CE/CS/EB/EC/EE/EI/ME/MRE/IT/SE 301 ENGINEERING MATHEMATICS – III

Module I

Fourier series and Fourier Integrals: Periodic functions, Euler formulae for Fourier coefficients, functions having arbitrary period, even and odd functions, half range expansions, Fourier integral, Fourier cosines and sine transformations, linearity property, transform of derivatives, convolution theorem (no proof)

Gamma and Beta functions, error functions – definitions and simple properties.

Module II

Special functions: Legendre polynomial, Rodrigue's formula – generation function, recurrence formula for Pn(x), orthogonality. Bessel function, Jn(x) – recurrence formula , general function, orthogonality.

Module III

Partial differential equations: Solutions of equations of the form F(p,q)=0, F(x,p,q)=0, F(y,p,q)=0, F(z,p,q)=0, $F_1(x,p)=F_2(y,q)$, Lagrange's form Pp+Qq=R.

Vibrating string: one dimensional wave equation, D'Alembert's solution, solution by the method of separation of variables. One dimensional heat equation, solution of the equation by the method of separation of variable, solution of Laplace's equation over a rectangular region and a circular region by the method of separation of variables.

Module IV

Probability and Statistics: Probability distributions: random variables (discrete and continuous), probability density, mathematical expectation, mean and variance of probability distribution, binomial distribution, Poisson approximation to the binomial distribution, uniform distribution, normal distribution.

Curve fitting : method of least squares, correlation and regression, lines of regression.

Module V

Sampling distributions: population and samples, the sampling distribution of the mean (? known), the sampling distribution of the mean (? unknown), the sampling distribution of the variance, point estimation, interval estimation, test of hypothesis, null hypothesis and significance tests, hypothesis concerning one mean, type I and type II errors, hypothesis concerning two means.

The estimation of variances: Hypotheses concerning one variance – Hypotheses concerning two variances.

Note: Treatment of the topics under Modules IV, V should be oriented towards application of the statistical techniques to problems in real life.

Reference :

1) Ervin Kreyszig : Advanced Engineering Mathematics, Wiley Eastern
2) Petter, Goldberg : Mathematical Methods, Prentice Hall
3) Churchil R.V. : Fourier series and Boundary value problems, McGraw Hill
4) Irvin Miller & Friend : Probability and statistics for Engineers, Prentice Hall of India
5) Bowker and Lieberman : Engineering Statistics, Prentice Hall
6) Kirk-Patrick : Introductory statistics and probability for engineering science and technology, Prentice Hall
7) Parzen E. : Modern Probability Theory and its applications, Wiley eastern.

EE 302 STRENGTH OF MATERIALS AND FLUID MECHANICS

Module I

Tension, compression and shear: - Types of external loads, internal forces, normal and shear stresses, strain, Hooke's law, Poisson's ratio, relationship between elastic constants, stress strain diagrams, working stress, elongation of bars of constant and varying sections, stresses on inclined planes for uniaxial and biaxial stress fields, principal stresses, Mohr's circle for stresses, principal strains.

Module II

Bending moment and shearing force :- Different types of beams, shear force and bending moment diagram for simply supported and cantilever beams, relationship connecting intensity of loading, shearing forces and bending moments.

Stresses in laterally loaded symmetrical beams :- Theory of simple bending, limitations, bending stresses in beams of different cross-sections, moment of resistance, strain energy due to bending.

Torsion:- Torsion of solid and hollow circular shafts, strain energy in shear and torsion, close coiled helical springs.

Module III

Properties of fluids :- Pressure, density and specific weight – various types of manometer and pressure gauges – transmission of fluid pressure – continuity equation for one-dimensional steady flow – Bernoulli's equation for steady one-dimensional incompressible flow – venturimeter – Orificemeter – Pitot tube – Notches – Weirs.

Flow through pipes:- Laminar flow, steady Laminar flow in circular pipes – equation for head loss in pipes due to friction – Darcy Weishach equation – Chezys formula – transmission of power through pipes – simple problems.

Module IV

Impact of jet on vanes – flat, curved, stationary and moving vanes – hydraulic turbines – Pelton Wheel, Francis turbine and Kaplan turbines – work done and efficiency – specific speed – selection of water turbines for power plants – governing of turbines.

Module V

Positive displacement pumps :- Reciprocating pumps – air vessels and their purposes – separation and cavitations – slip and efficiency – multicylinder pumps.

Roto dynamic pumps :- Centrifugal pumps – impeller, casing, manometric head – work, efficiency and losses – priming – specific speed – multi stage pumps – selection of pumps – jet pumps, gear pumps, vane pumps.

References:

1) Mechanics of structure : Junarkar
2) Strength of material : Ramanathan
3) Strength of Material and Mechanics of Structures : Dr. Punmiar
4) Hydraulics : Addison
5) Hydraulics and Fluid Mechanics : Dr. Jagadish Lal
6) Fluid Mechanics : N.S Govinda Rao
7) Hydraulics and fluid mechanics : Modi and Seth.
8) Elements of Strength of Material, East West Press : Timoshinko & Young
9) Mechanics of Materials, Prentice Hall : E P Popov

EI/EE 303 NETWORK ANALYSIS

Module I

Review of basic circuits concepts – classification of circuits, passive circuit elements, characteristics, sources, Kirchoff's Laws, definition of Graphs, outsets and loops, true incidence matrix – Network theorems – substitution, superposition, reciprocity – Maximum power transfer, Thevinin's , Norton's.

Module II

Review of node and mesh analysis by inspection : Application of graph theoretic methods to formulation of network equations – two port networks – characteristics in terms of hybrid and transmission parameters, Inter-connection of 2-port – series, parallel and cascade.

Module III

Transients in linear circuits – initial conditions – rise and decay of current in RL circuit – time constant – RC circuits with impressed DC voltage – RL and RC circuits with applied sinusoidal voltage – DC transient in RLC circuits – damping

Module IV

Signal representation and network response: Characteristics of signals – Unit step function, impulse and ramp function, non-sinusoidal signals – representation of a wave using Fourier series expansion – frequency spectrum of periodic wave forms – Fourier integral and Fourier transforms, discrete and continuous frequency spectra

Module V

Network transmission criteria: Signal distortion in transmission – relationship between bandwidth and rise time, delay time and network function – filters – analysis of constant K and M derived filters – network synthesis Foster and Cauer forms.

Reference:

1) Evoritt and Annour : Communication Engineering
2) Pottie & Fitch : Theory of network and linear systems
3) Van Valkinburg : Network Analysis
4) Rider : Network Lines and Fields
5) C.A Demoor and E J Kah : Basic Circuit Theory
6) N C Gupta : Circuit Analysis
7) Sudhakar : Circuits & Network Analysis & Synthesis

CS/EB/EC/EE/EI 304 DIGITAL ELECTRONICS

Module I

Number System and binary codes: Binary, Octal and Hexadecimal number systems – binary arithmetic, binary codes, excess-3 code, Gray code error detection and correction – Boolean algebra – minimisation of Boolean functions using Karnaugh map and Quine-Mclusky methods – formation of switching functions from word statements, realisation using NAND, NOR & XOR gates – combinational circuits – multiplexer – demultiplexer, decoder, encoder.

Module II

Sequential circuits: flip-flops – RS, JK, T & D flip-flops, shift registers – counters – asynchronous and synchronous counters, up-down counters, Modulo counter, ring counter, Johnson counter – sequence generators – analysis of sequential circuits – state table and diagrams.

Module III

Arithmetic circuits: Half adder, full adder, subtractor, serial and parallel addition – carry look ahead adder – binary multiplication and division – multivibrators – monostable and astable multivibrators using discrete gates.

Module IV

Memories – ROM , RAM, EPROM, Programmable logic array, devices – basic ideas – PLD architecture – PAL and PLA – programmable examples with software tools – study of PAL 22v10.

Module V

Logic families: DCTL, RTL, DTL, TTL, ECL, and CMOS – tristate logic – specification and transfer characteristics of basic TTL interfaces, - standard logic levels – current and voltage parameters – fan in and fan out – propagation delay, integrated circuits modules, noise consideration – interfacing of CMOS to TTL and interfacing of TTL to CMOS.

Reference:

1) Taub & Schilling : Digital Integrated Electronics
2) Samuel C Lee : Digital Circuits and Logic Design
3) A P Malvino : Digital Computer Electronics
4) Morris & Miller : Design with TTL Integrated Circuits
5) Peatman : Digital Hardware Design
6) Ronald J Tacobi : Digital Systems, Principles and Applications

EB/EC/EE/EI 305 SOLID STATE ELECTRONICS & CIRCUITS

Module I

Band Theory of solids – conductors, semiconductor and insulators – energy band diagram – semiconductor materials and their properties – elemental semiconductors – the energy band model of semiconductor – valence band model of semiconductor –equilibrium concentration of electrons and holes – fermi level and energy distribution of carriers inside the bands – temperature dependence of carrier concentration inside the bands – carrier transport in semiconductor – drift of carriers in electric fields, carrier flow by diffusion – constancy of fermi level across junction, excess carriers in semiconductors – injection of excess carriers – recombination of excess carriers – continuity equation – current flow equation.

Module II

PN junction – abrupt PN junction – energy band diagram - barrier potential, biasing PN junction, excess carrier calculation – current components diffusion – drift – boundary conditions for long and short diodes – solution – PN junction characteristics – calculation of diffusion –layer capacitance – simple model – principle of Zener and avalanche diodes – photodiodes – LDR – tunnel diode and PIN diode – varactor diode.

Module III

Bipolar junction transistor – NPN, PNP types, Basic structure – biasing – mechanism of carrier flow – current components in transistors boundary conditions in active region – solution for short base width – base width modulation – transistor configuration – characteristics – current amplification factor – relations between alpha & beta – comparison – Ebbers-Moll model – field effect transistors – JFET – basic structure – principles of operation – characteristics and current equation – basic principles of phototransistors – UJT – characteristics.

Module IV

MOSFET – semiconductor surfaces – C-V characteristics – the $Si\text{-}SiO_2$ system – basic structure and operating principles – current equation – V-I characteristics – simple model – CMOS. Compound semi conductor – semiconductor heterojunctions – V-I characteristics – real heterojunctions – frequency limitation of transistor – transit time effect – heterojunction bipolar transistor.

Module V

DC power supplies – power transformers – rectification – half wave, full wave, bridge – expression for ripple factor, efficiency, comparison, diode ratings filters – capacitor – inductor LC filters – use of bleeder resistor – voltage multipliers – dual power supplies – simple voltage regulator. Series regulators – IC regulators.

