UNIVERSITY OF KERALA
ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME OF STUDIES AND EXAMINATION AND SYLLABUS FOR B. TECH DEGREE
III to VIII SEMESTERS 2003 SCHEME

Semester III

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
03.301	Engineering Mathematics – II	3	1	0	50	3	100	4
03.302	Humanities	3	0	0	50	3	100	3
03.303	Hydraulic Machines & Heat Engines	2	1	0	50	3	100	3
03.304	Network Analysis & Synthesis	2	2	0	50	3	100	4
03.305	Introduction to Computers & Programming	2	1	0	50	3	100	3
03.306	Electrical Machines – I	2	2	0	50	3	100	4
03.307	Hydraulic Machines & Heat Engines Lab.	0	0	4	50	3	100	4
03.308	Electrical & Electronic Workshops	0	0	4	50	3	100	4
	Total	14	7	8	400		800	29

Semester IV

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
03.401	Engineering Mathematics – III	3	1	0	50	3	100	4
03.402	Solid State Devices & Circuits	2	2	0	50	3	100	4
03.403	Digital Electronics & Logic Design	2	1	0	50	3	100	3
03.404	Electrical Measurements – I	2	1	0	50	3	100	3
03.405	Engineering Materials Science	2	1	0	50	3	100	3
03.406	Power System Engineering – I	2	2	0	50	3	100	4
03.407	Electrical Drawing	0	0	4	50	3	100	4
03.408	Electrical Machines Lab – I	0	0	4	50	3	100	4
	Total	13	8	8	400		800	29

Semester V

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
03.501	Engineering Mathematics – IV	3	1	0	50	3	100	4
03.502	Engineering Electro – Magnetics	2	1	0	50	3	100	3
03.503	Electrical Measurements – II	2	1	0	50	3	100	3
03.504	Power Electronics	2	2	0	50	3	100	4
03.505	Electrical Machines – II	2	1	0	50	3	100	3
03.506	Elective – I	3	1	0	50	3	100	4
03.507	Electronic Circuits Lab.	0	0	4	50	3	100	4
03.508	Measurements & Instrumentation Lab	0	0	4	50	3	100	4
	Total	14	7	8	400		800	29

List of Elective I:
I.1. Computer Architecture
I.2. Superconductivity And Applications
I.3 Operations Research

I.4. New And Renewable Sources Of Energy

Semester VI

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
03.601	Numerical Techniques & Computer Programming	2	2	0	50	3	100	4
03.602	Microprocessors & Applications	2	2	0	50	3	100	4
03.603	Electronic Instrumentation	2	1	0	50	3	100	3
03.604	Electrical Machines – III	2	1	0	50	3	100	3
03.605	Power System Engineering – II	2	1	0	50	3	100	3
03.606	Elective – II	3	1	0	50	3	100	4
03.607	Power Electronics Lab.	0	0	4	50	3	100	4
03.608	Microprocessors & Software Lab	0	0	4	50	3	100	4
	Total	13	8	8	400		800	29

List of Elective II:

1. Energy Conservation And Management
2. Biomedical Instrumentation (E)
3. Software Engineering

Semester VII

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
03.701	Industrial Engg. & Management	2	1	0	50	3	100	3
03.702	Control Systems	2	2	0	50	3	100	4
03.703	Power System Engineering – III	2	1	0	50	3	100	3
03.704	Electronic Communication	2	1	0	50	3	100	3
03.705	Seminar & Project	0	0	4	50			4
03.706	Elective – III	3	1	0	50	3	100	4
03.707	Electrical Machines Lab. – II	0	0	4	50	3	100	4
03.708	Power System Lab.	0	0	4	50	3	100	4
	Total	11	6	12	400		700	29

List Of Elective III:

