in integral form, the retarded potentials.

The Uniform Plane Wave: Wave motion in free space, wave motion in perfect dielectric, plane waves in loose dielectrics. The Pointing vector and power considerations, propagation in good conductors, skin effect, reflection of uniform plane waves standing wave ratio.

The practical work will be based on the above course.

EL-231 ELECTRONIC DEVICES AND CIRCUITS

Ideal diode, terminal characteristics, small signal model, analysis of diode circuits, applications.

The bipolar junction transistor structure, transistor as amplifier, transistor biasing, small signal models, single stage BJT amplifier configurations, single stage mid frequency amplifier, analysis and design, feedback in amplifiers, multi stage amplifier, high frequency response of single stage amplifier, Bipolar transistor as switch, structure and physical operation of MOSFET, current-voltage characteristics of MOSFET, The depletion type MOSFET. The junction field effect transistor, FET circuits at DC, FET biasing, FET as amplifier and basic configurations of single stage amplifiers, frequency response of common source amplifier, FET switches.

The practical work will be based on the above course.

CS -205 LOGIC DESIGN AND SWITCHING THEORY

Computer Operations : Evaluation of the computer, basic organization of digital computer, instruction formats, some different types of computers, special purpose and general purpose computers.

Number Systems : Conversion between bases, arithmetic with bases other than ten, negative numbers, binary coded decimal numbers, octal, and hexadecimal number systems.

Truth Function : Binary connectives, evaluation of truth functions, many statement compounds, physical realizations, sufficient sets of connectives, a digital computer examples.

Boolean Algebra : Truth functional calculus as Boolean algebra, duality, fundamental theorems of Boolean algebra, examples of Boolean simplifications, remarks on Switching functions.

Switching Devices : Switches and relays, logic circuits, speed and delays in logic circuits, integrated logic circuits.

Minimization of Boolean Functions : Standard forms of Boolean functions, Minterm and maxterm, Designation of Boolean functions, Karnaugh map representation of Boolean functions, simplification of functions on Karnaugh maps, map minimization of product of sums expressions, incompletely specified functions.

Tabular Minimization : Cubical representation of Boolean functions, Determination of prime implicants, Selection of an optimum set of prime implicants, Design of Nand and Nor Networks and properties of combinational networks, Introduction to design and Nand and Nor Networks, Switching expressions for Nand and Nor Networks, Transient response of combinational Networks.

Introduction to Sequential Networks : Latches, Sequential Networks in fundamental mode, Introduction to the Synthesis of Sequential Networks, Minimization of the number of states, Clocked Networks.

The Practical work will be based on the above course.

CS-208 COMPUTER ARCHITECTURE & ORGANIZATION

Introduction to Computers : Evaluation of Computers Hardware and Firmware; Computer Software - Computer Programming, Operating System, Organization and Architecture; Structure and Functions; Types of Computers.

Computer Interconnection Structures : Computer Components Computer Function; Inter connective Structure, Bus Interconnection. Computer Instruction Set, op-code encoding, Addressing Modes, Instruction types - Data Transfer Instructions, Arithmetic Instructions, Logical Instructions, Program Control Instructions System Control Instructions, I/O Instructions, Reduced Instruction Computers - RISC Assignment; Rise-Pipelining

Execution Unit : Register Sections - General Register design, combinational shifter Design, Flag Register; Address; ALU design; BIT slice Processor; Multiplication of Signed and unsigned Integers; Division of Unsigned Integers; coprocessors; Intelligent Monitor Interface, Interface using special Bus Signals and Instructions, Coprocessor Interface using special instructions.

Control Unit : Basic concepts; Design Methods - Hardwired Control Design, Micro programmed Control Unit.

Memory Organization : Characteristics of Memory Systems; Main Design; Popular Electromechanical memory Devices; Memory Hierarchy; Cache Memories; Associative memory Virtual memory and memory Management Concepts.

Input/ Output : Basic Concepts; Program I/O; Standard I/O Versus Memory - Mapped I/O Unconditional and Conditional Programmed I/O; Interrupt I/O - Basic concepts, Main features of Interrupt I/O; Direct Memory Access (DMA); I/O Processor.

Operating Systems : Operating System Overview, Scheduling; Memory Management; Recommended Reading.

Fundamentals of Parallel Processing : Parallelization in conventional computers; General Classification of Computer Architectures; Array Processors - Systolic arrays, Wave front array Processors; Pipeline Processing - Basic Concepts, Arithmetic pipelines, Instruction Pipelines; Multiprocessors - Single Bus, Multibus, Crossbar, Multiple Memory; Data-flow Computer Systems.

The practical work will be based on the above course.

MT-222 LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS (B)

Linear Algebra: Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non- singular, symmetric, non- symmetric, upper, lower, diagonal), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, matrix of linear transformations, Eigen value and Eigen vectors of a matrix, Diagonolization. Applications of linear algebra (Scaling, translation, roatation and projection) with graphical representation.

Introduction to ODEs: The Concepts & Terminologies: Order and Degree; Linearity & Non-linearity; A Brief Classification of ODEs; Formulation of ODEs: Concrete Examples; Solutions: General & Particular: Concrete Examples & Applications: Initial Value Problems (IVP) and Boundary Value problems (BVP): A Brief Introduction to Issues related to Existence & Uniqueness of Solutions.

The First Order ODEs: Linear and Non-Linear: Variable Separable Cases & Applications: Growth & Decay Problems, Newton's Law of Cooling, Torricelli's Law, Simple Kinematical Dynamical Applications; Exact and No-Exact ODEs: Solution Procedures and Integrating Factors; The Standard Linear Differential Equation of First Order: Solution Procedures and Applications to RL-Circuits and RC-Circuits, Bernoulli's Equations & Logistical Growth Models, Direction Fields and Euler's and Picard,s Iterative Schemes for the 1st Order ODEs,

The Linear Second Order ODEs: Homogeneous and Non-Homogeneous Cases: Linear Second Order Homogeneous ODE with Constant Coefficients: Solution Procedures and the Principle of Linear Superposition and Applications --- Mechanical Systems & Electrical Systems, Undamped and Damped Harmonic Oscillators; Linear Second Order Non-Homogeneous ODEs with Constant Coefficients: Solution Procedures and the Principle of General Linear Superposition: Complementary Functions & Particular Solutions----the Method of Undetermined Coefficients & Variation of Parameters: Applications: Spring-Mass Systems -- Damped & Undamped Harmonic Oscillators with Forcing Terms and their ODEs and Solutions; RCL-Circuits and their ODEs and Solutions; The Physics and Mathematics of the Phenomenon of Resonance in Mechanical & Electrical Systems; Cauchy-Euler ODEs and their Solution Procedures.

Partial Differential Equation: Formation of partial differential equations. Solutions of first order linear and special types of second and higher order differential equations. Homogeneous partial differential equations of order one, Lagrange's multiplier

Advance Calculus & Vector Calculus: Double & triple integral with application (Area, centoroid, moment of inertia) vector differentiation & vector integral with applications, Green & Stokes theorem with applications.

MT-224 COMPLEX VARIABLE & FOURIER ANALYSIS

Infinite Series: Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.

Complex Variable: Limit, continuity, zeros and poles of a complex function. Cauchy-Reimann equations, conformal transformation, contour integration.

Laplace Integral & Transformation: Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the nth order derivative, initial and final value theorem Laplace transform of integrals, Laplace transform of functions t^n F(t) and F(t)/ t, Laplace transform of periodic function, evaluation of integrals, definition of inverse Laplace transform and inverse transforms, convolution theorem, solutions of ordinary differential and partial differential equations using Laplace transform (I.V.P's & B.V.P's). Z and Inverse Z – transformations, properties of Z – transformation and applications.

Fourier series: Introduction to Fourier series, Euler Fourier formulae, even and odd functions, application of Fourier series, Fourier transform and fast Fourier transform and properties with applications.

HS-205 ISLAMIC STUDIES

Quranic Verses: **Tauheed:** Al-Ambiya – 22, Al – Baqarah - 163&164. **Prophet hood:** Al – Imran – 79, Al – Huda – 7, Al- Maida0h-3. **Here-After:** Al – Baqarah – 48, and one Hadith. **Basic Islamic Practices:** Al – Mu' minun-1-11, and two Ahadith

Amer – Bil – Ma ' Roof Wa-Nahi Anil Munkar: the concept of Good & Evil, Importance and necessity of Da'wat-e-Deen Al- Imran – 110, Method of Da'wat-e-Deen An-Nehl-125, Al-Imran-104, and two Ahadith

Unity of the Ummah: Al-Imran-103, Al-Hujurat-10, Al-Imran-64, Al-An'am –108, and two Ahadith .

Kasb-e-Halal: Ta ha-81, Al- A'raf-32-33, Al-Baqarah-188, and two Ahadith.

Haquq-ul-Ibad: Protection of life (Al-Maidah-32), Right to Property (Al-Nisa-29), Right to Respect & Dignity (Al- Hujurat –11-12), Freedom of Expression (Al-Baqarah-256), Equality: (Al-Hujurat-13) , Economic Security: (Al-Ma' arij – 24-25), Employment Opportunity on Merit: (An-Nisa-58), Access to Justice: (An- Nisa-135)

Women's Rights: An-Nehl-97, Al-Ahzab-35, An-Nisa –07.

Relations with Non-Muslims: Al- Mumtahanah-8-9, Al-Anfa'al – 61 and The last sermon of Hajj of Holy Prophet (PBUH): Relevant extracts.