Text Books

1. Streetman, “Solid State Electronics Devices”, PHI (Module I to IV)
2. Ramanan, “Functional Electronics” (Module V)

References

1) SM SZE, “Semi conductor devices and technology”
2) SM SZE, “VLSI technology”
3) SM SZE, “Physics of semi conductor devices”
4) “Electronic Devices”, Learning Material Series, ISTE, New Delhi 1997
5) Electronic Devices & Circuits, Millman & Halkias
6) Solid state electronics IVth edition, George B Rutkowaki, McGraw Hill

EE 306 ELECTRONICS LABORATORY -I

1. Familiarisation with electronic components, devices and equipments.
2. Study of Cathode Ray Oscilloscopes
3. Characteristics of semiconductor diodes – Germanium diodes, silicon diode and Zener diode
4. Characteristics of BJT in CE configuration – drawing maximum power dissipation curve and fixing the operating point in the linear region of operation.
5. Static characteristics of the BJT in CB configuration
6. Characteristics of FET and drawing equivalent circuit.
7. Rectifiers and filters: Study of waveform with and without capacitor filters – calculation of % regulation, ripples factor and transformer utilisation factor.
8. FET amplifier: Measurement of input impedance, output impedance, voltage gain and current gain.
9. BJT CE amplifier: Measurement of input impedance, output impedance, voltage gain, current gain and distortion. Determination of h parameters.
10. BJT emitter follower: Measurement of input impedance, output impedance, voltage gain and current gain.
11. Measurement of frequency, voltage, current and phase difference using CRO.
12. UJT Relaxation Oscillator – Design and setting up of the circuit.
13. Frequency response of RC coupled amplifiers.
14. Clipping, clamping and slicing circuits using diodes.

Student shall present his/her fair record, notebook duly certified by the Head of the Department, to the examiners at the time of University practical examination.

EE 307 BASIC ELECTRICAL ENGINEERING LABORATORY

1. Determination of the voltage-current characteristics of linear resistance and an incandescent lamp
2. Measurement of linear resistance using voltmeter and ammeter.
3. Potential divider connection of rheostat and dependence of outp ut voltage upon the value of the load resistance.
4. Study of PMMC and MI voltmeters and ammeters, dynamometer type wattmeter, clip on ammeter, standard symbols on the dials of the meters
5. Verification of Kirchoff's laws using rheostats.
6. Verification of superposition theorem in a resistive circuit with two given d.c. sources.
7. Verification of Thevenin's theorem in d.c. circuits.
8. Verification of generalised Reciprocity theorem in a d.c. circuit.
9. RLC series parallel circuit – Measurement of current in various branches and verification by calculation – drawing Phasor diagram.
10. Study of voltage – current relationship of series circuit with given RLC elements and condition for series resonance.
11. Determination of fusing time versus current characteristics for two specimens – Fusing factor – study of various types of fuses.
12. Single phase power measurement using a wattmeter – determination of thermal efficiency of a kettle.
13. Measurement of power in a single phase circuit by a) three voltmeter method b) three ammeter method c) verification using wattmeter.
14. Measurement of power in three-phase circuits.

Student shall present his/her fair record, notebook duly certified by the Head of the Department, to the examiners at the time of University practical examination.

CE(A)/CS/EB/EC/EE/EI//ME/IT/SE 401 ENGINEERING MATHEMATICS IV

Module I

Complex Analytic functions and conformal mapping : curves and regions in the complex plane, complex functions, limit, derivative, analytic function, Cauchy – Riemann equations, elementary complex functions such as powers, exponential function, logarithmic, trigonometric and hyperbolic functions.

Conformal mapping: Linear fractional transformations, mapping by elementary functions like e^z, sin z, cos z, sinh z, and cosh z, Sohwarz – Christoffel transformation.

Module II

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, Taylor's series, Laurent's series, residue theorem, evaluation of real integrals using integration around unit circle, around the semi circle, integrating contours having poles, on the real axis.

Module III

Numerical Analysis : Errors in numerical computations, sources of errors, significant digits. **Numerical solution of algebraic and transcendental equations**: bisection method, regula falsi method, Newton-Raphson method, method of iteration, rates of convergence of these methods.

Solution of linear system of algebraic equations: exact methods, Gauss elimination method, iteration methods, Gauss-Jacobi method.

Polynomial Interpolation: Lagrange interpolation polynomial, divided differences, Newton's divided differences interpolation polynomial.

Module IV

Finite differences: Operators ?, ?, E and ?, Newton's forward and backward differences interpolation polynomials, central differences, Stirlings central differences interpolation polynomial.

Numerical differentiation: Formulae for derivatives in the case of equally spaced points.

Numerical integration: Trapezoidal and Simpson's rules, compounded rules, errors of interpolation and integration formulae. Gauss quadrature formulae (No derivation for 2 point and 3 point formulae).

Module V

Numerical solution of ordinary differential equations: Taylor series method, Euler's method, modified Euler's method, Runga-Kutta formulae 4^{th} order formula.

Solution of linear difference equations with constant co-efficients: Numerical solution of boundary value problems, methods of finite differences, finite differences methods for solving Laplace's equation in a rectangular region, finite differences methods for solving the wave equation and heat equation.

Reference:

1) Evin Kreyszig : Advanced Engineering Mathematics, Wiley Eastern.
2) S.S. Sastry: Introductory Method of Numerical Analysis, Prentice Hall of India.
3) Ralph G. Stanton : Numerical Methods for Science and Engg, Prentice Hall of India.
4) S.D. Conte and Carl de Boor : Elementary Numerical Analysis Analograthmic approach McGraw Hill.
5) M.K. Jani, S.R.K Iyengar and R.K. Jain : Numerical Methods for scientific and Engineering Computations. Wiley Eastern.
6) P. Kandaswamy K. Thilagavathy K. Gunavathy : Numerical Methods, S.Chand & Co.
7) E.V Krishnamurthy, S.K. Sen : Numerical Algorithms, Affiliated East West.

EB/EC/EE/EI 402 ELECTRONICS CIRCUITS

Module I

Small signal amplifiers: Units of gain, low, frequency equivalent circuits – ?-parameters, h-parameters – CE amplifiers – Biasing techniques –stabilization of operating point – methods of coupling – DC coupled amplifier – CE RC coupled amplifier – concept of load lines – loading effect at the input and output – emitter follower as Buffer stage – Boot strapping – frequency response of RC coupled amplifier – frequency analysis of RC coupled amplifier – lower cut-off frequency – upper cut-off frequency – 3 db bandwidth – frequency response of DC coupled amplifier.

Module II

FET amplifier : RC coupled common source amplifier – expression for gain – frequency response – comparison with BJT – FET as voltage variable resistor- Multistage amplifier, Negative and positive feedback – different types of negative feedback amplifier – voltage shunt – voltage series – current shunt – current series.

Module III

Power amplifier – classification – class A, class B, class AB, class C – transformer coupled class A power amplifier – transformer less class AB push-pull power amplifier – complementary symmetry power amplifier – harmonic distortion in power amplifier – transistor rating – heat sinks – Oscillators – principles of sinusoidal oscillators – Bark Hausen criteria – RC oscillators – phase shift Wienbridge – LC oscillators – Hartley, Colpitts – clap oscillators. (Using BJTs and FETs)

Module IV

Pulse circuits – pulse characteristics – pulse shaping using RC circuits – Differentiating and integrating circuits – clipping and clamping circuits using diodes and transistors – Transistor as a switch sweep circuits – Transistor sweep circuits – voltage and current sweep – Miller sweep circuit – Bootstrap sweep circuit – UJT relaxation oscillator. Multivibrators using transistors – astable – monostable and bistable operations.

Module V

High frequency amplifier – Tuned amplifier – coupled circuit, unilateralisation of transistor, Q-factor, single tuned, double tuned and stagger tuned amplifier (analysis not required) – Wide band amplifier – gain bandwidth trade off. Wide band transistor configuration cascade emitter coupled – broad banding, bandwidth trade-off, wide band transistor configuration with negative feed back, frequency compensation –low frequency RC compensation, High frequency inductor compensation (analysis not required)

Reference :

1) Millman & Halkias : Electronic Devices and Circuits
2) Bapat K.N. : Electronic Devices and Circuits
3) Allan Mottorshed : Electronic Devices and Circuits
4) Millman & Halkias : Integrated Electronics
5) Boylestead & Neshelsky : Electronic Devices and Circuits
6) Schilling & Belove : Electronic Circuits, Discrete and Integrated

EE 403 ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS

Module I

General : S.I. Units – Measurement system performance, Calibration, Static characteristics – errors in measurements – true value – static error – static correction scale range and scale span (fiducial value) error calibration curve – reproducibility and drift, repeatability, noise – accuracy, accuracy class and precision – indication of precision – significant figures – static sensitivity – instrument efficiency – linearity – hysteresis – threshold-dead time – dead zone – resolution and discrimination – loading effect – dynamic response – measurement lag.

Module II

Measurement of resistance – Wheatstone bridge – Kelvin double bridge – Carey Foster slide wire bridge – sensitivity of d.c. bridges – interchange of battery and galvanometer – bridge current limitations – Ohmmeter – Megger – measurement of insulation resistance by deflection method – localization of cable fault by Murray and Varley looptests – earth megger. Measurement of inductance using Maxwell and Anderson bridges – Measurement of capacitance using Schering Bridge.

Module III

Potentiometers and indicating instruments : general principle of potentiometers – modern form of d.c. potentiometers – vernier dial principle – standardization – use for measurement of voltage, current, resistance and power – a.c. potentiometers – co-ordinate and polar types – application of a.c. potentiometers. **Principle of indicating instruments**: Different types of control and damping arrangements in indicating instruments – Permanent magnet moving coil, moving iron, hotwire, electrostatic and dynamometer type meters – ammeters and voltmeters. **Extension of instrument range:** Shunts for ammeters – voltmeter multipliers – instrument transformers – current transformers – phasor diagram – ratio and phase angle error – use of instrument transformers with wattmeter – clip on ammeter.

Module IV

Wattmeters, energymeters and other measuring instruments : Measurement of energy and power : Dynamometer type – Wattmeter – errors and compensation – Correction – flux meter – Methods of correction – Induction type Wattmeter – principle of working of ampere hour meter – single and three phase energy meters – errors and compensation – calibration using wattmeter and rotating substandard. Frequency meters – power factor meters – oscillographs – Duddel and cathode ray types – multimeter – stroboscope.

Module V

Magnetic measurements and illumination : Classification of magnetic measurements – measurement of flux and permeability – Hibbert's magnetic standard – flux meter – Hall effect gauss meter – ballistic galvanometer – methods of calibrating ballistic galvanometer – Vibration galvanometer – B-H curve and permeability – measurement on bar and ring specimens – hysteresis measurement – Core loss measurement with Lloyd Fisher square. **Illumination**: Definitions and units – laws of illumination – Lummer – Brodhum and Flicker photometers – Determination of MSCP – Polar curve – Roussaeu's construction integrating sphere – Macbeth illuminometer.