1. Modern Operating Systems (Elective)
2. Computer Aided Power System Analysis
3. Robotics and Industrial Automations

Semester VIII

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
03.801	Advanced Control Theory	2	1	0	50	3	100	3
03.802	Electrical Machine Design	2	2	0	50	3	100	4
03.803	Electrical System Design	2	2	0	50	3	100	4
03.804	Digital Signal Processing	2	1	0	50	3	100	3
03.805	Power Semiconductor Drives	2	1	0	50	3	100	3
03.806	Elective – IV	3	1	0	50	3	100	4
03.807	Project & Viva voce (Industrial Visits)	0	0	4	100	3	50	4
03.808	Systems & Control Lab.	0	0	4	50	3	100	4
	Total	13	8	8	450		750	29

List of Elective IV:

1. Computer And Data Networks
2. Advanced Electronic Communication
3. High Voltage Engineering

03.301 Engineering Mathematics- II 3-1-0 4 Credits
(Common to all branches)

MODULE 1: Ordinary Differential Equations

Differential equations of the first order and higher degree:Equations solvable for p-Equations solvable for x-Equations solvable for y-Clairut's Equation.

Linear Diffirential Equations:Higher order with constant coefficients-Method of variation of parameters-Homogeneous linear equations(Cauchy's and Legender's)-

Simultaneous linear equations with constant coefficients.

Orthogonal Tragectories:Cartesian form only.

MODULE 2: Fourier Series And Multiple Integrals

Fourier Series:Dirichlet's conditions-Euler's Formula-Functions with periods 2π and $2l$-Even and odd functions-Half range sine and cosine series.

Multiple Integrals:Evaluation-Change of order of integration-Transformation to polar coordinates-Area as double integral-Volume as triple integral(cartesian coordinates only).

MODULE 3: Vector Calculus

Vector differentiation:Derivative of a vector function-Velocity and acceleration-Scalar and vector fields-Gradient-It's geometrical interpretation-Directional derivative-Divergence and Curl-Their physical meaning-Relations involving ∇ -Solenoidal and irrotational fields-Scalar potentials(simple problems).

Vector Integration:Line integral,surface integral and volume integral-work done by a force-Statement and verification of Green's theorem,Stoke's theorem and Gauss' Divergence theorem-their use in evaluating the integrals.

References:

1.Engineering Mathematics,Vol 2:S.S Sastry,Prentice Hall of India (P) Ltd
2.Higher Engineering Mathematics:B.S.Grewal,Khanna Publishers
3.Engineering Mathematics:Sarveswara Rao Koneru,Universities Press
4.Advanced Engineering Mathematics:Michael D.Greenberg,Pearson Education

Note:

The question paper consists of two parts. Part A (40 marks). Ten compulsory questions of 4 marks each. Part B (60 marks). Students must answer one out of two questions from each module. Each question carries 20 marks

03.302 Humanities Credits-3 3-0-0

Part I – Economics (2 Periods per week)

Module I

1. Definition and scope of Economics- Definition of basic terms-Goods-wants and their classifications-wealth- Income –Money- -Near money- Credit money- Utility, features and kinds of utility – National Income and related concepts as GNP, NNP, -Disposable Income Resource Allocation, Technological choice & production possibility curve. Indifference curve analysis- the concept of supply- Supply curves-Cost curves – loss of returns.
2. Basic laws in Economics – Law of Diminishing marginal utility – Demand, Law of Demand and demand curve- The concept of supply- Supply schedule and supply curve**.**

Module II

3. Market structure – Classifications – Pricing under different markets as perfect competition, monopoly and oligopoly. Pricing under monopolistic competition.
4. Inflation – Measures to control inflation – Monetary measures and fiscal measures – Effects of inflation.
5. Tax – Classification of Taxes – Direct & Indirect taxes specific and AdValorem taxes – personal income tax – characteristics of a good tax system – Tax evasion.