Seerat (life) of the Holy Prophet (PBUH): birth, life at Makkah, declaration of prophet hood, preaching & its difficulties, migration to Madina, brotherhood (Mawakhat) & Madina Charter, The Holy Wars of the Prophet (Ghazwat-e-Nabawi), Hujjat-ul-Wida, The last sermon of Khutbatulwida**:** Translation and important points

Islamic Civilization: a) in the sub continent: pre- Islamic civilizations. The political, social & moral impacts of Islamic civilization (b) in the world: academic, intellectual, social & cultural impact of Islam on the world.

HS-209 ETHICAL BEHAVIOUR

Introduction to Ethics:

i) Definition of Ethic ii) Definition between normative and positive science
ii) Problem of freewill iv) Method of Ethics v) Uses of Ethics

Ethical Theories:

i) History of Ethics: Greek Ethics Medieval, Modern Ethics ii) Basic concept of right and wrong good and evil iii) Utilitarianism hedonism self-realization: egoism, intuitionism rationalism iv) Kant's moral philosophy

Ethics & Religion:

i) The relation of Ethics to religion ii) Basic ethical principles of major religions: Hindusim, Judaism, Buddhism, Zoroastrianism, Christianity, Islam

Ethics, Society and moral theory:

- Society as the background of moral life
- Ethical foundation of Right and Duties
- Universalism and Altruism
- Applied Ethics
- Theories of punishment

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EE-312 CIRCUIT THEORY- II

Matrix Analysis: Introduction and review of Matrix theory, Determinants and Matrix inversion, systematic Formulation of network equations, Loop variable analysis, Node variable analysis, state variable analysis, formulation of state equations, source transformations, duality.

Elementary Time Functions: Introduction to singularity functions, The impulse function and response. The unit step function and response, Ramp function, Exponential function and response.

Analysis of Networks by Laplace transformations.

Review of the Laplace transformation, application to network analysis.

Two Port network: Introduction, Characterization of Linear Time Invariant, Two ports by six sets of parameters, Relationship among parameter sets, Interconnection of two ports.

Large Scale Network: Topological description of Networks, Basic definition and notations, Matric representation of a graph, state space representation, Tellegin's Theorem.

Networks Functions and Frequency Response: The concept of complex frequency, Transform impedance and transform circuits, Network functions of one and two ports. Poles and zeros of Network functions, restrictions on poles and zeros of transfer function, Magnitude and phase, Complex Loci' Plots from the plane phasors.

Fourier Transform : Fourier transform applications in circuit analysis in relation to frequency and time domain functions.

The practical work will be based on the above course.

EE-315 ELECTRIC FILTERS

Introduction : Circuit Design Problem, Kind of Filters and Terminology, Passive Filters, Choice of Analog filter.

Active Device Used In Active Filters : Operational amplifiers operational transconductance amplifiers, circuit based on OAs and OTAs, characteristics of OTAs, OA and OTA based integrators.

Circuit Design Approach : Direct form of synthesis approach, cascade form of synthesis, simulation of impedance.

Design of 1st Order Filter Sections, Cascade : Design with 1st order section, all pass circuits, phase shaping.

The Biquad Circuit : Design parameters Q and w_o , the biquad circuit and its response 4 opamp biquad circuit, phase response.

Sensitivity Analysis : Definition of Bode sensitivity, sensitivity analysis of sallenkey circuit, sensitivity comparison of circuit.

Circuit Design With Simulated Elements : The ideal gyrator circuit GIC and FDNR, realization of negative elements, realization of floating elements, circuit design.

Switched Capacitor Filters : The MOS switch, switched capacitor, analog operations, 1st and 2nd order filters.

Better OP-AMP Models : Realization of filter and oscillators, active R and active C Circuit approach.

Discrete Time Filters : Elements of FIR and IIR filter design, filter structures, windowing process, aliasing error and quantization effect.

The practical work will be based on the above course.

EE-342 ELECTRICAL MACHINES - II

Transformers: Poly phase transformers, star delta and zig zag connections for parallel operation, sharing of load, tertiary windings, harmonics and transients in transformers, sequence impedance, moving coil regulators, on load tap changing transformers, auto transformers and Scott connected transformer, furnace transformers, magnetizing current of a transformer and iron losses, testing of transformers, losses and efficiency mechanical stresses of transformers.

Three Phase Induction Motor: Equivalent circuit of induction motor, cage rotor, double cage and high torque motor, magnetizing current of an induction motor, noise of induction motor, crawling and cogging, speed and power factor control of induction motors by injecting EMF in the circuit, phase advancers and phase compensated induction motor, induction generators and regulators, testing of induction motor, efficiency and losses, circle diagram, starter calculations.

Synchronous Generators: Approximate theory of synchronous generator with synchronous impedance, winding factors and their effect on the wave form of the machine, voltage regulation of alternators, MMF and EMF vector diagrams and their application in voltage regulation problems, cylindrical rotor machines and effect of saturation, parallel operation of alternators and sharing of loads, working of alternators on infinite bus bars.

Synchronous Motors: Overexcited and under-excited motors, power factor and power factor control, starting of synchronous motors, circle diagram, V-curves and O-curves of synchronous motors.

Fractional HP Motors: Single phase induction motors, types, revolving field theory, analysis and performance, single phase synchronous motor, AC series motor, repulsion motors, two phase control motors.

The practical work will be based on the above course.

EE-351 ELECTRICAL POWER TRANSMISSION

Systems of Transmission: Systems of DC and AC Transmission; Transmission and sub-transmission, standard voltages in and abroad for transmission and sub transmission, WAPDA & KESC practices.

Basic Concepts: Phasor notation, complex power, power triangle, direction of power flow, current and power in balanced three-phase circuits.

Representation of Power Systems: Percent and Per-Unit quantities, Selection of base and change in base of p.u. quantities, Node Equations, One-line diagram, impedance and reactance diagrams.

Series Impedance of Transmission Lines: Conductor types, Resistance, Skin effect, Line inductance based on flux considerations. Inductance of single phase 2-wire line, inductance of composite conductor line, use of tables,. Inductance of 3-ph line with equilateral and unsymetrical spacings, transposition, inductance of Bundled conductors.

Capacitance of Transmission Lines: Review of Electric field on a long straight conductors, capacitance of two-wire, 3-ph line; Effect of Earth on capacitance; capacitance of bundled conductors, paralled circuit lines.

Current and Voltage Relations on a Transmission Line: Representation of lines; The short, medium and long transmission lines, solution of equations and their interpretation travelling waves, Hyperbollic form of the equation, Equivalent circuits, power flow through the line, voltage regulation and power circuit diagram, line surges.

Mechanical Design of Overhead Lines : Line supports, sag and tension calculations, total length of conductor, supports at different levels, mechanical degree of safety, effect of wind pressure and ice loading, conductor vibration and use of dampers.

Insulators : Insulator material, types of insulators, voltage distribution over insulator string, string efficiency, methods of improving the string efficiency, testing of insulators.

Corona : The phenomenon of corona, disruptive critical voltage and visual critical voltage, conditions effecting corona loss, power loss due to corona, radio interference due to corona.

Power System Stability : stability problem, steady state and transient stability, rotor dynamics and swing equation, the power angle equation, equal area criterion of stability, solution of swing equation by graphical method.

EE-353 ELECTRICAL POWER DISTRIBUTION AND UTILIZATION

Underground Cables : Cable resistance, inductance and capacitance, methods of cable installation, effect of bunching and temperature, voltage drop and power loss, types of cables used in industries, cable fault localization.

DC and AC Distributors : Pointed and uniform AC and DC distributors, distributors fed at and one and both ends, Ring mains, stepped mains, unbalanced loading of 3 phase AC distributors.

Static Substation : Substation location, Equipment and building layout, substation earthing, one line diagram of schematic, L.T. & H.T. cable layout.

Illumination Design : Light wave emission, standards of light, luminous ouput, light filtering and polar curve, reflection and absorption, lighting calculation.

Industrial Heating : Resistance heating, Induction furnace, eddy current heating, furnace applications.

Electric Traction : Advantages and disadvantages of electric traction, electrification systems, mechanics of train movement, speed time curves, traction motor types, characteristics and controls. overhead collection for locomotives, Electric Vehicle.

The practical work will be based on the above course.

EL-332 INTEGRATED CIRCUITS

Introduction to IC processing for Bipolar and MOS Circuit fabrication.
The output stages analysis of class A, B and AB amplifiers. Differential amplifiers, BJT and FET, common and differential mode gains, Analysis of circuits containing ideal Op Amps, Non-ideal performance of OP Amps, The internal structure of general purpose IC OP Amp and its circuit analysis. Large signal operation of Op Amps, Practical Op Amp limitations, stability and frequency compensation. Non-linear circuit application like comparator, Signal generator, wave shaping circuit, bipolar transistor inverter analysis, noise margins, TTL gate circuit analysis, ECL gates, The NMOS and CMOS inverter analysis, MOS gate circuits, BICMOS Logic Circuits.

The practical work will be based on the above course.

EL-343 POWER ELECTRONICS

Introduction and scope of Power Electronics.

Solid State Devices used as switches in power electronics, power diodes, power transistors, power MOSFETS, thyristors, triacs, diac. Characterstics of GTO, RCT, etc. Series and parallel operation of SCR, LASCR.

Thyristor turn on, integral cycle control and phase angle control, elementary and advanced firing schemes, sequence and close loop control.

Thyristor Commutation : Self commutation, impulse commutation, series capacitor commutation, parallel capacitor commutation.