References:

1) A. K. Sawhney : A course in Electrical and Electronics Measurements and Instrumentation – Dhanpat Rai and sons.
2) F. W. Golding : Electrical Measurement and Measuring Instruments, ELBS .
3) Issac F. Kinnard : Applied Electrical Measurement John Wiley Sons.
4) Forest K. Harris : Electrical Measurements wiley Eastern (P) Ltd.
5) C. T. Baldwin : Fundamentals of Electrical Measurement Lyall Book Depot Bhopal.
6) Errest Frank : Electrical Measurement Analysis McGraw Hill.
7) Melnille B. Stout : Basic Electrical Measurement Prentice Hall of India (P)Ltd.

EE/EI 404 COMPUTER ARCHITECTURE AND ORGANISATION

Module I

Basic structure of computer hardware and software – Addressing methods and machine programme sequencing – computer arithmetic – logic design and fast adders – multiplication – Booth's algorithm – fast multiplication – integer division – floating point numbers – control unit – instruction execution cycle – sequencing of control signals – hardwired control - PLAs – microprogrammed control – control signals – microinstructions – microprogram sequencing – Branch address modification – Prefetching of microinstructions – emulation – Bit-slice processors.

Module II

Memory organisation – semiconductor – RAM memories – internal organisation – Bipolar and MOS devices – Dynamic memories – multiple memory modules and interleaving – cache memories – mapping functions – replacement algorithms – virtual memory – address translations – page tables memory management units – secondary memory – disk drives – organisation and operations – different standards.

Module III

Input-output organisation – accessing I/O devices – direct memory access (DMA) – interrupts – interrupt handling – handling multiple devices – device identification – vectored interrupts – interrupt nesting – Daisy chaining – I/O interfaces – serial and parallel standards – buses – scheduling – bus arbitration – computer peripherals – printers – plotters – VDUs.

Module IV

Introduction to microprocessors – Architecture of typical 8 bit microprocessor – Intel 8085 microprocessor – study of functional units – function of various control signals- design of CPU section with buffers and latches – interrupt structure of 8085.

Module V

Instruction set of 8085 microprocessors – Addressing modes – programming – examples – instruction timing – memory design – design of memory using standard chips – address decoding – I/O addressing schemes – I/O mapped I/O and memory mapped I/O techniques.

Text Books

1. Hamacher C V : Computer Organisation, 3rd edition, McGraw Hill, New York, 1990

References:

1) Paul Chaudhary P : Computer Organisation and Design , Prentice Hall, New Delhi, 1995
2) Bartee T C : Digital Computer Fundamentals, McGraw Hill, New York, 1997
3) Hayes J P : Computer Organisation and Architecture, 2nd edition, McGraw Hill, New York
4) Tanenbaum A S : Structured Computer Organisation, 3rd edition, Prentice Hall, New Jersey
5) Goankar : Microprocessor Architecture Programming and Applications, John Wiley
6) Douglas V Hall : Microprocessor and Interfacing to 8085: Introduction to, Tata McGraw Hill
7) Ghose Sridhar : Microprocessor for Engineers and Scientists
8) Lance A Leventhal : Introduction to Microprocessor, Prentice Hall

EE 405 ELECTRICAL MACHINES I

Module I

DC generators: Principle of DC generators, constructional details, field, armature and commutator or magnetic circuits, field flux distribution. Armature windings – pole pitch, coil span, winding pitch and commutator pitch. Simplex lap and wave windings, parallel paths, equaliser ring connections, dummy coils – methods of setting brushes in d.c machines. Methods of excitation – separately excited, shunt, series and compound machines. Induced e.m.f – e.m.f. equations. Armature m.m.f. – magnitude and direction, armature reaction – air gap flux distribution under load conditions, effect of saturation, demagnetising and cross magnetising armature m.m.f. – variation with brush position – compensating winding connections.

Module II

Commutator: Time of commutation, e.m.f. in the coil undergoing commutation, reactance e.m.f. – effect of brush shift, interpoles – polarity an d winding connections. Type of d.c. generators – characteristics – open circuit characteristics, condition for self excitation, critical resistance, critical speed. Load characteristics, effect of compounding. Parallel operation – parallel operation of shunt series and compound generations, equaliser connections.

Module III

DC Motors: Principles of operation, back e.m.f, production of torque, torque equation, developed and shaft torque, performance characteristics of shunt, series and compound motors, applications of various types of DC motors. Starting – need of the starter, face plate starters – three point and four point starters, calculation of resistance elements for shunt meter starter, Speed control – field control, armature control – Ward Leonard speed control. Testing of d.c. machines – losses and efficiency, separation of losses – Swinburne's test, Hopkinson's test, Fields Test, retardation test.

Module IV

Transformers: Single phase transformer - constructional details – core, winding, insulation and brushing. Principles of operation, turns ratio, emf equation. Operation on load - magnetising and core loss components – phasor diagram – equivalent circuit. Regulation – losses and efficiency.

Module V

Testing of transformers: DC test, SC test, Sumpner's back to back test, separation of losses, three phase connections – star and delta connections using single phase transformers. Three phase transformers – oscillating, neutral, tertiary winding, Scott connection – open delta connection – six phase connection. Parallel operation, load sharing, distribution transformers – all day efficiency.

References:

1) Clayton A.E. & Hancock N.N. : Performance and Design of DC machines, ELBS/CBS Publishers, Delhi, 1990
2) Theraja B.L. : A text book of Electrical Technology Vol II, S. Chand & Co., New Delhi, 1992
3) Bhimbra P.S. : Electrical Machinery, Khanna Publishers, New Delhi,1992
4) M.G. Say : Performance and Design of AC machines, ELBS & Pitman, Third edition,1980

CS/EB/EC/EE/EI 406 DIGITAL ELECTRONICS LABORATORY

1. Transfer characteristics and specifications of TTL and MOS gate
2. Design of half adder and full adder using NAND gates
3. Set up R-S & JK flip-flops using NAND gates
4. Code converter – Binary to Gray and gray to Binary using mode control
5. Asynchronous UP/DOWN counter using JK Flip-Flops
6. Design and realisation of sequence generators.
7. Study of shift registers and design of Johnson and Ring counter using it
8. Binary addition and subtraction (a) 1's complement (b) 2's complement
9. Study of IC counters 7490, 7493 and 74192.
10. Astable and monostable multi-vibrators using gates – IC version Timing circuit using 555
11. ADC using dual slope method.
12. Study of MUX & Demux
13. ROM & RAM chips – Verification as memories

EE 407 ELECTRICAL MACHINES LABORATORY I

Plotting of the open circuit characteristics of the given d.c. shunt generator at rated speed. Pre-determination of o.c.c. at other speeds and critical resistances of various speeds. Finding the voltage built-up with a given field circuit resistance and the critical speed for a given field circuit resistance.
Load test on the given DC shunt generator and plotting external characteristics – Deduce the internal characteristics and armature reaction curve.

Brake test on DC shunt and series motor and plot the following characteristics:
Output Vs Efficiency
Output Vs Line current
Output Vs Speed
Speed Vs Torque
Line current Vs Torque

a) Study of 3 point and 4 point starters for DC shunt motor
b) Swinburne's test on DC shunt machine and pre-determination of armature current and percentage efficiency when the machine operates as a motor and as a generator delivering ¼, ½, ¾, full and $5/4^{th}$ rated output.

Hopkinson's Test on a pair of DC Machines and pre-determining of the efficiency of the machine working as motor and as a generator under various conditions of load on the generator.
Separation of losses in a d.c. machine by conducting a retardation test and determination of the moment of inertia of the rotating system.
Separation of losses in d.c. shunt machine by conducting no load test at different excitations and plotting the variations of these losses at various speeds.

Transformers

a) Polarity test on single phase transformers.
b) Connect three single phase transformers to form a 3 phase transformer with YY and DYI connection. Perform the load test, under balanced upf conditions – Plot the efficiency Vs output and % regulation Vs output characteristics.

O.C and S.C test on the single phase transformer and Pre-determination of the following:
Efficiency at various loads and power factors.
Regulation at various loads and lagging and leading power factors.
Equivalent circuits referred to H.V and L.V sides.
Calculation of performance using equivalent circuit and given load connection to the equivalent circuit.
Upf load at which efficiency is maximum.
Separation of losses of single phase transformer into hysteresis and eddy current loss components at normal voltage and frequency.
Sumpner's test on a pair of identical single phase transformers and pre-determination of the efficiency and regulations at various loads and power factor.
Scott connection of the single phase transformers and the performance under various load conditions at Upf and plotting the efficiency curves with
Main transformer secondary alone loaded.
Teaser transformer secondary alone loaded.
Balanced loading.
Unbalanced loading.
Student shall present his/her fair record, notebook duly certified by the Head of the Department, to the examiners at the time of University practical examination.

EC/EE/EI 501 ELECTROMAGNETIC THEORY

Module I

Introduction: Overview of vector analysis: Orthogonal co-ordinate systems – rectangular, cylindrical, spherical transformations, Flux, circulation open and closed surface Divergence, gradient, curl, stokes theorem Static Electric field: Coulomb's law, superposition, scalar potential, moment method, gradient, electric field, electric flux, Gauss's law for electric flux, capacitance of sphere, concentric sphere, coaxial cable and two wire transmission line. Energy stored in a charged capacitor.

Module II

Static Electric Field – Dielectric homogeneity, linearity, isotropy, permittivity, electric dipole, polarization, boundary relations, divergence of the flux density, Laplacian Field Mapping Laplace equation, uniqueness theorem, Poisson's equation. Static Magnetic Field – Ferromagnetic Materials, magnetic dipole, permeability, hysteresis, The Static Magnetic Field of Steady Electric Currents, magnetic flux, Biot-Savart law, Ampere's law, Gauss's law for magnetic flux, boundary conditions, inductance of a coaxial cable, two wire transmission line, energy stored in a magnetic field – Magnetic vector potential.

Module III

Time varying Electric and Magnetic Fields – Faraday's law, Stoke's theorem, self and mutual inductance, eddy current, displacement current. Maxwell's Equations integral & differential form – General solution of wave equation in free space – uniform plane waves – TEM waves – relation between electric and magnetic fields, phase velocity and group velocity – Plane waves in a lossy medium. Skin depth, propagation constants and intrinsic impedance – Time harmonic fields – Solutions of wave equations.

Module IV

Poynting theorem – real and complex Poynting vector – interpretation – application of Poynting theorem – power flow in transmission lines, uniform plane waves. Wave polarization, Reflection of plane waves at plane boundaries – normal and oblique incidence – refraction – transmission – Snells law – critical angle – Brewster angle – total internal reflection – evanescent wave concept. Guided waves – TE, TM, TEM waves, Velocity of propagation, attenuation – wave impedance.

Module V

Transmission Lines: Analogy between circuit theory and EM theory, uniform transmission line – V I solution – characteristic impedance. Terminated uniform transmission line – VSWR – impedance matching quarter wave and half wavelength transformer, stub matching – single stub matching, double stub matching and tuning – pulses on a transmission line – Smith chart – impedance matching using Smith Chart. Transmission line transformers. Wave guides: rectangular wave guide,- modes of wave propagation - $TE_{mn,}$ TM_{mn} waves, cut off wavelengths, derivation – dominant modes – cylindrical wave guides.