Module III

6. International Monetary Fund – Issues & Challenges – International liquidity – Special Drawing Rights - India & IMF.
7. Welfare Economics – Old Welfare Economics -Pigou's Analysis – New Welfare Economics Pareto's welfare criterion**.**

Books for Study : Part-I

Dewtt.K.K Modern Economic theory

Books for References:-

1. Prof. G.Narendrababu " Elements of Ecomic Analysis"
2. Sundaran K.P.M " Money, Banking . Trade & Finance "

Part II – Communicative English (1 period per week)

Reading- Skimming-scanning-detailed reading-predicting content-interpreting charts and tables-identifying stylistic features in texts - evaluating texts-understanding discourse coherence-guessing meaning from the context- note making / transferring information.

Word formation with prefixes and suffixes-discourse markers and their functions-degrees of comparison-expressions relating to recommendations and comparisons-active and passive voice-antonyms-tense forms- gerunds-conditional sentences-modal verbs of probability and improbability-acronyms and abbreviations - compound nouns and adjectives-spelling-punctuation.

Sentence definition-static description-comparison and contrast-classification of information-recommendations-highlighting problems and providing solutions-formal and informal letter writing-using flow-charts/diagrams paragraph writing-editing.

Defining, describing objects-describing uses/functions-comparing-offering suggestions-analysing problems and providing solutions-expressing opinions (agreement/ disagreement) –expressing possibility/certainty – framing questions-providing answers.

Text Books: Part II

1. " English for Engineers and Technologists ", Volume I. Authors : Humanities and Social Science Department, Anna University, Published by Orient Longman Ltd., 1990.
2. Sarah Freeman, Written communication in English, Orient Longman, 1977.

References:

1. Narayanaswami, V.R, .Strengthen Your Writing, Orient Longman Ltd., Chennai 1996 (Revised Edition)
2. Pickett and Laster, Technical English, Writing, Reading and Speaking, New York Harper and Row Publications.
3. Swan, Michael, Basic English Usage, Oxford University Press, 1984.
4. Bhatnagar and Bell, Communication in English, Orient Longman, 1979.
5. Pravin.S.R.Bhatia, A.M.Sheikh, Professional Communication skills, S.Chand and Company Ltd., 2003.

University Question

Note: Part I and Part II to be answered in separate answer books.

Part – I Humanities

Part A – 30 Marks (short answers) Covering entire syllabus (3x10=30)

Part B – 40 Marks (50% choice – One out of two or two out of four from each module.)

Part - II Communicative English

30 marks (50 % choice)

03.303 Hydraulic Machines and Heat Engines Credits-3 2-1-0

Module I – Fluid Mechanics

Basic concepts and definitions – Properties of fluids – Newton's law of viscosity – Fluid statics : Fluid pressure, Pascal's law – principle of manometers – pressure gauges – Atmospheric and Gauge pressure –Forces on plane and curved surfaces

Fluid Dynamics : Continuity equation – Euler equation and Bernoulli's equation – Flow measuring devices – Discharge – Venturimeter - Orifice meter – Flow through orifices - Hydraulic coefficients of orifice

Flow through pipes : Friction factor (Darcy's and Chezy's formula) Reynolds Number – Moody's chart – Effect of Reynolds number and pipe roughness on friction factor – □ompound pipes – pipes in parallel, equivalent pipes – Flow through branched pipe - Water hammer in pipes – Major and miner losses in pipes.

Module II - FLUID MACHINES

Hydraulic turbines : Classification – shape number – Specific speed – Impulse turbines- Radical flow turbines (Francis) – Axial flow function (Kaplan) – Work done – efficiency - draft tube – cavitation - performance curves of turbines – Governing of water turbines for power plants – Hydro electric power plant layout-penstock-surge tank.