Uncontrolled and Controlled rectifiers : Single phase, three phase, semi converter, full converter, dual converter, analysis and performance, parameters as harmonic factor, utilization factor, power factor, distortion factor, etc. rectifiers with purely resistive, highly inductive and RL loads.

AC Voltage Controllers.

DC Chopper : Principle, stepup operation, stepdown operation, buck regulator, boost regulator, buck-boost regulator, cuck regulator, choppers using thyristors.

Inverters : Principles, half bridge, full bridge inverters, constant phase width modulation, variable PW modulation, sinosoidal PW modulation, modified SPWM.

Protection Analysis : Over voltage, over current, Ldi/dt, heat sinks.

Introduction to Variable Speed Drives : Elementary discussion on DC drives, transfer function, elementary discussion of AC drives and it transfer function.

The practical work will be based on the above course.

TC-391 COMMUNICATION SYSTEMS - I

Introduction : Fundamental terms and definitions, information, message, signal, analog and digital signals, elements of communication systems, modulation and coding, need for modulation, coding methods and benefits.

Signals and Spectra : Methods of signal representation, time and frequency domain, mathematical representation of signals, Fourier series and Fourier transform, power in a signal, Parseval's power theorem, Rayleigh energy theorem, properties of Fourier transform, convolution of signals, some specific signals types as impulse step and signum functions.

Signal Transmission and Filtering : Linear time invariant systems, impulse response and superposition integral, transfer function, block diagram analysis, distortion and equalizers, transmission loss and repeater, ideal and real filters quadrature filters and hilbert transform, correlation and spectral density.

Probability and Random Variables : Probability functions, probability models and distributions, statistical averages.

Random Signals and Noise : Random process, ensemble and time average, stationary and ergodic process, noise, thermal noise, white noise and filtered noise, noise equivalent BW, Analog base band transmission.

Linear Modulation : Band pass systems and signals, AM, DSB, SSB, VSB, Power in modulated signals modulator, balanced modulator, switching modulator, SSB generation (methods), demodulators, synchronous detection, homodyne detection, envelope detection.

Transmission Lines : Fundamentals of Transmission line, characteristic impedance, losses in T/L, standing wave, quarter and half wave lines, reactance properties of T/L fundamentals of smith chart, double stub, directional couplers balloons.

The practical work will be based on the above course.

MT-331 APPLIED PROBABILITY & STATISTICS

Statistics: Introduction, Types of data & variables, presentation to data, object, classifications, Tabulation, Frequency distribution, Graphical representation, Simple & Multiple Bar diagrams, Sartorial & Pie-Diagram, Histogram, Frequency Polygon, Frequency Curves & their types.

Measures Of Central Tendency And Dispersion: Statistics Averages, Median Mode, Quartiles, Range, Moments, Skewness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems.

Curve Fitting: Introduction, fitting of a first and second degree curve, fitting of exponential and logarithmic curves, related problems. Principle of least squares, Second order Statistics & Time series not in bit detail,

Simple Regression & Correlation: Introduction, Scatter diagrams, Correlation & its Coefficient, Regression lines, Rank Correlation & its Coefficient, Probable Error (P.E), Related problems.

Sampling And Sampling Distributions: Introduction, Population, Parameter & Statistic, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-Sampling Errors, Random Sampling, Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems.

Statistical Inference And Testing Of Hypothesis: Introduction, Estimation, Types of Estimates, Confidence interval, Tests of Hypothesis, Chi-Square distribution/test, one tails & two tails tests. Application in related problems.

Probability: Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability, Conditional probability, Baye's rule. Related problems in practical significance.

Random Variables: Introduction, Discrete & Continuous random variables, Random Sequences and transformations, Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F.), Markove random walks chain/ Related problems.

Probability Distributions: Introduction, Discrete probability distributions, Binomial, Poisson, Hyper geometric & Negative binomial distributions. Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance.

EF-303 EGINEERING ECONOMICS

Introduction: Basic concept and principles of Economics, Micro-economics theory, the problems of scarcity. Basic concept of Engineering Economy

Economic Environment: Consumer and producer goods, Goods and services, Demand & Supply concept. Equilibrium, Elasticity of demand, Elasticity of Supply, Measures of Economic worth. Price-supply-demand-relationship. Theory of Production, Factors of production, Laws of returns, break-even charts and relationships. Perfect competition, monopoly, monopolistic competition and oligopoly.

Elementary Financial Analysis: Basic accounting equation. Development and interpretation of financial statements – Income Statement, Balance Sheet and Cash flow. Working capital management.

Break Even Analysis: Revenue / cost terminologies, Behaviour of Costs. Determination of Costs / Revenues. Numerical and graphical presentations. Practical applications. BEA as a management tool for achieving financial / operational efficiency.

Selection Between Alternatives: Time value of money and financial internal rate of return. Present value, Future value and Annuities. Cost-benefit analysis, Selection amongst materials, techniques, designs etc. Investment philosophy. Investment

alternatives having identical lives. Alternatives having different lives. Make or buy decisions and replacement decisions.

Value Analysis / Value Engineering: Value analysis procedures. Value engineering procedures. Value analysis versus value engineering. Advantages and applications in different areas. Value analysis in designing and purchasing.

Linear Programming: Mathematical statement of liner programming problems, Graphic solution Simplex procedure. Duality problem.

Depreciation and Taxes: Depreciation Concept. Economic life. Methods of depreciations. Profit and returns on capital, productivity of capital. Gain (loss) on the disposal of an asset. Depreciation as a tax shield.

Business Organization: Type of ownership, single ownership, partnerships, corporation, type of stocks and joint stock companies. Banking and specialized credit institutions.

Capital Financing & Allocation: Capital Budgeting. Allocation of capital among independent projects. Financing with debt capital. Financing with equity capital. Trading on equity. Financial leveraging.

HS 304 BUSINESS COMMUNICATION & ETHICS

Communication Skills (oral): Definitions and Conditions, Modes: verbal, non-verbal, vocal, non-vocal, sender, Receiver, en-coding, decoding, noise, context, emotional maturity, relationships, etc., Language, perception, Non-verbal, body language, physical appearance, cultural differences etc., Personal and interpersonal skills / perceptions, Communication dilemmas and problems, Public Speaking – speaking situation, persuasion, Making presentations, Interviews.

Business Writing: Formal / Business letters, e-mails : a) job applications and resumes/ cv, b) enquiries, c) complaints / adjustments, d) orders, e) quotations, f) banking etc., Memos : layout, language, style, Meeting management : notice, agenda, conducting / participating, writing minutes., Contracts and agreements (basic theoretical knowledge and comprehension), Research / scientific, reports : types, structure, layout / presentation, writing process etc., Tenders (basic theoretical knowledge and comprehension)

Engineering / Business Ethics: Need and objectives for code of ethics and its importance, Type of ethics, involvement and impact in daily life, Problems / conflicts / dilemmas in application (case studies), Sexual Harassment / discrimination in the workplace a) why it occurs, b) myths regarding sexual harassment, c) how to deal with it, d) gender equality, e) respect etc., Codes of conduct: Pakistan Engineering Council, Code for Gender Justice, Brief study of other codes of conduct.

EE-401 ELECTRICAL ENGINEERING PORJECT

The final year students will be required to consult the Chairman of Electrical Engineering Department regarding the offering of various projects in the department.

The student or group of students will be assigned the project by teaching by teacher concerned and will carry out the assignment as required an directed by the teacher. At the end of the academic session, they will submit the written report on work of their project to the Chairman, preferably in the typed form. The students will be required to appear before a panel of examiners for oral examination.

The Project will be of the Following Scopes : A detailed theoretical study of some problem in communication, Power Control or Electronics. This may be of investigative research nature or it may be laboratory research oriented.

Preparation of feasibility report concerning some small projects, like Power Plants, Grid station etc. The report may be purely economic, technical or both and may include the comparative study of different choice for the solution of the problems.

Investigative practical laboratory work of research nature in Power, Communication, Control or Electronics.

An in-depth study of some Electrical System or Design already under execution in the country such as Power Plant, Communication System, Electrification of Building of National importance etc.

Any other topic or problem falling within the scope of afore mentioned areas.

EE-445 ELECTRICAL MACHINES THEORY AND DESIGN

Design Considerations : Factors influencing design of electrical machines, magnetic loading, electric loading, output equations, choice of specific magnetic loading, specific electric loading, flux density and current density, selection of D and L for different machines, properties of electric and magnetic materials used in electrical machines, classification and properties of insulating materials, temperature rise and methods of cooling.

Design of Transformers : Output equation, voltage per turn, optimum designs, choice of flux density and current density, design of core, window dimension, design of yoke, design of low voltage and high voltage windings, number and arrangement of coils, calculation of resistances, leakage reactances, regulation, losses, efficiency, no load current, mechanical stresses, tank design and temperature rise calculations.

Design of Induction Motors : Output equation, choice of flux density, electric loading, main dimensions, stator design, winding, conductor size, slot dimensions, stator teeth, stator core, rotor design, air gap, rotor slots, rotor bars, end rings, rotor core, magnetic circuit calculations, iron losses, friction and windage losses, no load current resistances, leakage reactances, circle diagram and performance evaluation, temperature rise calculations.

Coupled Circuits and Two Winding Transformer: Coupled circuits, The air cored two winding transformer, Ironcored transformer.

Elements of Generalised Theory: Simplifying assumptions, concentrated and distributed winding inductances, concentrated coil representation for a rotational transducer, commutator machines, the primitive multi coil machines.

DC and Cross Field Machines: General analysis, DC machine steady state analysis sudden short circuit of a DC generator, DC motor steady state analysis, cross field machines.