Texts

1. Fields and Waves : Cheng, Pearson Education (LPE)
2. Electromagnetic Waves and Fields : Jordan and Balmain PHI

Reference:

1) W H HAYT	:	Engineering Electromagnetic, McGraw Hill
2) Parmani	:	Electromagnetism PHI
3) Guru Thomson	:	Fundamentals of Electromagnetism
4) J.D. Kraus	:	Electro Magnetics, McGraw Hill
5) K P Harrington	:	Introduction to Electromagnetic Engineering McGraw Hill
6) Edminister	:	Electromagnetics, Schaum Series
7) Saddique, Oxford	:	Elements of Electromagnetics
8) S Ramo, W Whignary	:	Fields and waves in Communication Wiely

EE/EI/ME/SE/ 502 INDUSTRIAL ORGANISATION AND MANAGEMENT

Module I

Organization, concept of organization, characteristics of organization; elements of organization, organizational structure organization charts, types of organizational- formal line, military of scalar organization, functional organization, line & staff organization, project organization, matrix organization authority and responsibility, span of control, delegation of authority.

Management: Concept of management and administration, difference and relationship between management, administration, and organisation, evolution of management theory, principles of scientific management, levels in management, introduction to project management and MIS.

Industrial ownership: Types of ownership- single ownership, partnership, joint stock company, co-operative societies, public sector, private sector, scientific management, review of different schools of thought.

Module II

Personnel Management Recruitment and training, labour, turn-over, operator, training, suggestion system, Industrial Society: Working conditions, environmental factors, psychological attitude to work and working condition, fatigue, accidents and hazards.

Wages and Incentives: features of wages, time and piece rate, different incentive plans, Profit sharing job evaluation and merit rating, factors of comparison and point rating.

Industrial Relations: Industrial dispute, collective bargaining: trade unions, workers' participation in Management, labour welfare.

Module III

Marketing Management: concept of marketing Vs Sales approach, Consumer behaviour and demand concept, buying motives, influence of income level, product design, new product distribution, pricing decisions, major price policy consideration, pricing methods & tools, break even analysis & marginal costing in pricing, sales promotion, marketing research, test marketing, marketing of services, advertising management, types of advertising, choice of media, economic & psychological factors in advertising.

Module IV

Finance Management: Tasks, evolution of corporate Management, long term financing, equity, preference & debenture capitals, term loans, dividends & share valuation, legal aspects of dividends, short term financing, working capital influencing factors, cash budgeting, terms of liquidity, management of receivable & inventories, budgets & budgetary controls – objectives of budgeting, classification, ratio analysis.

Module V

Management accounting: fundamentals of Book keeping, journalising, ledger accounts, subdivision of journals, cash book, banking transactions, trial balance, preparation of trading, profit & loss account, balance sheet and adjustments.

References:

1) Industrial Organization & Management : Bethel, McGraw Hill.
2) Principles of Industrial Management : Kootnz & Donnel
3) Financial Management : Prasanna Chandra, Tata McGraw Hill
4) Operation Management : Fabricky, Tata McGraw Hill
5) Hand Book of MBO : Reddin & Ryan, Tata McGraw Hill
6) Industrial Finance of India : SK Basu
7) First Step in Book Keeping : JB Batliboi
8) Management Accounting : Hingrani & Bemnath

EE/EI 503 MICROPROCESSOR SYSTEM DESIGN

Module I

Interfacing of peripheral Chips with 8085: Programmable peripheral Interface (Intel 8255) Programmable communication Interface (Intel 8251) programmable Interval timer (Intel 8253 and 8254) Programmable keyboard/display controller (Intel 8279) Programmable Interrupt Controller (Intel 8259) DMA controller (Intel 8257) - block diagram, interfacing, initialization program and its applications- serial and parallel bus standards - RS 232C, IEEE 488, Centronics.

Module II

Architecture of typical 16 bit microprocessor (Intel 8086) - Memory address space and data organization-segment registers and memory segmentation - I/O address space- addressing modes- comparison of 8086 and 8088 - Basic 8086/8088 configuration- minimum mode- maximum mode- system timing - bus interface - Interrupts and interrupt priority management.

Module III

Instruction set, assemblers, Assembly level programming and programming examples in 8086 - Introduction to IBM PC architecture, peripherals and interface buses.

Module IV

Introduction to 80386, 80486, and Pentium family processors - Interrupts and exceptions management of task -real, protected and virtual mode- super scalar architecture, intelligent branch prediction and pipelining - introduction to Pentium and Pentium Pro architectures - introduction to RISC and CISC architecture.

Module V

Introduction to micro controllers- comparison with microprocessors- study of micro controllers (MCS 51 family) - architecture, instruction set, addressing modes and programming, typical applications.

References:

1) Yu Cheng Liu & Glen A Gibson : Microprocessor System, Architecture Programming and Design.
2) Douglas V Hall : Microprocessor & Interfacing, TMH.
3) Avtar Singh : IBM PC/8088 Assembly Language Programming
4) Scott Muller : Upgrading and repairing IBM PC
5) James L Hardey : Advanced 80386 Programming Techniques
6) Intel Users Manual for 8086, 80386, 80486, Pentium & Pentium Pro
7) Microprocessor Systems, Learning Material Series, ISTE, New Delhi, 1997.

EE 504 ELECTRICAL MACHINES II

Module I

Alternators- constructional features of high speed cylindrical rotor and low speed salient pole machines, synchronous speed AC windings - different types (detailed drawing not required) emf equation- distribution factor- coil span factor- field mmf and gap flux density distribution – harmonics in induced emf - remedial measures - mmf of AC windings- space harmonics- revolving magnetic field.

Module II

Theory of cylindrical rotor machines- armature reaction- synchronous impedance- voltage regulation- determination of regulation by mmf, emf and Potier methods- Principles of operation of automatic voltage regulators - determination of Xd, Xq by slip test.

Module III

Parallel operation of alternators - performance of two machines in parallel-synchronising power - effect of speed regulation on load sharing -methods of synchronizing- synchroscope- principle of automatic synchronizing. ***Synchronous motor***- torque and power relationship - phasor diagram- starting of synchronous motors - losses and efficiency calculations.

Module IV

Synchronous machines on infinite bus bars - power angle diagrams - V curves- synchronous condenser -load angle-power flow equation for cylindrical and salient pole machines-reluctance power-maximum power transfer-stability limit-control of active and reactive power in synchronous machines on infinite bus bars.

Module V

Symmetrical short circuits (only qualitative analysis) - steady state, transient and subtransient reactance - time constants. Hunting in synchronous machines- natural frequency of oscillations - damper windings. Brushless alternators- principle of operation- constructional feature- excitation methods and voltage regulation.

Text Book:

1. Nagrath I.J. and Kothari D.P. : Theory of AC machines, Tata McGraw Hill
2. Bimbra P.S. : Electrical Machinery, Khanna Publications

References:

1) Say M.G. ELBS & Pitman : Performance and Design of AC Machines,
2) Langsdorf A.S. : Theory of AC machines, Tata McGraw Hill
3) Gupta B.R. & Vandana Singhal: Fundamentals of Electrical Machines, New Age International , 1990

EB/EC/EE/EI 505 INDUSTRIAL & POWER ELECTRONICS

Module I

Power transistors- Design of high power amplifier- Transistor as a switch- Parallel operation of transistor- power MOSFET- Operating Principles- Structure and Characteristics. Thyristors- Classification and Constructional details . SCR - working principle - turn on, turn off and VI characteristics- gate characteristics, and rating: Series and parallel operation of SCR-TRIAC characteristics, modes of operation, Trigger circuits-magnetic & solid state, half wave and full wave operation.

Module II

Single phase controlled rectifiers- half wave, full wave, half controlled and fully controlled- typical waveforms with R, RL, RL with diode and RL with voltage source-voltage and current equation for half wave controlled rectifier. Three phase half wave and full wave control rectifier with R load, waveforms. DC motor speed control- various schemes- multiquadrant operation- simple circuits for speed control of series, PM and separately excited motors.

Module III

Commutation schemes-(different classes) waveforms-single phase inverters-series, parallel and bridge-PWM inverter- square wave and sine wave output. Chopper circuits using SCR transistor (detailed analysis not required)-Jones Chopper. AC Motor speed control- various schemes-electronic control of speed of induction motors and synchronous motors.

Module IV

Static switches - Timer circuits- Flasher circuits - switching regulators- Basic concepts and analysis and design of Buck, Boost, Buck-Boost and derived converters. UPS - Characteristics - configuration-application-battery selection, charging circuits. Thyristor protection- over current, over voltage, di/dt, dv/dt, gate protection, RFI minimization, Thyristor mounting and heat transfer.

Module V

Principle, characteristics and application of induction heating and dielectric heating- Ultrasonic-characteristics- application in non-destructive testing - application of power electronics in welding.

References:

1) Power Electronics Rashid, Pearson Education/PHI
2) Modern Power Electronics and AC Drives B.K. Bose, Pearson Education
3) Introduction to Power Electronics D.W. Hart, Pearson Education
4) Power Electronics-Converters applications & Designs Mohan Undeland, Robbins, WE
5) Power Electronics J Micheal Javob Vik as Thompson Pub
6) Power Electronics PC Sen, TMH
7) Power Electronics Singh and Khanchandhani, TMH
8) Power Electronics Asgar M Syed, PHI
9) Power Electronics N. Mohan John, WE
10) Art of Electronics Hays, Cambridge

CS/EB/EC/EE/EI 506 MICROPROCESSOR LAB

Part A (Compulsory)

Study of a typical microprocessor trainer kit and its operation

Simple programming examples using 8085 instruction set. To understand the use of various instructions and addressing modes – monitor routines.

Interfacing and programming of 8255 (eg: traffic light control , Burglar alarm, stop watch)

Interfacing and programming of 8253/8254

Interfacing and programming of 8279.

Part B

A/D and D/A converter interface

Stepper motor interface.

Display interface.

Programming of different types of EPROM 2716, 2732, etc…(at least two topics from Part B has to be covered.)

EE 507 ELECTRICAL MEASUREMENTS LABORATORY

Measurement of resistance using Wheatston's bridge

Measurement of resistance using Kelvin's double bridge

Measurement of self and mutual inductance of coupled coils

Measurement of KVAR in 3-phase circuits by single and two wattmeter method.

Calibration of ammeter using slide wire potentiometer

Calibration of Voltmeter using slide wire potentiometer

Measurement of internal resistance of battery using ver nier potentiometer

Measurement of resistance of earth electrode using earth megger.

Calibration of wattmeter using vernier potentiometer

Determination of B-H curve

Determination of Hysterisis loop-tracing the loop using CRO

Calibration of single phase energy meter by direct and phantom loading

Calibration of single-phase energy meter at 0.5 & 0.866 p.f. without using phase shifting transformer.