Pumps-Classification- Rotodynamic and positive displacement pumps
Rotodynamic pumps – forced vortex flow – working – head of a pump – work done – efficiency – Installation of pumps – Cavitation – operations of pumps in series and parallel – Characteristics curves –Multi stage pumps- deep well pumps-Jet pumps – air lift pumps.
Position Displacement pumps : Reciprocating, single acting and double acting – effect of acceleration, friction on performance – Air vessels, calculation of max. speed of reciprociting pumps .
Fans, blowers and Compressors for compressible fluids – types- Principle of operation (Description only)

Module III – Heat Engines

I C Engines – Classification - two-stroke and four – stroke engines – SI and CI engines – Governing of I C Engines, performance test – Brake pressure , Indicated pressure – Efficiencies – Mean effective pressure – Morse test – Retardation test – Heat balance test.
Steam turbines : Impulse and reaction turbines – velocity diagram – condition for maximum efficiency - compounding – pressure compounding and velocity compounding - Governing of turbines.
Gas turbines : Ideal gas turbine cycle – simple cycle with regeneration, reheating, inter cooling, open and closed systems – cycle efficiency and work output – effect of compressor and turbine efficiencies – performance of gas turbine.

References

1. Fluid mechanics – Levitt
2. Fluid mechanics – Jagadish lal
3. Fluid mechanics and Hydraulics machines – R.K.Bansal.
4. Fluid mechanics and machines _ Mo and Seth
5. Fluid mechanics and machines – Jagadish lal
6. Heat Engines – Ballaney
7. I C Engines – V. Ganesan.
8. GasTurbines - V. Ganesan

Gas Turbines – Cohen, Rogers and Saravanamittoo

Note: Question paper will be in two parts. Part A(Total 40 marks) consists of 10 short answer type questions of 4 marks each. Part B (Total 60 marks) will have 2 questions of 20 marks each from each module and the candidate has to answer one question from each module.

03-304 Network Analysis And Synthesis Credits-4 2-2-0

Module - I

Introduction to networks - circuit parameters - active and passive elements - energy sources - dependent and independent sources - standard symbols. Review of mesh analysis and node analysis. Coupled circuits - analysis of coupled circuits. Analysis of 3-phase circuits - star and delta connections - 3-wire and 4-wire systems - neutral displacement. Network theorems - Superposition, Thevenin, Reciprocity; Millman and Maximum power transfer theorem, Telligen's theorem - application to AC & DC networks.

Module - II

Resonance in series and parallel circuits - energy in a resonant circuit - bandwidth of series resonant circuits - quality factor. Current locus diagrams - Circuit representation in s-domain - Transients in linear circuits - solution for DC and AC excitations in RL, RC & RLC circuits - response curves - time constants. Z, Y, h and ABCD parameters - determination for given networks - conversion formulae. Fourier series - application of Fourier series - harmonic analysis - effective valve of non-sinusoidal wave - simple circuit applications.

Module - III

Network functions - one port network and two port network - transfer function – impedance and admittance functions - driving point and transfer impedance functions - necessary conditions for driving point function and transfer functions, Introduction to network synthesis - positive real functions - properties - synthesis of one port LC, RC & RL networks by Foster and Cauer methods. Introduction to filters - low pass, high pass, band pass and band elimination filters - Design of constant k and m derived filters.

TEXT BOOKS

1. Roy Choudhury D., "Network and Systems", Wiley Eastern Ltd., 2nd Reprint, July 1991.
2. A. Sudhakar, S.P. Shyammohan, "Circuits & Networks - Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd, NEW DELHI
3. Edminister JA, "Electric circuits", Schaum's Outline Series, Tata McGraw Hill, New Delhi, 1999.

4. Boylestad, "Introductory Circuit Analysis" 10/e Pearson Education, India, 2003.

REFERENCES

1. Van Valkenburg M.E., "Network Analysis", Prentice Hall, Third edition, 1989
2. Rajeswaran, "Electric Circuit Theory", Pearson Education, 2003.
3. James W Nilson, Susan A Riedel, "Introductory Circuits for Electrical and Computer Engineering." Pearson Education, 2002.
4. S.R. Paranjothi, "Electric Circuit Analysis", second edition, New Age International publishers, New Delhi 2001.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03-305 Introduction To Computers and Programming Credits:3 2 – 1 – 0

Objective: To equip the students with basics of Computer organization, Operating system concepts, Programming methodologies and basic C programming skills.