Three Phase Winding Transformations : Transformation between three phase (abc) and two phase (abc) windings, transformation between three phase (abc) and two phase (DOY) windings and poly phase magnetic field.

Three Phase Induction Machine : Transformation to the primitive machine, steady state analysis, steady state torque analysis, double cage rotor, machine inductances.
Single Phase Motors: Single phase commutator motors, single phase induction motors.
Two Reaction Theory: Introduction to two reaction theory.

The practical work will be based on the above course.

EE-452 POWER SYSTEM ANALYSIS

The Admittance Model and Network Calculations : Branch and Node admittances; Mutually coupled Branches in Y-bus; Equivalent Admittance Network; Modification of Y-bus; Impedance matrix and Y-bus; the method of successive elimination; Node Elimination (Kron Reduction); Triangular Factorization;

The Impedance Model and Network Calculations : The bus, admittance and impedance Matrices; Thevenin's Theorem and Z-bus; Modification of an existing Z-bus; Direct determination of Z-bus; Calculation of Z_{bus} elements from Y_{bus} ; Power Invariant Transformations; Mutually coupled branches in Z_{bus}.

Symmetrical Faults : Transients in RL circuits; internal voltages of loaded machines. Under fault conditions; fault calculations using Z_{bus} ; Equivalent circuits; Selection of circuit breakers.

Symmetrical Components and Sequence Networks : Synthesis of unsymmetrical phasors; symmetrical components of unsymmetrical phasors; symmetrical Y and Δ circuits; power in terms of symmetrical components; sequence networks of Y and Δ impedances; sequence networks of a symmetrical Transmission line; sequence Networks of the synchronous Machines; Sequence Networks of Y-Δ Transformers; unsymmetrical services impedances; sequence networks; positive, negative and zero sequence networks;

Unsymmetrical Faults : Unsymmetrical faults on power systems; single line-to-ground faults; line-to-line faults. Double line-to-ground faults; Demonstration problems; open conductor faults.

Circuit Breakers : Functions of Circuit breakers and fuses, Arc phenomenon, Arc extinction, zero current interruption theory, recovery voltage and restriking voltage, rate of rise of re-striking voltage, types of circuit breakers, circuit breaker ratings, testing of circuit breakers, HRC fuses.

Protective Relays : Purpose and functions of relays, types of relays, theory and construction of various types of relays, Protective schemes for transformers,

generators, motors and transmission lines. Use of static relays and schemes, advantages offered by static relays.

Reactors : Types of reactors, applications, purpose of reactors, locations in feeder, ratings, neutral grounding impedance.

The practical work will be based on the above course.

EE-454 ENERGY CONVERSION

Thermal Power Plants : Sources of conventional energy and method of harnessing, special features and cycles used in steam, gas and diesel power plants, location of the above plants and selection of units, prime movers and associated equipments.

Hydroelectric Power Plants : The plants and their equipment, layouts, run of the river and accumulation type station, types of hydroelectric turbine and their station.

Nuclear Power Plants : Nuclear reaction, fission and fusion reaction, critical mass chain reaction, moderators, reactor control and cooling, classification of reactors, different types of reactors, radiation damages, shielding of γ-rays neutrons, materials for construction.

Thermoelectric Generators : Thermoelectric effect, solid state description of thermoelectric effect, analysis and design of thermoelectric generator, figure of merit, device configuration, solar and radioisotope powered generators, applications.

MHD Generators : Gaseous conductors, analysis and design of MHD generator, problems associated with MHD generation, possible configuration.

Photovoltaic Generators : Radiation principles, optical effects in semiconductors and p.n. junction, Analysis and design of converter, fabrication of cells, solar cells in space.

Fuel Cells : Thermodynamic principles, efficiency of fuel cell factors limiting the performance, design, new development in fuel cells, possibility of future use in Electric vehicles.

EE-455 ELECTRICAL POWER SYSTEM PROTECTION

Protective Relays: Definitions, functional characteristics of Protective Relays, Operating Principles of Relays, Torque production in an Induction Relay, Over Current Relays, Directional Over current Relays, The Universal Relay Torque Equation, Differential Relays Feeder Protection, Distance Protection, Generator Protection, Protection of Transformers, Static Relays, Fuses & HRC Fuses.

Circuit Breakers: Arc in Oil, Arc-interruption theories, Current chopping, Oil Circuit Breaker, Air Circuit Breakers, Air Blast Circuit Breakers, Vacuum Circuit Breakers, Sulphur Hexafluoride (SF6) Circuit Breaker, Rating of Circuit Breakers, Testing of Circuit Breakers.

Insulation Coordination and Over Voltage Protection: Voltage time curve, Over Voltage Protection, Ground Wires, Surge Arresters / Absorbers, Surge Protection of Transformers, Substations and Rotating Machines.

The practical work will be based on the above course.

EE-474 FEEDBACK CONTROL SYSTEMS

Introduction: Introduction to control systems, examples and classifications, Feedback and its characteristics. Nature and representation of control system problem, block diagram fundamentals, terminology of block diagram for a feedback control system, block diagram representation of various control systems.

Linear Systems and Differential Equations : Methods of writing differential equations of various physical systems such as static electric circuits, mechanical translational and rotational systems, thermal systems, hydraulic linear and rotational transmission systems, electromechanical dynamic systems DC and AC speed control systems.

Time-Response of Linear Systems: Types of standardized inputs to linear systems, steady state response and transient response of systems to standard inputs, response of second order systems time response specifications.

Laplace Transforms: Definition, derivation of Laplace transforms of simple functions, Laplace transform theorems, transformations of differential equations of physical systems, inverse transformation techniques, stability, Routh's stability criterion.

Block Diagram Algebra: Transfer functions of physical systems, canonical and unity feedback forms of control system block system block diagram, block diagram reduction techniques, signal flow graph algebra, block diagram reduction using signal flow graphs.

Control System Characteristics: Classification of feedback systems by type, analysis of system types, error coefficients, error constants, sensitivity.

Root Locus : Introduction, rules for construction of root locus, qualitative analysis of root locus, the spirule, analysis of performance characteristic of systems in time domain, dominant pole zero approximations, gain margin and phase margin, root locus compensation. Phase & gain compensation, root locus compensation, PID controller.

Frequency Response: Introduction, transfer function of systems in frequency domain, magnitude and phase angle frequency response of plots of closed loop control systems.

Introduction to Digital Control: Computer as control device, Single-loop digital control system, Digital control: pros and cons, Data Converters.

Linear Difference Equations (LDE) and z-transform: Scalar difference equation, z-transform of simple sequences and inversion, solving LDE using partial fraction and z-transform, z-domain transfer function and impulse response, relation between S and z-domain.

Digital control system design techniques: Digital control strategies and implementation, closed-loop characteristic equation, z-domain design considerations, General PID digital control algorithm, Tuning procedure for PID controller.

EE-493 DIGITAL SIGNAL PROCESSING

Relationship between sampling frequency and Shannon's theorem, continuous time and discrete time signals, Z-transform, inverse Z transform, discrete Fourier transform, fast Fourier transform, elements of FIR and IIR filter design, filter structures, FFT techniques for high speed, convolution, windowing process, aliasing error its reduction, quantization effects.

The practical work will be based on the above course.

TC-492 COMMUNICATION SYSTEMS - II

Exponential CW Modulation : Frequency and phase modulation, bandwidth criteria, generation methods, receivers, de-emphasis and pre-emphasis filtering.

Pulse Modulation and Digital Modulation : Sampling Theory, ideal sampling and reconstruction, aliasing, PAM, PWM, PPM, TDM, PCM, DPCM, error control coding ASK, PSK, FSK.
Telephony : Modern telephone systems, Transmission aspects, system organization, distribution system, Electromechanical and electronic exchanges, EPABX, mobile phones.

Television : Scanning Format of video signal, block diagram of B/W receiver, transmitter, color TV fundamentals, PAL and NTSC systems.

Satellite Communication : Introductory remarks and historical C background, orbital mechanics, locating, satellite in orbit and w.r.t. earth, look angles and their determination, effect of earth's obliqueness, sun and moon, orbital effect in communication system performance, transponders, reliability.

Information Theory : Information contents in message, units of information, source coding, entropy and information rate, compact codes and channel capacity.

Microwave Engineering : wave guides and resonators, rectangular wave guides, waveguide coupling, matching.

Microwave tubes and circuits : Microwave triode, klystron types.
Semiconductor Microwave devices : Transistors, varactors, Gunn effect.

The practical work will be based on the above course.

CS-410 MICROPROCESSORS AND ASSEMBLY LANGUAGE

Introduction to the Microprocessor : The evolution of the microprocessor, basic microprocessor architecture, memory and the microprocessor, the programming model, real mode memory addressing, protected mode memory addressing, data formats, the instruction set.

Addressing Modes : Data-addressing modes, register addressing, immediate addressing, direct data addressing, Base-pulse-index addressing, register relative addressing, base relative plus index addressing, scaled index addressing, program memory addressing modes, stock memory addressing.

Data Movement Instructions : MOV revisited, RUSH/POP, load-effective address, string data transfers, miscellaneous data transfer instructions, segment override prefix, assembler details.

Arithmetic and Logic Instructions : Addition, subtraction, and comparison, multiplication and division, BCD and ASCII arithmetic, basic logic instructions, shifts and rotates, string comparisons.

Program Control Instructions : The jump group, procedures, introduction to interrupts, machine control and miscellaneous instructions.

Programming the Microprocessor : Modular Programming, using the keyboard and video display, data conversion, disk files, hooks.