Calibration of 3-phase energy meter.

Adjustments in energy meter using rotating sub- standard.

Student shall present his/her fair record, notebook duly certified by the Head of the Department, to the examiners at the time of University Practical examination.

CS/EE/EI 601 DIGITAL SIGNAL PROCESSING

Module I

Introduction to discrete time signals & system-Discrete time signals and systems-Properties of discrete systems-linearity-time invariance-causality-stability-convolution-difference equation representation of discrete systems-The z transform-properties of z transform- the inverse z transform-system function.

Module II

Discrete Fourier Transform & Fast Fourier Transform. Discrete Fourier series-properties-discrete Fourier transform properties-block convolution-decimation in-time FFT algorithms-decimation in-frequency FFT algorithms-FFT algorithms for N, a composite number.

Module III

FIR digital Filters Realizations-direct-cascade-lattice forms-hardware implementation-FIR filter design using Fourier series-use of window functions-frequency sampling design.

Module IV

IIR Digital Filters Realizations-Direct-Cascade-Parallel forms-hardware implementation- Analog filter approximations - Butterworth and Chebycheve approximations - The method of mapping of differentials- impulse invariant transformation- Bilinear transformation- Matched z transform technique.

Module V

Finite word length effects in digital filters- fixed point arithmetic-Floating point arithmetic- Block floating point arithmetic- Truncation-Rounding - Quantization error in analog to digital conversion-finite register length effects in IIR & FIR filters Limit cycles. Digital signal processing application (only brief description required) Software implementation of digital filters- Architecture of typical DSP processor.

References:

1) Oppenheim & Ronald W Schafer : "Digital Signal Processing", Prentice Hall India
2) Andreas Antoniou : "Digital Filters Analysis & Design", Prentice Hall India
3) R. Rabiner & B.Gold, : "Theory & Application of Digital Signal Processing", PHI
4) Andreas Antonion, : "Digital Signal Processing", Prentice Hall India
5) John G Proakis & Dimitris G Manolakis : "Digital Signal Processing", Prentice Hall India
6) Sanjit K. Mithra, : " Digital Signal Processing", Tata Mc- Graw Hill
7) Douglas K. Lindner, : "Introduction to Signals & Systems" McGraw Hill

EE 602 ELECTRICAL MATERIAL SCIENCE

Module I

Conducting Materials: Classical free electron theory- derivation for drift velocity, conductivity, relaxation time- Fermi- Dirac distribution - variation of conductivity with temperature and composition- contact potential- thermionic and thermoelectrial materials- properties and specifications of wire and cable materials- materials for electrical resistances, brushes of electrical machines, lamp filaments, solder.

Semiconductors: Compound Semiconductors-basic ideas of amorphous and organic semiconductor- preparation of semiconductor materials- zone-refining technique- fabrication of p-n-p junctions.

Module II

Dielectrics: Dielectric polarization under static fields- derivation of expression for electronic polarization in monatomic gases- expression for electrical, ionic and dipolar polarization in polytomic gases- derivation of expression for polarization in solids and liquids- Claussiac- Mosotti relation- behaviour of dielectrics in alternating fields-complex dielectric constant-dipolar relaxation - dielectric loss - Ferroelectricity- main features - domain theory and explanation of hysterisis curve (qualitative explanation only)

Module III

Dielectric Breakdown: Mechanism of Breakdown in gases, liquids and solids - factors influencing dielectric strength of capacitor materials.

Insulating materials: Good insulators- properties and classification on temperature basis- common insulating materials used in electrical apparatus-inorganic materials (Mica, glass, porcelain, asbestos)- organic materials (paper, rubber, cotton, silk fiber, wood, plastics, Bakelite)- resins and varnishes- liquid insulators-transformer oil gaseous insulators (air, SF6 and hydrogen)- ageing of insulators

Module IV

Magnetic materials: Classification of magnetic materials- origin of permanent magnet dipoles- Langevin's theories of dia and paramagnetism- Ferromagnetism - hysterisis curve - ferromagnetic domains (qualitative explanation only) - Corie - Weiss law - hard and soft magnetic materials and applications - ferrites - design of permanent and electromagnets - magnetic materials used in electrical machines, instruments and relays.

Module V

Solar energy materials: Photothermal conversion- use of coatings for enhanced solar thermal energy collection - solar selective coatings - cold mirror coatings - heat mirror coatings - antireflection coatings - photo - voltaic conversion - solar cells - silicon, cadmium sulphide and Gallium Arsenide.

Fuses: different types of fuses and the materials used. Applications of superconductivity.

References

1) A.J. Dekker : Electrical Engineering Materials, Prentice Hall of India
2) C.S. Indulkar & Thiruvengadam & Co. :An introduction to Electrical Engineering Materials, Chand S
3) Yu Koritsky : Electrical Engineering Materials, Peace publications, Moscow
4) A. Arumugam : Material Science, Anuradha Agencies, Kumbakonam
5) O.P. Agnihotri & B.K. Gupta : Solar selective surfaces, John Wiley & Sons
6) A.B. Meinel & M.P. Meinel : Applied Solar Energy-An Introduction, Addison Wesley, New York
7) P.L. Kapoor : Electrical Engineering Materials, Khanna Publications
8) Tareev : Electrical Engineering Materials, Peace Publications, Moscow.

EI/EE 603 COMMUNICATION ENGINEERING

Module I

Introduction to various communication systems- Modulation- Different types of modulation- AM- Expression - modulation index - bandwidth - AM Modulator (Block level treatment) - Introduction to DSBSC, AM - Balanced Modulator (Block level treatment) SSB, VSB-FM expression, Modulation index- Bandwidth - Carsion's rule – FM modulator (Block level treatment) phase modulation – comparison between FM & PM- Armstrong Modulator (Block level treatment)

Module II

Transmitters (Block level treatment) AM transmitter - Low level - High Level -FM -Transmitter - FM Stereo transmitter - Receivers (block level treatment only) - AM receivers - TRF - Super- Heterodyne receiver- Image frequency- envelop detector- FM receiver- FM stereo receiver- Pulse Modulation Systems - PAM-PWM-PPM

Module III

Radiation and Propagation of Waves: - (analysis not required) - Electro magnetic Radiation- Waves in free space- polarization - reception- effects of Environment- Propagation of waves:- Ground waves- Sky-wave propagation - space waves- antennas- Basic consideration - wire radiator in space - common terms and definitions- Effects of ground on Antennas- Directional High frequency Antennas - UHF Micro wave antennas - Wide band and special purpose antennas.

Module IV

Micro wave Techniques (analysis not required) Micro waves in perspective - Transmission lines wave guides- cavity resonators- microwave semiconductors Micro wave tubes- Micro wave antennas.

Satellite communications: satellite orbits - satellite communication systems- satellite sub systems- earth stations.

Module V

Fiber optic communication: light wave communication systems- Fiber optic cable - optical transmitter and receiver.

Modern communication Applications: Facsimile- cellular Radio system- Radar - Television.

References:

1) Electronic Communications : Dennis Roddy and John Coolen, Prentice Hall, India.
2) Electronic Communication Systems : Kennedy & Davis - Fourth Edition-TMH
3) Communication Electronics : Frenzel, McGraw Hill, International Editions.
   For Modules IV & V
4) Communication Electronics : Frenzel MGH

EE 604 ELECTRICAL MACHINES III

Module I

Three phase induction motor - constructional details - slip ring and squirrel cage types- Theory of the induction machine with constant mutual flux - slip phasor diagram - mechanical power and developed torque - Torque slip curves - variation and starting torque with rotor resistance- pull out torque - losses and efficiency - approximate and exact equivalent circuits - circle diagram - No load and blocked rotor tests - performance calculations from the equivalent circuit.

Module II

Starting - starting squirrel cage motors- direct on-line starting auto transformer and star - delta starter - starting current and torque - starting of slip ring motors - design of rotor rheostat.

Effects of harmonics - Harmonic induction and harmonic synchronous torques - cogging, crawling and noise production - methods of elimination - special rotor construction - Deep bar, composite bar and Boucherot rotor constructions - equivalent circuits and torque curves of double cage motors.

Module III

Methods of speed control - pole changing methods - rotor rheostatic control - change of supply frequency - use of SCR for speed control - principle of speed regulation and improvement of power factor by rotor injected emf.

Induction generator Theory - phasor diagram - circle diagram - equivalent circuit - applications.

Module IV

Synchronous induction motor- construction - rotor winding connections - circle diagram - pulling into step.

Single phase induction motor - revolving field theory equivalent circuit - torque slip curve - starting methods - split phase, capacitor start, capacitor run motors shaded pole motor - repulsion start and repulsion induction motor.

Module V

Commutator motors - General, principles and theory - commutator as a frequency converter - emf induced in a commutator winding - single phase series motor - theory - phasor and circle diagram - compensating and interpole windings - universal motor - principle of repulsion motor - torque production - phasor diagram - compensated type of motors repulsion start induction motor - applications.

Poly phase commutator motors - Three phase series and shunt type - schrage motor - characteristics and applications - use of commutator machines as phase advancers - Expedor and Susceptor types - Walker and Scherbius advancers.

References:

1) Performance & Design of AC Machines : Say MG
2) Theory of AC Machinery : Langsdorff AC
3) AC Commutator Motors : Openshaw Taylor
4) Alternating Current Machines : Puchstein & Lloyd
5) Electrical Machines Part I & II : Kostenko & Pietrovsky

EE 605 ELECTRONIC INSTRUMENTATION

Module I

Operational Amplifier – characteristics of ideal op-amps – internal circuit – block diagram – linear circuits using op-amps – DC & AC analysis – inverting amplifiers – non-inverting amplifiers – voltage follower – differential amplifier – adder – subtractor –instrumentation amplifier, precision rectifiers, half wave and full wave - log and antilog amplifier – differentiator – integrator – non-ideal characteristics of op-amps – bias current – offset voltage – drift – offset compensation – frequency response – frequency compensation – slew rate.

Module II

Non-linear circuits using op-amps – comparators, multivibrators, Schmitt triggers, triangular wave generators, phase shift and Wein bridge oscillators – introduction to different types of ADC's and DAC's (brief idea only) – PLL: block diagram, basic principles. Applications – timer IC 555: functional diagram, applications – 723 general purpose regulators: functional diagram, current limit and fold back protection.

Module III

Science of measurements – methods of measurement – functional block of a measurement system – input output configuration of measuring instruments and instrument systems. Methods of correction for interfering and modifying inputs. Definition of transducers – classification based on physical effect employed – classification based on quantity converted – classification based on source of energy for the output.

Resistance transducers – strain gauge – types – construction – temperature effect on strain gauge – strain gauge circuitry. Semiconductor strain gauge - load cell. Resistance thermometer – types- circuits – errors – thermistor – advantage of thermistor.

Module IV

Inductive transducers – LVDT – principle of operation – applications – LVDT load cell – LVDT pressure transducer – resolver – capacitive transducer – principle of operation – applications – capacitor microphone.