Module 1

Introduction to Computer Organisation - Organisation in terms of Memory, Control unit, CPU and I/O - Yon-Neumann Architecture, functional organisation and execution of a complete instruction, Buses - address, data and control buses, Memory - word and word-length - Memory hierarchies - caches - RAM - secondary storage, Memory locations, addresses and encoding of information.

Operating System fundamentals - Operating system as an extended machine - Operating system as a resource manager - Overview of different types of OS, Operating system concepts - overview, System calls - overview. Introduction to Software Engineering principles - Software development life cycle.

Steps involved in Program solving - Algorithm - flowcharts - Pseudo-codes, structured, procedural and object oriented programming, Application software and system software, High level and Machine level languages, translators - Compilers - interpreters -assemblers.

Module 2

Introduction to programming methodologies - structured approach and stepwise refinement techniques (top-down design), Implementation of algorithms - use of procedures/functions to emphasize modularity - choice of variable names - documentation of programs. Basic Data structures - Lists, arrays, stacks and queues - overview.

Important C concepts - preprocessor directives, header files, data-types, operators and expressions, enumerations, data input and output statements, control statements - if-then and switch-case, loops - for, while and do-while, break and continue.

Module 3

Structured data types - arrays, structures and union.

Pointers - array of pointers, functions - call by value and call by reference, recursion, function overloading-default arguments, dynamic allocation of memory, command line arguments.

File handling in C.

References:

1) V. Carl Hamacher, "Computer Organisation", McGraw-Hill Publishing Company, 2002.
2) Hennessy & Patterson, Computer Organisation and design, "Harcout Asia Pte Ltd., 2000.
3) Andrew S Tanenbaum - "Modern Operating Systems" - Pearson Education, Asia 2002.
4) Roger Pressman, "Software Engineering", McGraw Hill 2002.
5) S. Jose - "Introduction to Computers", Phaser Books.
6) Dromey, "How to do it with Computer".
7) Yaswant Kanitkar, "Let us C", BPB Publications.
8) Ashok N. Kamthane, "Programming with *ANSI* and TURBO C", Pearson Education.
9) Schaums Outline series to C Programming.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.306 Electrical Machines –1 Credits-4 2-2-0

Module I

DC machines - constructional features - principle of generator and motor- Armature winding – types - DC generator - e.m.f equation. Different types of excitation. Armature reaction, effects, methods of compensation - Commutation - Open Circuit and Load Characteristics - Applications - parallel operation of dc generators.

Module II

DC motor - production of torque - torque equation - performance characteristics - starting of dc motors. Starters - design of starter resistances. Speed control of dc motors - field control - armature control. Braking of dc motors - Losses and efficiency - Testing of dc motors -Hopkinson's test, Swinburne's test and retardation test - dc motor applications. Permanent magnet DC motors.

Module III

Single phase transformers - principle of operation - constructional details - operation on no load - Magnetising Current phasor diagram - Equivalent circuit - transformer losses - Methods of cooling. Testing of transformers - polarity test, OC test, SC test, Sumpner's test - separation of losses - efficiency - voltage regulation - effect of load and load power factor - all day efficiency - parallel operation of transformers - Auto transformers - dry type transformers. 3-phase transformers - 3-phase transformer connections - choice of transformer connections - Transformer harmonics - oscillating neutral. 3-phase bank of single-phase transformers - Parallel operation of 3-phase transformers – Vector groups – Three winding tansformers - stabilization by tertiary winding - equivalent circuit - Tap changing transformers - no load tap changing - on load tap changing.

References

1. Bimbra P S, Electrical Machinery, Khanna Publishers.
2. Nagarath I J and Kothari D P, Electrical Machines, Tata Mc-Graw Hill.
3. B R Gupta, Vandana Singhal, Fundamentals of Electric Machines, New Age International.
4. H Partab, Art and Utilization of Electrical Energy.
5. Clayton A E & Hancock NN – Performance and Design of DC Machines, ELBS/CBS Publishers, Delhi 1990.
6. M G Say – Performance and Design of AC Machines.
7. Theodore Wildi – "Electrical Machines, Drives and Power Systems", Pearson Education Asia, 2001.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.307 Hydraulic Machines and Heat Engines Lab Credits:4 0-0-4

Hydraulic Machines Lab

Study of pipe fittings (GI and PVC), plumbing tools and materials, pressure gauge, vacuum gauge, flow measuring equipments.