Memory Interface : Memory devices, address decoding, memory interface of microprocessors, dynamic RAM.
Basic I/O Interface : An introduction to data communications, parallel I/O, serial communications, the serial interface and the UART, serial communication lines modems. I/O port address decoding, the programmable peripheral interface, the 8279 programmable keyboard/display interface, 8251A programmable communication interface, 8254 programmable interval timer, analog-to-digital (ADC) and digital-to-analog converters (DAC).

Basic Interrupts : Basic interrupt processing, hardware interrupts, expanding and interrupt structure, 8259A programmable interrupt controller, real time clock.

The Microcontroller : Single-chip microprocessor, an introduction to microcontrollers, the 8051 internal RAM and registers, the 8051 interrupts system, the 8051 instruction set, other microcontrollers on the 8051 family.

Developing Microprocessor-Based Products : An introduction to the design process, preparing the specification, developing a design, implementing and testing the design, regulatory compliance testing, design tool for microprocessor development.

The practical work will be based on the above course.

MT-442 NUMERICAL METHODS

Error Analysis: Types of errors (relative, Absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart. Use any Computational tools to Analysis the Numerical Solutions.

Linear Operators: Functions of operators, difference operators and the derivative operators, identities.

Difference Equations: Linear homogeneous and non homogeneous difference equations.

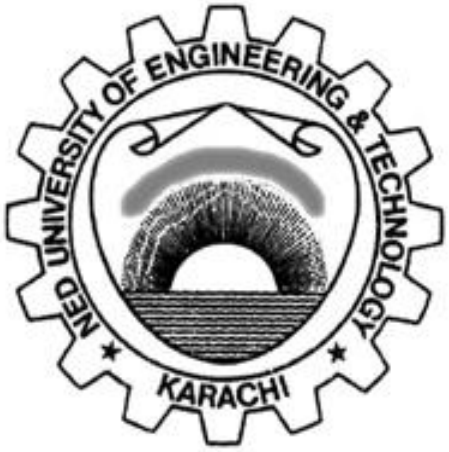
Solution of Non-linear Equations: Numerical methods for finding the roots of transcendental and polynomial equations (Secant, Newton – Raphson Chebyshev and Graeffe's root squaring methods), rate of convergence and stability of an iterative method.

Solution of Linear Equations: Numerical methods for finding the solutions of system of linear equations (Gauss- Elimination, Gauss-Jordan Elimination, triangularization, Cholesky, Jacobi and Gauss – Seidel).

Interpolation & Curve Fitting: Lagrange's, Newton, Hermit, Spline, least squares approximation. (Linear and non-linear curves).

Numerical Integration & Differentiation: Computation of integrals using simple Trapezoidal rule, $\frac{1}{3}th$ Simpson's rule, $\frac{3}{8}th$ Simpson's rule, Composite Simpson's and Trapezoidal rules, computation of solutions of differential equations using (Euler method, Euler modified method, Runge Kutta method of order 4). Numerical Solutions of Partial differential Equations, Optimization problem (Simplex Method). Steepest Ascent and Steepest Descent Methods.

DEPARTMENT OF ELECTRICAL ENGINEERING



INTERDISCIPLINARY COURSES

(APPLICABLE FROM BATCH 2010-2011)

EE -101 ELECTRICAL TECHNOLOGY

Electric and Magnetic Circuits:

Electric Circuits, Kirchoff's Laws, Superposition theorem, Substitution theorem. Thevenin's theorem, Norton's theorem, Rosen's theorem of star / mesh transformation, Proof for DC circuits and their application to circuit analysis, Magnetic Circuit, Series and parallel circuits, Principles of calculation of ampere turns for magnetic circuits of electromagnets, Transformers, Bipolar and multipolar DC machines Inductances in series and parallel, Hysteresis loss, Eddy current loss, Lifting power of magnet.

AC Single phase and Poly phase Systems:

Single-Phase systems, Series, Parallel and series parallel circuits, J operator method and polar method. Resonance and measurement of power and power factor, Poly phase system, Poly phase generation, Star and delta connections, Voltage and current relations, Balanced and unbalanced load analysis.

DC Machines:

Construction, Simple Lap and Wave Windings, Equalizing Connections and Dummy Coils, Elementary concept of armature reaction and commutation, Cross and demagnetizing ampere turns, DC Generator, Types, emf equation, Losses, Efficiency, Performance curves, Characteristics, Critical resistance and speed and effect of armature reaction of OCC, Internal and external characteristics from OCC neglecting and accounting armature reaction, Calculation of series ampere turns for level and over compounding. Motors, Principle, Back EMF, Torque, Speed and speed regulation, Types, Characteristics, Performance curves, Losses and efficiency, speed and torque problems involving magnetization curve, charging and ignition circuits of automobiles.

AC Synchronous Machine:

Construction, Stator Single Layer, Double Layer and Concentric Windings, Damping Windings, Coil span factor, Distribution factor, Leakage and armature reaction, Synchronous impedance, Alternators, Types, emf equation, speed and frequency, losses and efficiency, Alternator on load, Voltage regulation by synchronous impedance method, Synchronous Motors, Types, Principle of working, Vector diagram on load and its analysis for stator current, power factor, torque and mechanical output, Effect of variation of excitation, Losses and efficiency.

AC Induction Machines:

Induction Motors, Construction, Types, Rotating field theory, Principle of working, Slip and its effect on motor current quantities, Losses, efficiency and performance curves, Starting, Full load and maximum torque relations, Torque slip characteristics.

Transformers:

Construction, Principle of working, Emf equation, Transformation ratios, No load working and vector diagram, magnetizing current, Vector diagram on load, Equivalent Circuit, open circuit and short circuit tests, Losses, Efficiency and performance curves, All-day efficiency, Percentage and per unit R,X and Z Voltage regulation and Kapp's regulation diagram. Transformer as a mutually inductive circuit.

Converting Machines:

Rotary Converters. Construction, Principle of working, Transformer connections. Voltage and current ratios of single and three phase converters, Mercury arc Rectifiers, Construction, Operation, Transformer connection, Voltage and current ratios of single phase and three phase rectifiers.

The practical work will be based on the above course.

EE -102 ELECTRICAL ENGINEERING

Electric and Magnetic Circuits:

Electric Circuits, Kirchoff's Laws, Superposition theorem, Substitution theorem. Thevenin's theorem, Norton's theorem, Rosen's theorem of star / mesh transformation, Proof for DC circuits and their application to circuit analysis, Magnetic Circuit, Series and parallel circuits, Principles of calculation of ampere turns for magnetic circuits of electromagnets, Transformers, Bipolar and multipolar DC machines, Inductances in series and parallel, Hysteresis loss, Eddy current loss, Lifting power of magnet.

AC Single phase and Ployphase Systems:

Single-Phase systems, Series Parallel and series parallel circuits, J operator method and polar method. Resonance and measurement of power and power factor, Poly phase system, Poly phase generation, Star and delta connections, Voltage and current relations, measurement of power and power factor, Balanced and unbalanced load analysis.

DC Machines:

Construction, Simple Lap and Wave Windings, Equalizing Connections and Dummy Coils, Elementary concept of armature reaction and commutation, Cross and demagnetizing ampere turns, DC Generator, Types, emf equation, Losses, Efficiency, Performance curves, Characteristics, Critical resistance and speed and effect of armature reaction of OCC, Internal and external characteristics from OCC neglecting and accounting armature reaction, Calculation of series ampere turns for level and over compounding. Motors, Principle, Back EMF, Torque, Speed and speed regulation, Types, Characteristics, Performance curves, Losses and efficiency, speed and torque problems involving magnetization curve, charging and ignition circuits of automobiles.

AC Synchronous Machine:

Construction, Stator Single Layer, Double Layer and Concentric Windings, Damping Windings, Coil span factor, Distribution factor, Leakage and armature reaction, Synchronous impedance, Alternators, Types, emf equation, speed and frequency, losses and efficiency, Alternator on load, Voltage regulation by synchronous impedance method, Synchronous Motors, Types, Principle of working, Vector diagram on load and its analysis for stator current, power factor, torque and mechanical output, Effect of variation of excitation, Losses and efficiency.

AC Induction Machines:

Induction Motors, Construction, Types, Rotating field theory, Principle of working, Slip and its effect on motor current quantities, Losses, efficiency and performance curves, Starting, Full load and maximum torque relations, Torque slip characteristics.

Transformers:

Construction, Principle of working, Emf equation, Transformation ratios, No load working and vector diagram, magnetizing current, Vector diagram on load, Equivalent Circuit, open circuit and short circuit tests, Losses, Efficiency and performance curves, All-day efficiency, Percentage and per unit R,X and Z, Voltage regulation and Kapp's regulation diagram. Transformer as a mutually inductive circuit.

Converting Machines:

Rotary Converters. Construction, Principle of working, Transformer connections. Voltage and current ratios of single and three phase converters, Mercury arc Rectifiers, Construction, Operation, Transformer connection, Voltage and current ratios of single phase and three phase rectifiers

The practical work will be based on the above course.

EE -114 BASIC ELECTRICAL ENGINEERING

Electrical Elements and Circuits:

Energy and energy transfer, Electric Charge, Electric Current, Potential difference and voltage, Electric power and energy, Electric circuit sources and elements, Resistance, Ohm's law, Inductance, Capacitance, Fundamental circuit laws, Kirchhoff's Laws, Direct application of fundamental laws to simple resistive networks, Introduction to node voltage and loop current methods.

Steady State AC Circuits:

An introduction to periodic functions, RMS or effective Average and maximum values of current and voltage for sinusoidal signal wave forms. The Phasor method of analysis an introduction, Application of phasor methods to simple AC circuits, Power and reactive power, Maximum power conditions.