Piezoelectric transducer – materials of piezoelectric transducers – equivalent circuit – d,g,h, coefficients – thermocouple – princip le – applications – magnetostrictive transducers – magnetostrictive materials – application – Hall effect transducer – application – elastic transducers (brief study) – Bourdon tubes – diaphragms – Bellows – Fibre Optics transducers – digital transducers – shaft encoder.

Module V

Digital instruments – operating principles of DVM using successive approximation – V/F conversion and integrating principles – counter digital method for frequency, phase, time and period measurements – digital RLC meters – Q-meter – vector impedance meter – electronic multimeter.

CRO- block diagram – cathode ray tube – vertical deflection system – horizontal deflection system – oscilloscope probes – time base applications – voltage, frequency and phase angle measurements.

Text Books:

1. Albert D. Helfric & William D. Cooper : Modern Electronic Instrumentation & Measurements Techniques (Prentice Hall)
2. E.O. Deobelin : Measurement Systems Application & Design (Tata McGraw Hill)
3. Dr. S. Renganathan : Transducers Engineering (Allied Publishers Ltd. Delhi)
4. Ramakant A. Gayakwad : Op-Amp & Linear Integrated Circuits (Prentice Hall)
5. Dr. Roy Chaudhury : Linear Integrated Circuits (New Age International Ltd.)

EE 606 ELECTRICAL MACHINES LABORATORY II

Synchronous Machines

Regulation of alternator by direct loading

Regulation of alternator by emf and mmf methods.

Regulation of alternator by potier and ASA methods

Slip test and regulation of salient pole alternator using two - reaction theory

Synchronizing of alternator to mains by dark lamp & bright lamp method and control of reactive power.

Induction machines

Variation of starting torque with rotor resistance in slip ring induction motor.

Direct load test on induction motor.

Pre determination of Characteristic and equivalent circuit of induction motor from no load and blocked rotor test.

Synchronous induction motor V- curves, pre determination of field current.

Pre determination of characteristic of pole changing motor

Test on Induction generator. Determination of rotor hysterisis.

Special experiments

V/f control of induction motor.

Characteristic of single phase induction motor.

Complete torque slip characteristic of induction motor.

Characteristic of double cage induction motor.

Slip power recovery schemes:

Cascade operation of induction motor. Determination of slip and load shared by each motor and overall efficiency of the test.

Methods using converter/inverter operations

From the above list, maximum number of experiments may be conducted subject to facility available.

EE 607 MINOR PROJECT

This mini project involves the design and construction of electrical/electronic circuits with live applications. The evaluation includes an internal examination (along with demonstration & viva) and the day-to-day performance of the student.

EB//EE/EI 701 Computer Communication and Networks

Module 1

Introduction to computer networks - need for networking - various topologies and configurations Concept of Internet -Internet services - concept of layering - peer processes - ISO - OSI - & layer standard - functions of each layer.

Module 2

Transmission media - description and characteristics - base band and broad band transmission - synchronous and asynchronous transmission - full duplex and half-duplex links - MODEMS serial communication standards - X-21 digital interface - need for data link layer - stop and wait sliding window protocol - HDLC protocols terminal handling - polling, multiplexing and concentration.

Module 3

Virtual circuits and data grams - routing - different types congestion control - LAN - base band and broad band LANs - carrier sense networks - CSMA/CD - ring networks - shared memory systems - IEEE 802 standard - introduction to X-25 standards.

Module 4

Transport layer - design issues - connection management - connection establishment flow control and buffering - multiplexing - crash recovery - a simple transport protocol on top of X-25 standard . Session layer - design issue - data exchange – dialogue management - synchronisation - remote procedure call - client server model

Module 5

Presentation layer - data representation - data compression - network security and privacy - cryptography - presentation layer in ARPANET application layer - virtual terminal and file transfer protocols - electronic mail - introduction to distributed system.

References:

- A S Tannenbaum, " Computer Networks
- Hausly, " Data Communication"
- UYLESS BALACK, " Computer Networks, Protocols Standards & Interfaces"
- Stalling , "Local Area Networks"
- Communication networks, 2nd Edition By Jean Walrand

EE 702 CONTROL SYSTEMS I

Module I

Open loop and closed loop control systems : Transfer function- poles and zeros – block diagram representation – block diagram reduction – signal flow graph – Mason's gain formula- characteristics equations – concept of stability – stability of feed back systems – Routh's stability criterion.

Module II

Time domain analysis of control systems Transient and steady state response – Time domain test signals – Time domain specifications – second order systems – impulse and step responses. steady state error analysis – static error coefficient of type 0, 1 ,2, systems – Generalized error series.

Module III

PID controllers – Trade – off between steady state and transient behaviour. Root locus diagram. General rules for constructing Root loci – root locus analysis of control system effect of addition of poles and zeros.

Module IV

Frequency domain analysis: Introduction – Bode plot – polar plot – Log magnitude Vs Phase plot – closed loop frequency response – Frequency domain specifications – gain margin – phase margin – Nyquist stability criterion – stability analysis from bode plot.

Module V

Control system components: Electrical systems – DC motor – DC servomotor – AC servo motor – synchro – magnetic amplifier series and parallel connections. Basic principle of operation and transfer function of gyroscope – stepper motor – Tacho meters. Simulation of time domain solution of control systems by using Analog computer – fundamentals of time and amplitude scaling - simulation of transfer function using Analog Computer.

Text Books:

1. Kastuhiko Ogata, Modern control engineering, second edition Prentice Hall of India, New Delhi, 1991.
2. Nagarath I.J and Gopal M, Control System, Engineering, Wiley Eastern, NEW DELHI, 1992.

References:

1) Kuo B.C.: Automatic control systems, Prentice Hall of Delhi Sixth edition, 1991.

EE 703 POWER SYSTEM - I

Module I

Introduction – Power system scenario in India – Generation of electrical energy – layout and components of hydro electric, thermal, diesel & nuclear power plants.

Economic aspects – load curve – important terms and factors such as load factor, plant factor etc. Cost of electrical energy, depreciation, tariff, power factor improvement.

Module II

Electrical supply systems – comparison of AC and DC transmission – Advantages of high transmission voltage. Various systems of power transmission – comparison of conductor material in different systems – economic choice of transmission voltage.

Main components of overhead lines – conductor materials – ACSR conductor – line supports – insulators – string efficiency – methods of improving string efficiency – corona, advantages & disadvantages – sag in overhead lines, calculation of sag.

Module III

Inductance and resistance of transmission lines – inductance of 3 phase overhead lines – double circuit 3 phase line, concepts of self GMD and mutual GMD. Bundled conductor capacitance of transmission lines – capacitance of 3 phase lines – effect of earth on transmission line capacitance.

Underground cables – construction of cables – insulating materials for cables – classification – insulation resistance – grading of cables – capacitance of 3 core cables, selection of cable – failure of underground cables – HVDC cables, testing of cables.

Module IV

Distribution system – classification – AC & DC distribution – underground versus overhead systems – types of DC distributors – calculations. Ring distributor – Ring main distributor with interconnector – AC distribution calculations.

Representation of Power System components – single line diagram and impedance diagram – per unit system. Complex power, synchronous machine, representation of loads.

Module V

Characteristics and performance of transmission lines – short line – medium line, equivalent ? and ? networks – long lines, rigorous solution. Ferranti effect - Tuned lines, equivalent circuit of long line – power flow through transmission line. Methods of voltage control – Generalized constants of transmission line.

HVDC transmission – principles of system operation. Advantages & limitations. Comparison between HVDC and HVAC transmission – Types of DC links – ground return – Earth electrodes & station earth. Converter station equipments. Corona in HVDC lines – protection aspect. HVDC circuit breaking.

Text Books

1. J. B. Gupta : A course in electrical Power (S.K. Kataria & Sons)
2. V.K. Mehta : Principles of Power System (S. Chand & Company)
3. I.J. Nagrath & D.P. Kothari : Modern Power System Analysis (Tata McGraw Hill)

EE 704 ELECTRICAL ENGINEERING DRAWING

Module I

ISI symbols for Electrical Systems (1 sheet)
DC armature Windings – simple lap and wave windings with dummy coils and equalizer ring. (3 sheets)
Automobile wiring diagram. (1 sheet)
DC machine. (3 sheets)
Assembly of pole and yoke of a medium size DC machine.
Assembled views of armature and commutator.
Sectional elevation and end views of DC machines

Module II

Transformer. (3 sheets)
Sectional plan and elevation of core type and shell type single-phase transformer.
Sectional plan and elevation of three-phase transformer.
Induction motor: Sectional elevation and views of squirrel cage and slip ring induction motor. (3 sheets)
Synchronous machines: Half sectional elevation and end views of salient pole and turbo alternators. (3 sheets)

Module III

1. Three phase AC windings. (7 sheets)
Concentric windings
Mush windings
Double layer lap windings – full pitched, short pitched and fractional Slot
Double layer wave windings.

Module IV

Dimensional sketches of : (4 sheets)
Pin and suspension type insulators
Single circuit and double circuit transmission towers for 66 KV and 220 KV.
Single line layout of generating stations – specific ratings of all equipments. (3 sheets)

Module V

Single line layout of substations, MV, HV and EHV (3 sheets)
Panel Board layout and wiring, suitable for a medium sized industry. (3 sheets)

Reference :

1) Electrical Engineering Drawing : S.K. Battacharya
2) Electrical Machine Design : Sahney A.K.

ELECTIVE I
CS/EE/IT 705 (A) – DIGITAL IMAGE PROCESSING

Module I
Image representation and modeling – enhancement- restoration – Image analysis and reconstruction – image data compression. Two dimensional systems – linear systems and shift invariance. Fourier transform – Z – transform- Block matrices and Kronecker products- Random signals.

Module II
Image perception – introduction – light – luminance- brigtness and contrast – MTF of the visual system – visibility – function – monochrome vision models – color matching and reproduction – color vision model. Image sampling and quantization – Two dimensional sampling theory – reconstruction of images from its samples – Nyquist rate – aliasing – sampling theorem. Practical limits in sampling reconstruction. Image quantization – visual quantization.

Module III
Image transforms – Two dimensiona l orthogonal and unitary transforms – properties of unitary transforms – one dimensional DFT – cosine, sine Harmrd and Haar transforms.

Module IV
Image enhancement – Point operations – contrast stretching – clipping and thresholding- digital negative intensity level slicing – bit extraction. Histogram modeling – histogram equalization – modification. Spatial operations – smoothing techniques. Magnificant and interpolation. Transform operations. Color image enhancement.

Module V
Image analysis and computer vision – spatial feature extraction – transform features. Edge detection - gradient operators- compass operators – stochastic gradients – line and spot detection.

References:

1) Jain Anil K, " Fundamentals of Digital Image Processing ", Prentice Hall
2) Gonzalez Rafel C, Wintz Paul, " Digital Image Processing" , Addison Wesley
3) Pratt William K, " Digital Image Processing", John Wiley and Sons
4) Rosenfield Azriel Kak Avinash, " Digital Image Processing ", Academic Press Inc.