Study of pumps, Study of turbines.

Experiments

1. Determination of Coefficient of discharge of Notches, Orifice, Venturi meter
2. Calibration of Notches, Orifice, Nozzle, Venturi meter
3. Experiment on pipe friction apparatus
4. Determination of Hydraulic coefficients of circular orifice
5. Performance evaluation test on pumps
6. Performance evaluation test on turbines

Heat Engines Lab

Study of IC engines , Pollution of testing equipment, Blowers and Compressors, tools and accessories used

Experiments

1. Load test on SI Engines
2. Load test on CI Engines
3. Performance test on Blowers
4. Performance test on compressors

03.308 Electrical And Electronic Workshops 0-0-4

I. Electrical

Study of wiring cables and electrical accessories. Simple wiring circuits- A light is controlled by a single pole single throw (S.P.S.T) switch, Addition of a plug point in the light circuit, circuit with Fluorescent tube light, connection of

AC Fan and it's regulator; addition of a Calling bell in the wiring circuits. Special wiring circuits - to control a lamp from two independent positions, to control a lamp from more than two places and wiring circuits combining simple and special circuits. Wiring of D.B with ELCB and MCB. Testing of circuits - testing of ON/OFF conditions using a tester, testlamp, and location of phase and neutral. Common faults in AC fans - Identification of faults and its rectification. Measurements of I.R and E.R. Testing of batteries

II. Electronics

Study and identification of components, study of CRO, Multimeters and other electronic meters and accessories. Measurement of waveforms. Soldering of circuits - Half wave and full wave rectifiers and Zener voltage regulator.

03.401 Engineering Mathematics III Credits:4 3-1-0
(Common to all branches)

MODULE 1: Partial Differential Equations

Formation of P.D.E-Solution by direct integration-solution of Lagrange's linear equations-Nonlinear equations of first order-Types f(p,q)=0,f(z,p,q)=0,f(x,p)=g(y,q)-

Homogeneous P.D.E with constant coefficients-solution by the method of separation of variables.

MODULE 2: Application of partial differential Equations

Derivation of one dimensional wave equation-solution of the wave equation by the method of separation of variables –Boundary value problems involving wave equation-Derivation of one dimensional heat equation-solution by the method of separation of variables-Problems with zero and nonzero boundary conditions-Solution of Laplace equation in two dimensions(cartesian only)-Problems on finite and infinite strips.

MODULE 3: Fourier Transforms and Optimization Techniques

Fourier Transforms: Fourier integral Theorem(no proof)-Fourier sine and cosine integrals-Fourier Transforms-complex form-Sine and cosine Transforms-Inversion Formula-simple problems.

Optimization techniques: Linear Programming Problems-Formulation-Graphical solution-General L.P.P-Slack and Surplus variables-Basic feasible solution-Solution of L.P.P. using Simplex method-Big-M-method-Duality-Dual Simplex method.

References:

1.EngineeringMathematics,Vol.3:V.Sunderam,R.Balasubramanian,K.A.Lakshminara-yanan,Vikas Publishing House (P) Ltd.
2.Higher Engineering Mathematics:B.S.Grewal,Khanna Publishers.
3.Advanced Engineering Mathematics:Michael D Greenberg,Pearson Education.
4.Engineering Mathematics,Vol2:S.S.Sastry,Prentice Hall Of India(P)Ltd.
5.Engineering Mathematics:Sarveswara Rao Koneru,Universiries Press.
6.Quantative Techniques:P.C.Tulsian and Vishal Pandey,Pearson Education.