Magnetic Circuits and Transformers:

Magnetic effects of electric current, Magnetic circuit concepts, Magnetization curves, Characteristics of magnetic materials, Magnetic circuits with DC excitation, Magnetically induced voltages, Self inductance magnetic circuits with AC excitation, Hysteresis and eddy current losses, Introduction to transformer the ideal transformer.

Electromechanical Energy Conversion:

Basic Principles, Generated voltage, Electromagnetic Torque, Interaction of Magnetic Fields, Alternating Current Generators. Commutator Actions, DC Machine, Direct Current Generators, Electric Motors, Losses and Efficiency, Machine Application Considerations.

The practical work will be based on the above course

EE -115 ELECTRICAL TECHNOLOGY FUNDAMENTALS.

Electrical Elements and Circuits:

Energy and energy transfer, Electric Charge, Electric Current, Potential Difference and Voltage, Electrical Power and Energy, Electric circuits sources and elements, Resistance Ohm's law, Inductance, Capacitance, Kirchoff's Laws, Thevenin and Norton Equivalents, Superposition, Node voltage and Loop current methods.

Steady State AC and DC Analysis:

An introduction of periodic functions, RMS or effective, Average and Maximum values of current and voltage for sinusoidal signal wave forms. Introduction to phase method of Analysis, Simple AC and DC circuits, Real and Reactive power, Power Factor, Maximum power transfer condition.

Magnetic Circuits and Transformers:

Magnetic effects of electric current, Magnetic circuits concepts, Magnetic circuits with DC excitation, Magnetically induced voltage, LR and LC circuits with sinusoidal excitation, Introduction to transformer and related concepts, voltage and current relation, Introduction to AC motors.

Electrical Measurements and Instruments:

1. Introduction to Analog and Digital Multimeters and Frequency counters.

2. Measurement of AC/DC voltage and current using Analog and Digital meters.

3. Measurement of Frequency using Frequency counters.

The practical work will be based on the above course.

EE -116 PRINCIPLES OF ELECTRICAL ENGINEERING

Electric and Magnetic Circuits:

Circuits, Sources and Elements, Ohm's Law, Resistance, Inductance, Capacitance, Fundamental Circuit Laws, Kirchhoff's Laws. Direct Application of Fundamental Laws to simple resistive networks, Introduction to node Voltage and Loop current methods, Network Theorems, Star/mesh transformation.

Magnetic Circuit, Series and Parallel Circuit, Principles of Calculation of ampere turn.

AC Single Phase and Poly Phase Systems:

Single phase systems, Series, Parallel and series parallel circuits, J operator method and polar method. Resonance and measurement of power and power factor. Poly phase systems, Poly phase generation, Star and Delta connections, Voltage and current relations, measurement of power and power factor, Balanced load analysis.

DC Machines:

Construction and principle of DC machine, Simple lap and wave windings, Concept of armature reaction and commutation Cross and demagnetizing ampere turns. DC Generators, Types EMF equation, Losses, Efficiency principle Back EMF, Speed and speed regulation. Types, Characteristics, Performance Curves, Losses and efficiency, Speed and torque problems involving magnetization curve, charging and Ignition circuits of automobiles.

AC Synchronous Machines:

Working Principle and Constructing, Stator single layer, Double layer and concentric windings, Damping windings, Coil Span factor, Distribution factor, Leakage and armature reaction, Synchronous impedance. Alternators, Types, EMF equation, speed and frequency, Losses and efficiency, Alternator and load, Voltage regulation by synchronous impedance method, Synchronous Motors, Types Principle of working, vector diagram on load and its analysis for stator current, Power factor, Torque and mechanical output.

Effect of variation of excitation, Losses and efficiency.

AC Induction Machines:

Principle of induction Motors construction, Types, Rotating field theory, Principle of working, Slip and its effect on motor current quantities. Losses, efficiency and performance curves. Starting, Full load and maximum torque relations, Torque slip characteristics.

Transformers:

Construction, Principle of working, EMF equation, Transformation ratios, No load working and vector diagram, Magnetizing current, Vector diagram on load, Equivalent circuit, Open circuit and short circuit tests, Losses, Efficiency and performance curves, All day efficiency, Percentage and per unit R, X and Z. Voltage regulation.

Rectifiers and Applications:

Rectification, Half wave and Full wave rectifiers simple treatment, Elementary concept of amplification with transistor used as amplifier in common emitter configuration.

The practical work will be based on the above course.

EE -117 FUNDAMENTALS OF ELECTRICAL ENGINEERING

Electrical Elements and Circuits:

Energy and energy transfer, Electric Charge, Electric Current, Potential difference and voltage, Electric power and energy, Electric circuit Sources and Elements, Resistance, Ohm's law, Inductance, Capacitance, Fundamental circuit laws, Kirhhoff's Laws, Direct application of fundamental laws to simple resistive networks, Node voltage and loop current methods.

Steady State AC Circuits:

An introduction to periodic functions, RMS or effective Average and maximum values of current and voltage for sinusoidal signal wave forms. An introduction to phasor method of analysis, Applications of phasor methods to simple AC circuits, Power and reactive power, Maximum power conditions.

Magnetic Circuits and Transformers:

Magnetic effects of electric current, Magnetic circuit concepts, Magnetization curves, Characteristics of magnetic materials, Magnetic circuits with AC excitation, Hysteresis and eddy current losses, Introduction to transformer, The Ideal transformer.

Electromechanical Energy Conversion:

Basic Principles, Generated voltage, Electromagnetic Torque, Introduction of Magnetic Fields, Alternating Current Generators. Commutator Action, DC Machines, Direct Current Generators, Electric Motors, Losses and Efficiency, Machine Application Consideration.

Sinusoidal Steady State Analysis:

Network Response to Sinusoidal Driving Functions, Complex Impedance and Admittance Functions, Development of Concept of Phasors, Power Consideration,

Complex Power, Maximum Power Transfer, Tuned Circuits, Series and Parallel RLC Tuned Circuits, Definition of Quality Factor.

The practical work will be based on the above course.

EE -118 BASIC ELECTRICITY AND ELECTRONICS

DC Analysis:

Series and parallel electric circuits: Kirchhoff's voltage law(KVL) and Kirchhoff's current law(KCL),voltage divider and current divider rules; series-parallel circuits; Y-Delta conversions; methods of circuit analysis: mesh analysis and nodal analysis; network theorems: superposition, Thevenin's, Norton's and Maximum power transfer; Magnetic circuits: magnetic fields, flux density, permeability, reluctance, magnetizing force, hysteresis, Ampere's circuital law; capacitors and inductors: electric field and dielectric strength'; charging and discharging phase of capacitor; capacitor types; Faraday's law of electromagnetic induction; Lenz's law; charging and discharging phase of an inductor.

AC Analysis and Poly Phase Systems:

\ General format of sinusoidal voltage and current; phase relations; average power and power factor, frequency response of basic elements(R, L, C); rectangular and polar form conversions; series-parallel circuits with phasor diagrams; mesh analysis and nodal analysis; Network Theorems; passive filters: low pass, high pass, pass band, stop band filters; resonance: series resonant and parallel resonant circuits, poly phase systems.

Electrical Machines:

Introduction to electrical machines; Transformer: basic construction, operation and types; DC Motors and Generators: construction of DC motors and generators, working principles, equivalent circuits, losses and efficiency calculations; AC motors and generators: construction of AC motors and generators, working principles, equivalent circuits, losses and efficiency calculations, power and torque curves in generators.

Basic Electronics:

Introduction to electronics engineering; P-N Junction: Semiconductor theory, doping and energy bands, diode models, diode data sheet understanding, diode applications (half wave, full wave and bridge rectifier, clipper and clamper); BJT and FET construction, operation and characteristic curves, introduction to Digital electronics; Comparison with Analogue electronics.

EE -155 ENGINEERING DRAWING

Mechanical Drawing:

Drawing equipment and the use of instruments. Basic drafting techniques and standards, Geometrical curves including plan curves, Cycloid, Hypocycloid and the Involutes. Intersection at various positions of geometrical bodies, such as pyramids, Cylinders and Cones, Development of surfaces, Freehand sketch of machine and engine components, locking arrangement, foundation bolts, stuffing box, shaft couplings, foot step bearing, Engine connecting rod, Concepts of working drawings of components and parts of machine and engines, dimension and specifications.

Section of Machines and Engine Components:

Orthographic projections and standard practices, Isometric views with particular reference to piping and ducting.

Civil Drawing:

Plan, Elevations (front, left and right) and details of buildings such as Bungalows, Flats, Offices, Workshops school and market etc., Elements of Perspective drawings.

Electrical Drawing:

11 KV Electric substation building plan including equipment layout, Trenches (for cabling etc.) Manholes, Doors, Windows, Ventilators etc.

Cable and Earth continuity conductors plan including the size and specifications. Cable laying in trenches, directly in ground, in pipes while crossing the roads etc. Details of plate type and Rod type, Earthing Electrodes.

Schematic Diagrams of substations, lighting and power distribution boards, Electrical Symbols and One line diagrams of a typical power system.

The practical work will be based on the above course.

EE -211 CIRCUIT THEORY-I

Introduction to Circuit Concepts:

Basic two terminal circuit elements, Linear time invariant resistor, Linear time invariant capacitor, Linear time invariant inductor, energy concepts in two terminal elements, energy dissipated in a resistor, energy stored in an inductor and capacitor, ideal independent voltage and current sources.