ELECTIVE–I
EE 705 (B) HIGH VOLTAGE ENGINEERING

Module I

Generation of high voltages. Generation of High DC. voltages – Half Wave and full wave circuits – Ripple voltages in HW and FW rectifiers. Voltage doubler circuits – Simple voltage doubler and cascade voltage doubler. Voltage multiplier circuits – Crockroft Walton voltage multiplier circuits. Ripple and regulation. Electrostatic machines – principles – Van de Graff generator. Generation of high AC voltages: Cascade transformers, resonant transformers – parallel and series resonant test systems. Generation of high frequency high voltages – Tesla coil.

Module II

Generation of impulse voltages – Standard impulse wave shape Basic circuits for producing impulse waves – Analysis of commercial impulse generator circuits – Wave shape control, multi-stage impulse generators – Marx circuit – modified Marx impulse generator circuit – Components of multi stage impulse generator. Generation of Switching surges. Generation of impulse current. Definition of impulse current waveform – Circuit for producing impulse current waves.

Module III

Principles of insulation co ordination on HV and EHV power systems: Over voltage and their significance – insulation level of an equipment. Insulation co-ordination of a substation. Insulation co-ordination of EHV systems – Terms and definitions- Normal system voltage, highest system voltage, over voltage.

Module IV

Protective devices against lightning over voltages – rod – rod gaps, overhead ground wires – voltage – current characteristic of surge arrestors, Thyrite & ZnO arresters. Switching over voltages – origin and characteristics – switching over voltage in EHV and UHV systems. Switching over-voltages in EHV substation (400 K V AC, 765 K V AC) Control of over voltages due to switching – Method for reducing switching over voltage. Connections and rated voltages of surge arresters.

Module V

Non-destructive testing of dielectric materials – measurement dielectric constant and loss factor. Partial discharge phenomena – discharge detection using straight detectors. HV testing of electrical apparatus – Definitions – Terms and conditions. Test on insulators, bushings, cables, transformer surge arrester, High current impulse test on surge arresters HV and EHV bushing design, selection, quality control, maintenance and diagnostic testing.

Text Book

1. M S Naidu & V Kamaraju “High Voltage Engineering” Tata McGraw Hill,
2. New Delhi 1997

Reference:

1) Kuffel Ea and Zaengai W “High Voltage Engineering” Pergam Press
2) Oxford
3) Dieter Kind “An Introduction to High Voltage ExperimentalTechniques”
4) Wiley Eastern

ELECTIVE I
EE 705 (C) - ADVANCED POWER ELECTRONICS

Module I

Thyristor Converter 3-phase fully controlled bridge – principles of working – continuous and discontinuous working-Average DC output voltage- effect of source inductance. Voltage lost due to source inductance- wave forms of output voltage –output current- analysis by Fourier series-voltage across any device with and without overlap Twelve pulse converter-use of interphase transformer.

Module II

Firing circuits for six pulse converter-linear comparison and cosine comparison technique.
Dual converter-principle of working – circulating current and circulating current free modes of operation. Necessary wave forms of using half bridge converters.

Module III

Forced commutated inverters-Forced commutation circuits-basic parallel inverter-modified parallel inverter-power circuit of half bridge and full bridge 3-phase inverter-Harmonic analysis by Fourier series – Inverter voltage control- pulse width modulation-single pulse-multiple pulse and sinusoidal pulse.

Module IV

D.C. motor speed control – speed control at constant power and constant torque – Two and four quadrant operation – closed loop control.
Dynamics of D.C. motor speed control – controller-different types-optimization control-magnitude optimization - 4 quadrant operation-closed loop control (Block schematic).

Module V

A.C. Motor control – stator voltage control – Rotor resistance on - off-control – slip power recovery scheme closed loop control.
Chopper circuits – Types of chopper circuits – analysis of Type A and B choppers – D.C. motor control using chopper.

References:

1) Rectifier Circuits - J. Schafer-Wiley
2) Principles of Inverter Circuits - Bedford and Hoft
3) Thyristor Control of A.C. Motor - Murphy
4) Solid State D.C. Motor Drives - Kusko A.

ELECTIVE I
EI 704/EE 705 (D) – DIGITAL COMMUNICATION

Module I
Digital modulation schemes: BPSK, DPSK, QPSK, M-ary PSK, QASK, BFSK, BPSK, M-ary FSK, MSK.

Module II
Digital communication A/D and D/A converters – uniform and non- uniform quantization – PCM – DPCM- delta modulation. Entropy encoding and data compression.

Module III
Digital transmission and reception: Timing- symbol and frame synchronization – codes of synchronization Modulators and demodulators – ASK, FSK, PSK. Digital multiplexing – modems – probability of error - matched filters – probability of error in matched filters.

Module IV
Digital Switching Switched Systems – circuit switching, message switching, packet switching ISDN: introduction - network and protocol architecture transmission channels - user network interface – signaling – numbering and addressing – ISDN standards. Network access control – centralized – distributed – decentralized.

Module V
Design of digital communication systems: Digital design trade off - paging systems – cellular telephone – global positioning satellite – facsimile – videotext – video conferencing.

Reference:

1) Taub and Schilling "Principles of communication systems" Tata Mc Graw Hill.
2) Martin's Roden "Analogue and Digital Communication system"
3) Martin's Roden "digital communication system design"
4) Bruce Carlson" Communication system"
5) Tanenbaum :"Computer Networks"
6) John Freer" Computer communication networks"
7) Thiagarajan Viswanath " Telecommunication switching systems and networks" Prentice Hall.
8) William C Y Lee 'Mobile Cellular telecommunication " Tata Mc Graw Hill
9) John G. Proakis "Digital Communications" Mc Graw Hill International.

EE 706 POWER ELECTRONICS LABORATORY

Part A - Power Electronics

Study of Power devices – power BJT, SCR, power MOSFET, IGBT etc.

Characteristics of SCR and Triac

Characteristics of power MOSFET

Triggering circuits for SCRs – R, RC and UJT triggering

Single phase fully controlled SCR bridge circuit – R load, RL load – effect of free wheeling diode.

Triggering circuits for SCR chopper

Triac triggering

Speed control DC motor using SCR

Study of V/F control of induction motor.

AC controller using Triac

Study of UPS/SMPS

Part B - Op-Amps

Study of Op-Amps

Op-Amp inverter – scale changer – summer – integrator – differentiator – comparator and instrumentation amplifier

Design and setup of low pass – high pass and band pass filters using Op- Amps

Voltage Regulation using 723

PLL measurement of lock range and capture range

Circuits using Op-Amps for wave form generation

Astable, monostable multivibrators

Wein Bridge Oscillator

Triangular and square wave form generation

Precision rectifiers

Schmitt trigger using Op-Amps

According to the facility available in the laboratory any 15 experiments can be conducted.

EE 707 ADVANCED ELECTRICAL LABORATORY

PART A – Instrumentation & Control

Predetermination and verification of frequency response characteristics of lag and lead networks.

Determination of transfer function of a dc motor

a) Armature control b) Field Control

Characteristics and transfer function of an ac servomotor.

Magnetic amplifier – control characteristics when connected in series, parallel and parallel with feedback configurations.

Amplidyne characteristics – transfer function and feedback control.

Study of various types of synchro (TX, TR, TDX) and experiments using them.

Study of controllers such as first order time lag, Integral, Proportional plus integral and Proportional plus derivative plus time lag. Verification of gains and time constant.

Experiments on digital control system

Characteristics of LVDT

Characteristics of RTD

Characteristics of Thermocouple

Pressure measurement module with Bourdon tube and LVDT

Study and experiments on pneumatic control systems

Force measurements using strain gauge module

PART B – Digital Signal Processing

Study of DSP based AC and DC drives and controls

Switched reluctance motor

Study of DSP processors used in motor control TMS 320 C24X processors

EE 708 SEMINAR

Each student shall individually prepare and submit a seminar report on a topic of current relevance on stipulated time. Few panels consisting of three teachers (internal) each should evaluate the seminar report and the presentation. Marks should be distributed considering report writing, presentation, technical content, depth of knowledge, brevity and references and their participation in seminar. The time allotted for presentation is 30 minutes.

EE 801 CONTROL SYSTEM II

Module I

State space analysis of systems: Introduction to state concept- state equation of linear continuous data systems, matrix representation of state equations. Phase variable and canonical forms of state representation.

Module II

Solution of time variant autonomous systems - state transition matrix relation between state equation and transfer functions. Properties of state transition matrix - controllability & observability.

Module III

Sampled data control systems - sampling process - sampling Z transform method solving difference equation by the Z transforms method - pulse transform function - system time response by the Z transform method.

Module IV

Analysis of the sampling process- data reconstruction and holds circuits - zero order holds circuits - stability of sampled data system - Routh Hurwitz criterion and Jury's test - Liapunov stability criterion - linear time invariant systems.

Module V

Non - linear systems - introduction - characteristics of non - linear systems - types of non - linearities - describing function analysis. Determination of describing function of static non- linearities (saturation and ideal relay only) application of describing function for stability analysis of autonomous system with single non- linearity.

Reference

1) Katsuhiko Ogata: Modern Control Engineering, Prentice Hall of India.
2) Nagrath and Gopal: Control System Engineering, Wiley Eastern
3) Gopal M : Digital Control and State variable methods, Tata Mc Graw Hill
4) Kuo BC: Analysis and synthesis of sampled data systems, Prentice Hall.

EE 802 POWER SYSTEM - II

Module II

Load flow studies – Bus classification – Formation of Y_{BUS} by singular transformation – Gauss-Seidal method – Newton Raphson method – Decoupled load flow method – Comparison – Control of voltage profile. *Optimal System operation* – Optimum generation scheduling – optimal load solution – optimal scheduling of hydrothermal system.

Module II

Symmetrical fault analysis – transients on transmission line – short circuit of synchronous machine – selection of circuit breakers – Z_{BUS} formulation. ***Symmetrical components*** – construction of sequence networks of power system – unsymmetrical fault analysis – single line to ground fault, line to line and double line to ground fault – Bus impedance, matrix method for analysis.

Module III

Power system stability – dynamics of synchronous machines – power angle diagram and equation – steady state stability – transient stability – equal area criterion – numerical solution of swing equation – factors affecting transient stability and methods of its improvement.

Introduction to switch gear, switch gear equipment – Bus-bar arrangements – switch gear accommodation – fuses – fuse element materials – types of fuses. Fuse selection. Difference between fuse and circuit breaker.

Module IV

Circuit breakers – theory of circuit interruption – circuit breaker rating – outline of conventional circuit breakers – low voltage air circuit breakers – air blast, vacuum, SF_6, MOCB, DC circuit breaker HVDC circuit breakers, testing of circuit breakers.