Note:

The question paper consists of two parts. Part A (40 marks). Ten compulsory questions of 4 marks each. Part B (60 marks). Students must answer one out of two questions from each module. Each question carries 20 marks

03.402 Solid State Devices And Circuits Credits:4 2-2-0

Module 1

Review of BJT configurations - CB, CC and CE. Biasing and bias stability - design of potential divider bias and collector feed back bias circuits. Bias compensation circuits - diode bias and thermistor bias. Factors causing bias instability.

Transistor modeling - h parameter equivalent circuit - graphical determination of h parameters. BJT Small signal analysis of CE amplifier at low frequencies - current gain, input impedance, voltage gain, output impedance and power gain using exact equivalent circuit.

Field effect transistor - construction and characteristics of JFETs - JFET parameters - ratings and specifications JFET bias circuits - voltage divider bias. Design of JFET amplifier with self bias circuit. JFET small signal analysis - small signal model - biasing - fixed bias, self bias, voltage divider, source follower and common gate configurations. MOSFET construction and characteristics - depletion and enhancement type - specifications - CMOS devices - advantages. MOSFET bias circuits.

Module 2

Multistage amplifiers - RC coupled, transformer coupled and direct coupled transistor amplifiers - Cascade amplifier - General frequency considerations of single stage amplifier - Low frequency considerations - High frequency

considerations - hybrid pi model (qualitative study) - Overview of frequency response of cascaded FET amplifiers, Large signal amplifiers - Classifications of amplifiers - Maximum power and efficiency of class A (series fed and transformer coupled) amplifier Class B and Class C amplifiers - Push pull and complementary symmetry power amplifiers - Distortion in amplifiers - causes and effect (analysis not required).

Feedback amplifiers - effect of feed back - principle of negative feed back - gain and frequency response - standard amplifier circuits. Oscillator circuits - General theory - Barkhausen criterion for oscillation - Phase shift Wein Bridge, Colpitts, Hartley and Crystal oscillator circuits.

Module - III

Operational Amplifiers - differential amplifier - emitter coupled differential amplifier - analysis - transfer characteristics - typical IC operational amplifiers - 741, 301 - gain, CMRR, offset, slew rate - drift compensation - frequency compensation.

Opamp circuits - inverting and noninverting modes - summer, integrator and comparator circuits - comparator IC 311 - voltage level detectors - zero crossing detectors - wave form generation using Op-Amps.

Text books:

1. Millman and Halkias, "Integrated Electronics: Analog and digital circuits and systems", McGraw-Hill Book Co.
2. Robert Boylestad and Louis Nashelsky: "Electronic Devices and Circuit Theory", 8th edition, Pearson Education, 2002.

References:

1. Thomas L Floyd "Electronic Devices", 6th edition Pearson Education India, 2002.
2. Malvino, "Electronic Principles," Tata McGraw Hill Publishing Co.
3. B. Somanathan Nair, "Electronic Devices and Applications" Prentice Hall India, New Delhi, 2002.
4. Ben G. Streetman, Sanjay Banerjee, "Solid State Electronic Devices", Pearson Education Asia, 2002.
5. Bogart: "Electronic Devices and Circuits", Universal Book Stall, New Delhi.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.403 Digital Electronics and Logic Design Credits:3 2-1-0

Module I

Transistor as switch - Switching times of transistors (ON and OFF times of practical transistors) - Schotky transistors.

Number systems and codes: Review of number systems - decimal and binary number system - decimal and binary fractions - octal number system - octal fractions - hexadecimal system - HEX fraction. Binary codes - BCD, excess-3 code, and gray code - alphanumeric codes ASCII code - EBCDIC.

Logic functions and gates: Review of basic gates and truth tables - Elements of Boolean algebra - De Morgan's theorem - Universality of NAND and NOR gates

Module II

Realization of combinational circuits using sum of products (SOP) and product of sums (POS) expression - Minimization of Boolean functions by Boolean algebra and K map (up to four variables only).