Kirchhoff's Law:

Basic definitions of branch, loop and node, statements of Kirchhoff's voltage and current laws, linearly independent KCL and KVL, equation of KVL and KCL laws, series and parallel conceptions of two terminal one port circuit elements. Thevenin's theorem, Norton's theorem, Maximum power transfer theorem and Reciprocity theorem.

Elementary Transient Analysis:

Differential and integral forms of circuit equation, Initial voltage on a capacitor, initial current in an inductor, first order circuits, solution of single first order differential equations, particular and total solution of second order linear time invariant differential equations.

Sinusoidal Steady State Analysis:

Network response to sinusoidal driving functions, complex impedance and admittance functions, development of concept of phasors, power consideration, complex power, maximum power transfer, tuned circuits, series and parallel RLC tuned circuits, definition of quality factor.

Exponential excitation and Transformed Network:

Representation of excitations by exponential functions, single element responses, forced response with exponential excitation, introduction to the transformed network, driving point impedance and admittance.

Nonsinusoidal Periodic Analysis:

Fourier Series and it's use in Circuit Analysis, Evaluation of Fourier Coefficients, Waveform symmetries, exponential form of Fourier series, Steady state response to periodic signals.

Magnetically Coupled Circuits:

Mutual inductance, Dot conventions, energy considerations, the linear transformer and ideal transformer.

The practical work will be based on the above course.

EE -221 INSTRUMENTATION

General Theory:

Classification, performance and characteristics, absolute and secondary instruments, indicating, recording and integrating instruments, controlling balancing and damping, static and dynamic characteristics.

Ammeter and Voltmeter:

Classification, moving iron, moving coil, thermal, electrostatic and induction type, errors extension of ranges, CTs and PTs their burden and accuracy.

Power and Energy Meters:

Wattmeter types, Active and Reactive power measurement, Max. demand indicator, Calibration, Classification of energy meter, KWH meter and KVARH meters, P.F. meter.

Electronic Instruments :

Electronic and digital voltmeters, counters, digital frequency meter, time interval measurement, RLC meter, Power and energy meter, oscilloscope and its use.

Basic Concepts:

Basic concepts of measurement, measurement of resistance, inductance and capacitance, potentiometer and bridge methods.

Magnetic Measurement:

Measurement of field strength flux, permeability, B-H curve and hysteresis loop, magnetic testing of materials.

Transducers:

Variable, resistance and inductance transducers, linear variable differential transformer (LVDT), capacitive, Photconductive and piezo-electric transducers, thermo electric transducers. Filtering, Instrument amplifiers, A/D conversion.

Measurement of Non-electrical Quantities:

Measurement of temperature, pressure, flow, strains, thermal conductivity, motion, speed and vibrations, thermal and nuclear radiations.

High Voltage measurement:

Measurement of dielectric strength of insulators, high voltage surges.

The practical work will be based on the above course.

EE -222 INSTRUMENTATION & MEASUREMENT

Functional Description and Performance Characteristics of Instruments:

Analog and Digital mode of operations, Static and Dynamic characteristic, Resolution, Sensitivity, Accuracy, Hysteresis, uncertainty, range, Repeatability, Engineering Units and Standards.

Data Conversion

Sampling, DAC, ADC, V/f and f/V converters.

Measuring Instruments:

Principle, construction and working of DC and AC AVO meters, power meters, Power factor metes, DC & AC Bridges.

Electronics Instruments:

Working principle of analog, digital and sampling oscilloscope, frequency generator, frequency counter and logic analyzer.

Transducer Principles and Types:

Variable Resistance and inductance transducers, Hall effect, Linear Variable Differential Transformer (LVDT), Capacitive, Photoconductive, Piezo-Electric Transducers, Thermo electric transducers, Optical Transducers.

EE -246 ELECTRICAL MACHINES

Three Phase Circuits:

Three phase voltages, Currents and power, Star and Delta connected circuits, Analysis of balanced three phase circuits, Line diagram, Power and power factor measurement in 3-phase circuits.

Transformer:

Basic principles, Single and 3-phase transformers, Construction, General transformer equation, Voltage and current relations in transformer, Ratio of transformation, Loading a transformer, Equivalent circuits of a transformer, OC and SC tests, Regulations and methods of calculation of regulation, Efficiency and calculation of efficiency, Auto transformer, 3-phase transformer.

Direct Current Machines:

Electric circuit aspects of DC machine,Magnetic circuit aspects, Types of DC generator, Performance, Types of motors, Performance, Motor speed control, Transient and dynamic responses, Transfer functions and frequency response.

Alternating Current Machines:

Rotating magnetic field, Induction motor action, Induction motor characteristics and performance, Synchronous generator characteristics and performance, Synchronous motors, Induction motor, Speed control elementary AC two phase control motors, Constructional features of fractional horse power AC motors.

Direct Current Machines Winding:

Gramme Ring winding, Simple lap and wave windings, Diagrams and developments and elementary calculations.

Control Systems:

Motor drive systems, Introduction to feedback control systems, System aspects and classification, Elements of analysis of feedback control systems, Digital control systems.

The practical work will be based on the above course.

EE -262 PROGRAMMING WITH C-LANGUAGE

The Turbo C Programming Environment:

Setting up the Integrated Development Environment, File used in C program Development, using the Integrated Development Environment, the Basic Structure of C programs, Explaining the print f ( ) Function.

C Building Blocks:

Variables, Input/ Output, Operators, Comments.

Loops:

The for Loop, The while loop, The do while loop.

Decisions:

The if statement, the if-else statement: the else-if construct. The switch statement, the Conditional operator.

Functions:

Simple Functions, Functions that return a value, using arguments to pass data to a function, using more than one functions, external variables, prototype versus classical K and R, Preprocessor directives.

Arrays and strings:

Arrays, Referring to individual Elements of the Array, String.

Pointers:

Pointer Overview, Returning data from functions, pointers and Arrays, ointers and Strings, Double Indirection, Pointers to Pointers.Structures, unions, and ROM BIOS.

Turbo C Graphics Functions:

Text-mode Functions Graphics - Mode Functions. Text with Graphics.

Files:

Types of Disk I/O, Standard, Input/ Output Binary Mode and Text mode, Record, input/ Output, Random Access, Error Conditions, System-Level Input/ Output, Redirection.

Advanced Variables:

Storage Classes, Enumerated data type, Renaming data type with typedef, Identifiers and Naming classes, type conversion and casting, labels and goto statement.

C++ and Object Oriented Programming:

Object Oriented Programming, some useful C++ features classes and objects, constructors and memory Allocations, Inheritance, Function Overloading, Operator Overloading

The practical work will be based on the above course.

EE -281/EE-382 ELECTROMAGNETIC FIELD

Vector Analysis:

scalars and vectors, vector algebra, the Cartesian coordinate system, vector components and Unit vectors, the vector field, the dot product the cross product, other

coordinate systems, circular cylindrical coordinates, the spherical coordinate system, transformations between coordinate systems.

Coulomb's Law and Electric Field Intensity:

\ The experimental law of coulomb, Electric field intensity, field of a point charge, field due to a continuous volume charge distribution, field of line charge, field of sheet charge, streamlines & sketches of fields.

Electric Flux Density Gauss's Law and Divergence:

Electric flux density, Gauss's law, application of Gauss's law, some symmetrical charge distributions, differential volume element, divergence, Maxwell's first equation, electrostatics, the vector operator and the divergence theorem.

Energy and Potential:

Energy expanded in moving a point charge in an electric field, the line integral, definition of 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.

Conductor Dielectrics and Capacitances:

Current and current density continuity of current metallic conductors, conductor properties and bounded conditions, semi conductors, the nature of dielectric materials, capacitance, several capacitance examples, of a two wire lines. Curvilinear square, physical modules, current analogies, fluid flow maps the iteration method.

Poisson's and Laplace's Equations:

Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, examples of the solution of poison, product solution of Laplace's equation.

The Steady Magnetic Field :

Biot Savart's Law, Amperes circuit law, curl, Stoke's theorem, Magnetic flux and magnetic flux density, the scalar and vector magnetic potentials, 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 element, 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 equation in point form, Equation in integral form, the related potentials

The Uniform Plane Wave:

Wave motion in free space, wave motion in perfect dielectric, plane waves in loose dielectrics. The Pointing vector and power considerations, propagation in good conductors, skin effect, reflection of uniform plane waves standing wave ratio.

The practical work will be based on the above course.

EE -312 CIRCUIT THEORY- II

Matrix Analysis:

Introduction and review of Matrix theory, Determinants and Matrix inversion, systematic Formulation of network equations, Loop variable analysis, Node variable analysis, state variable analysis, formulation of state equations, source transformations, duality.

Elementary Time Functions:

Introduction to singularity functions, The impulse function and response. The unit step function and response, Ramp function, Exponential function and response. Analysis of Networks by Laplace transformations. Review of the Laplace transformation, application to network analysis.

Two Port network:

Introduction, Characterization of Linear Time Invariant Two ports by six sets of parameters, Relationship among parameter sets, Interconnection of two ports.

Large Scale Network:

Topological description of Networks, Basic definition and notations, Matrix representation of a graph, state space representation, Tellegin's Theorem.

Networks Functions and Frequency Response:

The concept of complex frequency, Transform impedance and transform circuits, Network functions of one and two ports. Poles and zeros of Network functions, restrictions on poles and zeros of transfer function, Magnitude and phase, Complex Loci' Plots from the plane phasors.

Fourier Transform:

Fourier transform applications in circuit analysis in relation to frequency and time domain functions.

The practical work will be based on the above course.