Protective relays – definition of operation – classification – electromagnetic attraction relays – induction relays – thermal relay, induction type over current relay, Buchholz relay, directional over current relay, differential relay – static relay, distance relay (Induction type & impedance type).

Module V

Protection of alternators – differential protection – Merz-Price protection system – protection of transformer- Buchholz protection. Differential protection for transformers. Protection of bus bars and lines – time graded over current – differential pilot wire and distance protection.

Protection against over voltages – cause of over voltage – protection against lightening, surge diverters and lightening arresters. Surge absorbers, insulation coordination – neutral earthing, methods of neutral earthing – earthed transformers.

Electric traction – systems of electric traction – systems of track electrification – comparison between DC & AC systems of railway electrification from the point of view of main line and suburban line railway service. Speed-time curve, problems – mechanics of train movement. Determination of specified energy output using simplified speed time curve.

Text Book

1. Stevenson W.D. Jr. : Elements of Power System Analysis (Tata McGraw Hill)
2. J. B. Gupta : A course in electrical Power (S.K. Kataria & Sons)
3. V.K. Mehta : Principles of Power System (S. Chand & Company)
4. I.J. Nagrath & D.P. Kothari : Modern Power System Analysis (Tata McGraw Hill)

Reference:

1) S.L. Uppal : Electrical Power (Kanna Publication)
2) C.L. Wadhawa : Generation, distribution & utilization of electrical energy (Wiley Eastern Ltd.)
3) S.S. Rao : Switch gear & Protection (Kanna Publication)
4) E. W. Kimbark : HVDC transmission
5) Soni, Guptha, Bhatnagar : A Course in Electric Power (Dhanapat Rai & Sons)

EE 803 ELECTRICAL MACHINE DESIGN

Module I

Principles of electrical machine design - general design considerations - specifications of machines - types of enclosures - types of ventilations - hydrogen cooling - heating - short - time rating - overload capacity - temperature rise time curve - hotspot rating. Review of properties of materials used in electrical machines.

Module II

Design of power transformers - single phase and three phase transformers - distribution and power transformers - output equation - specific magnetic loading - core design - window area, window space factor - overall dimensions of core. Windings number of turns - current density - conductor section - types of coils - insulation electric stress. Cooling of transformers - design of cooling tank and tubes.

Module III

Field flux distribution curve - field form factor - magnetic leakage co-efficient calculation of field ampere turns - air gap mmf- effect of slot and ventilating duct - active iron length - mmf for teeth - real and apparent flux densities - mmf per pole - design of electromagnet. Design of dc machines - output equations - specific loading - choice of speed and number of poles - calculation of main dimensions - choice of type of winding - number of slots - number of conductors per slot - current density - conductor section - slot insulation - length of air gap.

Module IV

Design of field winding - excitation voltage - conductor cross-section -height of pole - design of interpole - flux density under interpole - calculation of interpole winding.

Design of synchronous machines - specific loading - output equation - main dimensions - types of winding - number of turns - number of slots and slot design - field design for waterwheel and turbo alternators - cooling of alternators.

Module V

Design of three phase induction motors - main dimensions - stator design - squirrel cage and slip ring type - number of stator and rotor slots - rotor bar current - design of rotor bar - end ring current - design of end ring - design of slip ring rotor winding. Introduction to computer aided design. Analysis and synthesis methods - hybrid techniques - optimization - electrical machine design - general procedure - simple programs.

Text Books :

1. Sawhney A.K. Course in electrical machine design; Dhanpat Rai & Sons.

Reference :

1) M.G. Deshpandae : Design and testing of electrical machines, Wheeler publishing.
2) R.K. Agarwal : Principles of electrical machine design, Esskay Publications.
3) Ramamurthy. M. : Computer aided design of electrical equipment, East West Press.

ELECTIVE II
EE 804 (A) – SWITCH GEAR AND PROTECTION

Module I

Circuit breakers and isolators – types of circuit breakers – basic principles of operation – arc extinction – arc voltage and current wave form in AC circuit breaking – restriking and recovery voltage – DC breakers – rupturing capacity – making capacity – Oil circuit breakers – MOCB, ABCB – SF6 circuit breakers.

Module II

Relay – classification of relays – induction types – inverse time characteristics – directional over current and power relays – earth fault protection – distance relay – distance earth fault protection.

Basic static relay – block schematic – auxiliary voltage supply – voltage stabilization by Zener diode – time delay circuit – block diagram of over current and directional relay.

Module III

Generator protection – over current – external and internal faults – earth fault protection – self balanced system – protection against failure of excitation. Transformer protection – differential protection – self balanced system – Buchoiz relay – Feeder protection – protection of ring mains – differential pilot wire protection – Merzprice voltage balanced system.

Module IV

Electric heating – resistance – types – design of heating element – induction heating – types – high frequency heating – Dielectric heating – direct and indirect arc furnaces – welding - resistance welding – arc welding – electric welding control.

Module V

Illumination – lighting calculation – design of interior and exterior lighting systems – factory lighting – flood lighting – street lighting – arc lamps.

Industrial drives – electric drives – advantages – factors affecting choice of motor – mechanical characteristics of DC and AC motors – motors for particular application – textile mill –steel mill - paper mill mine – hoist – crane – motor – selection for intermittent loads.

Text Books:

1. Sunil S. Rao : Switch Gear Protection and Power Systems (Khanna Publication)
2. S.L. Uppal : Electrical Power (Khanna Publication)

Reference:

1) B. Ravindranath & M. Chander : Power System Protection and Switch Gear (New Age International)
2) E. Openshaw Taylor : Utilisation of Electrical Energy (Orient Longman)
3) Warrington A.C. : Power system protection I, II

ELECTIVE - II
EE 804 (B) DIGITAL SYSTEM DESIGN

Module I

Introduction to combinational modules and modular network. Standard combinational modules design of arithmetic modules. Implementation of combinational systems with ROM's and PLA's. Comparison with other approaches. Implementation of multi-module combinational systems – decoder networks, Mux trees, demux network, encoder network, shifter network and barrel shifters.

Module II

Introduction to digital systems. Synchronous and asynchronous – state diagram, state names, mili and moor machines binary description. Time behavior of sync. Sequential systems. Minimization of no. of states Specification of various types of sequential system.

Module III

Canonical implementation – analysis and synthesis of networks in the canonical implementation. Flip Flop modules and networks. Modular sequential networks.

Module IV

Standard sequential modules – registers- shift register – counters – RAM- Content addressable memories and programmable sequential arrays (PSA) – design of sequential systems with small number of standard modules – state register and combinational networks – use of ROMs in sequential networks – counter and combinational networks – RAM and combinational networks – SR and combinational networks.

Module V

Multimodule implementation of sequential systems – multimodule registers – shift registers and RAMs – multimodule counters – sequential arrays – introduction to hardware/firmware algorithms.

References:

1) Milos D Ercegovac, Tomas Lang, Digital systems and hardware/firmware algorithms, John Wiley.
2) William I Flethcher, "An engineering approach to digital design, Prentice Hall.
3) Hayes, Digital System design and Microprocessors, McGraw Hill.
4) John B Peatman, Digital Hardware design, McGraw Hill.

ELECTIVE - II
EE 804 (C) NEW AND RENEWABLE SOURCES OF ENERGY.

Module I

Renewable and non-renewable sources of energy – brief review of conventional sources of energy – energy production and world energy consumption – green house effect and global warming. Solar energy option. Thermal conversion – design fabrication and performance of flat plate collectors – description of solar thermal devices (stills water heater, furnaces cookers and refrigerators) – Solar thermal power generation systems – thermal storage.

Module II

Photo voltaic conversion – conceptual description of photo voltaic effect – electrical characteristic of silicon PV cells and modules – solar cell material and prospects – Instruments for measurement of solar radiation – Empirical equations for predicting availability of solar radiation.

Module III

Wind energy – wind turbines – Horizontal axis and vertical axis with turbines – Power and energy from wind turbines – wind characteristics. Energy from oceans : wave energy – Physical principles – wave characteristics and wave power – wave energy technology. – fixed devices – floating devices

Module IV

Ocean thermal energy conversion. (OTEC) – principles – Methods of power generation – Heat exchangers – Basic ideas about other practical considerations. Tidal power – Basic principles – power generation – limitations of tidal generator.

Module V

Bio mass extracting energy from bio fuels. – Direct combustion gasification, pyrolisis anaerobic digestion, fermentation – energy from refuse – refuse derived fuel (RDF) – Energy farming, small hydro power: classification as micro, mini and small hydro projects. – Basic concepts and types of turbines – design and selection consideration. Recent trends (only brief treatment expected) Fuel cells, hydrogen energy, alcohol energy, cold fusion energy, power from satellite stations.

References:

1) Renewable energy sources – John W, Twidell & Antony D. Wier – ELBS Publication
2) Renewable Energy: Power for sustainable Future – Edited by Godfrey Boyle – Oxford University Press in association with the open university, 1996.
3) Applied solar Energy- Meinel A B and Meinel MP, Addison Wesley Publications.
4) Renewable and Novel energy sources – SL Sah, MI Publications, New Delhi, 1995.
5) Direct Energy Conversion – George Sutton – McGraw hill Publications.

ELECTIVE - II
EI801/EC 804/EE 804 D BIO -MEDICAL INSTRUMENTATION

Module I

Source of bio electric potential – resting and action potential – propagation of action potential – The bio electric potential – Electrodes for ECG ,EEG and EMG- Micro electrodes

Module II

Bio medical recorders- electro cardio gram –lead systems – block diagram of ECG – EEG – EMG (Block diagram level treatment only)- Ink jet recorders- UV recorders

Module III

Theraputic equipments – Cardiac Pacemakers – External and Implantable pacemakers – power sources for Implantable pace makers leads and electrodes – Cardiac defibrillators – Implantable Defibrillators – electro surgical machines – Ultra sonic therapy unit.

Module IV

Imaging Systems – Basics of X-ray machines – Computed Tomography – MRI Systems – basic NMR components –Thermographic Equipment – Real time ultra sonic Imaging systems.

Module V

Bio telemetry – Inntroductuion –components – implantable units –single channel telemetry systems – multichannel wireless telemetry systems – transmission of analog physiological Signals over telephone lines.

References:

1. Bio medical Instrumentation and Measurements , Leslie Cromwell
2. Hand book of bio medical instrumentation R.S. Khandpur
3. Principles of Bio medical Instrumentation , Richard Aston .

EE 805 PROJECT

The project work commencing from the VII th semester shall be completed and project report shall be submitted by each student by the end of the VIII th semester. There will be an internal examination of the project that includes demonstration and oral examination of the project work. The evaluation panel shall consisting of at least three faculty members including the project guide as appointed by Head of the department

EE 806 VIVA_VOCE

Each student is required to appear for a viva-voce examination, and he/she has to bring his/her seminar report and project report. The evaluation panel should contain at least one External and Two internal examiners appointed by the university. There can be more than one panel in case the number of students is large