EE -315 ELECTRIC FILTERS

Introduction:

Circuit Design Problem, Kind of Filters and Terminology, Passive Filters, Choice of Analog filter.

Active Device Used In Active Filters:

Operational amplifiers, operational trans-conductance amplifiers, circuit based on OAs and OTAs, characteristics of OTAs, OA and OTA based integrators.

Circuit Design Approach:

Direct form of synthesis approach, cascade form of synthesis, simulation of impedance.

Design of 1st Order Filter Sections, Cascade:

Design with 1st order section, all pass circuits, phase shaping.

The Biquad Circuit:

Design parameters Q and w_o , the bi-quad circuit and its response, four op-amp bi-quad circuit, phase response.

Sensitivity Analysis:

Definition of Bode sensitivity, sensitivity analysis of sallen-key circuit, sensitivity comparison of circuit.

Circuit Design With Simulated Elements:

The ideal gyrator circuit GIC and FDNR, realization of negative elements, realization of floating elements, circuit design.

Switched Capacitor Filters:

The MOS switch, switched capacitor, analog operations, 1st and 2nd order filters.

Better OP-AMP Models:

Realization of filter and oscillators, active R and active C Circuit approach.

Discrete Time Filters:

Elements of FIR and IIR filter design, filter structures, windowing process, aliasing error and quantization effect.

The practical work will be based on the above course.

EE-316/ EE-216 CIRCUIT THEORY

Elementary Transient Analysis:

Differential and integral forms of circuit equations, Initial voltage on a capacitor, Initial current in an inductor, First–order circuits, Solution of single first order differential equations, particular and total solution of second order linear time invariant differential equations.

Matrix Analysis:

Introduction and review of Matrix theory, determinants and matrix inversions, Systematic formulation of network equations, Loop variable analysis, State variable analysis, formulation of state equations, source transformations, Duality.

Elementary Time Functions:

Introduction to singularity functions, The impulse functions and response, The unit step function and response, Ramp function, Exponential function and response.

Exponential Excitation and the Transformed Network:

Representation of excitations by exponentials functions, Single element response, Forced response with exponential excitation, Introduction to the transformed network, Driving point impedance and admittance.

Laplace Transformation:

Analysis of networks by Laplace transformation. Review of Laplace transformation, Application to network analysis.

Two Port Network :

Introduction, Characterization of linear time invariant two-ports by six sets of parameters, Relationship among parameter sets, Interconnection of two ports.

Networks Functions and Frequency Response:

The concept of complex frequency, transform impedance and transform circuits, Network functions, One & Two ports. Poles and zeros of network functions, Restrictions on pole and zero transfer function, magnitude and phase, Complex Loci's plots from the plane phasors.

The practical work will be based on the above course.

EE -372/ EE -472 LINEAR CONTROL SYSTEMS

Introduction:

Introduction to control systems, examples and classifications, Feedback and its characteristics. Nature and representation of control system problem, block diagram fundamentals, terminology of block diagram for a feedback control system, block diagram representation of various control systems.

Linear Systems and Differential Equations :

Methods of writing differential equations of various physical systems such as static electric circuits, mechanical translational and rotational systems, thermal systems, hydraulic linear and rotational transmission systems, electromechanical dynamic systems DC and AC speed control systems.

Time-Response of Linear Systems:

Types of standardized inputs to linear systems, steady state response and transient response of systems to standard inputs, response of second order systems, time response specifications.

Laplace Transforms:

Definition, derivation of Laplace transforms of sample functions, Laplace transform theorems, transformations of differential equations of physical systems, inverse transformation techniques, stability, Routh's stability criterion.

Block Diagram Algebra:

Transfer functions of physical systems, canonical and unity feedback forms of control system block, system block diagram, block diagram reduction techniques, signal flow graph algebra, block diagram reduction using signal flow graphs.

Control System Characteristics:

Classification of feedback systems by type, analysis of system types, error coefficients, error constants, sensitivity.

Root Locus :

Introduction, rules for construction of root locus, qualitative analysis of root locus, the spi-rule, analysis of performance characteristic of systems in time domain, dominant pole zero approximations, gain margin and phase margin, root locus compensation. Phase & gain compensation, root locus compensation, PID controller.

Frequency Response:

Introduction, transfer function of systems in frequency domain magnitude and phase angle frequency response of plots of closed loop control systems, correlation of response in frequency and time domain.

Bode Analysis:

Introduction to logarithmic plot, Bode plots of simple frequency response functions, Bode plots of type 0, type 1 and type 2 systems, phase margin, Gain margin and stability, closed loop frequency response, gain factor compensation.

Nyquist Analysis:

Introduction to polar plots, direct and inverse polar plots of type 0, type 1 and type 2 systems, Nyquist stability criterion, phase margin, gain margin and stability on direct and inverse polar plots.

Performance Analysis of Systems on Polar Plots:

M_m and W_w of simple second order system, correlation of frequency and time responses. Construction of M_m and W_w contours for performance analysis on Direct and Inverse polar plots, gain adjustments on direct and inverse polar plots.

Nichols Chart Analysis:

The Nichols chart, decibel magnitude and phase angle plots of type 0, type 1 and type 2 systems

phase margin, gain margin. The practical work will be based on the above course.

EE -373 MACHINE CONTROL SYSTEM

Open and closed loop control, feedback simple control system, sequence control, static switching and logic Switching Algebra. Stability, accuracy, frequency and transient response.

Time Scale Effects

Linear control system, determination of system performance and design with reference to stability. Transient response, steady state accuracy and frequency response. Laplace transformation method: Root Locus, Nyquist criteria and Bode plots, Conformal plotting. Series parallel and feedback techniques of system compensation. Three term pneumatic controller for chemical plants. Control system types; regulations, Servomechanism. Electrical, hydraulic and pneumatic amplifier.

Instrumentation:

Analysis of the performance of electro mechanical transducers used in control.

The practical work will be based on the above course.

EE -444 ELECTRICAL DRIVES

Variable Speed Drive Systems:

Elements of the drive system. The Mechanical systems, Compressors, Centrifugal pumps or fans, constant power drives, Transmission, winch drive and crane hoist. Required drive characteristic. Type of sources. Selection of Drive elements.

DC Motors:

Characteristics of separately and self-excited DC motors. Classical methods of speed control of DC Motors. Block diagram representation and closed loop control of DC motors.

Induction Motors:

Equivalent circuit, analysis of performance using equivalent circuit. Characteristics of induction motors. Speed control of induction motors by classical methods.

Solid state AC to DC Converters:

Semi conductor power devices, Power diodes, Thyristors, Transistors and MOSFETS. Single phase uncontrolled, semi and fully controlled bridge rectifiers

Solid State DC Drivers:

Single phase and Three phase DC drives using single phase and three phase converters.

Solid State Chopper Drivers:

Introduction to DC choppers. Chopper fed DC drives.

Solid State Inverters:

Single and three phase inverter circuits. Square wave and PWM inverters. Voltage source and current source inverters.

Solid State AC Drivers:

Inverter fed AC drives, Voltage and frequency control techniques, analysis of performance.

The practical work will be based on the above course.

EE 474 FEEDBACK CONTROL SYSTEMS

Introduction: Introduction to control systems, examples and classifications, Feedback and its characteristics. Nature and representation of control system problem, block diagram fundamentals, terminology of block diagram for a feedback control system, block diagram representation of various control systems.

Linear Systems and Differential Equations : Methods of writing differential equations of various physical systems such as static electric circuits, mechanical translational and rotational systems, thermal systems, hydraulic linear and rotational transmission systems, electromechanical dynamic systems DC and AC speed control systems.

Time-Response of Linear Systems: Types of standardized inputs to linear systems, steady state response and transient response of systems to standard inputs, response of second order systems time response specifications.

Laplace Transforms: Definition, derivation of Laplace transforms of simple functions, Laplace transform theorems, transformations of differential equations of physical systems, inverse transformation techniques, stability, Routh's stability criterion.

Block Diagram Algebra: Transfer functions of physical systems, canonical and unity feedback forms of control system block system block diagram, block diagram reduction techniques, signal flow graph algebra, block diagram reduction using signal flow graphs.

Control System Characteristics: Classification of feedback systems by type, analysis of system types, error coefficients, error constants, sensitivity.

Root Locus : Introduction, rules for construction of root locus, qualitative analysis of root locus, the spirule, analysis of performance characteristic of systems in time domain, dominant pole zero approximations, gain margin and phase margin, root locus compensation. Phase & gain compensation, root locus compensation, PID controller.

Frequency Response: Introduction, transfer function of systems in frequency domain, magnitude and phase angle frequency response of plots of closed loop control systems.

Introduction to Digital Control: Computer as control device, Single-loop digital control system, Digital control: pros and cons, Data Converters.

Linear Difference Equations (LDE) and z-transform: Scalar difference equation, z-transform of simple sequences and inversion, solving LDE using partial fraction and z-transform, z-domain transfer function and impulse response, relation between S and z-domain.

Digital control system design techniques: Digital control strategies and implementation, closed-loop characteristic equation, z-domain design considerations, General PID digital control algorithm, Tuning procedure for PID controller.

EE-393/EE-493 DIGITAL SIGNAL PROCESSING

Relationship between sampling frequency and Shannon's theorem, continuous time and discrete time signals. The z-transform and the inverse z-transform. Discrete Fourier transform and fast Fourier Transform.

Elements of FIR and IIR filter design. Filter structures.

FFT techniques for high speed convolution, windowing process, aliasing error and its relation, quantization effects.

The practical work will be based on the above course.