Combinational logic circuits: Half adder and full adder - parallel binary adder - binary subtracter - parity checker/generator, 4 bit magnitude comparator - multiplexers and demultiplexers - decoders and encoders - BCD to decimal and BCD to seven segment decoders.

Logic families: Description of TTL, CMOS and ECL families - advantages and disadvantages of major logic families - Current sourcing and current sinking operations of ICs - fan in, fan out - familiarization of commercially available logic gates in 7400/5400 and 4000 series of IC's.

Module III

Sequential logic circuits: Flip flops - SR, clocked SR, D, JK, master slave and T flip flops - level and edge triggering - Shift registers - SISO, SIPO, PIPO and PISO shift registers - left shift register - Universal shift register - applications of shift registers - Counters - ring counter, binary counter, ripple counter, synchronous counter, modulo N counter - state diagrams - up-down counter.

Timer circuits: 555 Timer - astable multivibrator and monostable multivibrator circuits, Basic principles of analog to digital and digital to analog converters - sampling - Nyquist sampling theorem - binary weighted DAC, counter-ramp type ADC. Introduction to Programmable Logic Devices: Description of PROM, PLA, PAL, FPGA and GLA. Basics of Hardware Description Language - VHDL.

Text Books:

1. Ronald J Tocci and Neal S Widmer, "Digital Systems: Principles and Applications", 8th edition, Pearson Education Asia, 2002.
2. B. Somanathan Nair, "Digital Electronics and Logic Design", Prentice Hall of India, 2002.
3. Albert Paul Malvino and Donald P Leach, "Digital Principles and Applications", McGraw Hill International Edition.

References:

1. John F Wakerly, "Digital Design, Principles and Practices", 3rd edition, Pearson Education Asia, 2002.
2. DC Green, "Digital Electronics", *5th* edition, Pearson Education Asia, 2001.
3. H. Taub and D. Schilling, "Digital Integrated Electronics", McGraw Hill.
4. Morris Mano, "Logic and Computer Design Fundamentals", Prentice Hall of India/ Pearson Education 2001.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.404 ELECTRICAL MEASUREMENTS – I 3 Credits 2-1-0

Module I

Dimensions of electrical quantities and dimensional analysis - error analysis -combination of component errors - accuracy - precision - sensitivity - resolution -loading effects.Principle of PMMC instruments, moving iron instruments and electrodynamometer type instruments. Electrostatic voltmeter - quadrant electrometer. Ohm meter and multimeter.

Module II

DC potentiometers - Vernier potentiometer - calibration of ammeter, voltmeter and wattmeter - AC potentiometer polar and coordinate type.

Wattmeters - electrodynamic type wattmeter - constructional features - errors and compensations - measurement of 3-phase power (active and reactive).

Induction type watt-hour meter - construction - working principle - testing and adjustment - rotating substandard - maximum demand indicator (Merz Price Type only) - trivector meter - TOD meter.

Module III

Frequency meter - moving coil type, Phase angle meter - moving coil and moving iron types.

DC bridges - Wheatstones bridge - Kelvin's double bridge. AC bridges - Maxwell's bridge, Wein bridge, Anderson bridge, Hay's bridge, Schering bridge, Carey Foster bridge.

Measurement of insulation resistance - loss of charge method, insulation megger. Measurement of earth resistance using earth megger, determination of resistivity of earth.

Text book:

1. Sawhane A K., “A Course in Electrical & Electronic Measurements & Instrumentation”, Dhanpath Rai & Co. 1992.
2. Golding EW & Widdies : Electrical Measurements & Measuring Instruments, Fifth Edition, Wheeler & Co, 1991.
3. Rajendra Prasad: Electrical Measurements and Measuring Instruments (3rd Ed), Khanna Publishers, New Delhi.

References:

1. Albert D. Helfrick & William D. Cooper : Modern Electronic Instrumentation and Measurement Technique, Prentice Hall of India, 1992.
2. Melwille B. Stout: Basic Electrical Measurements, Prentice Hall of India, 1992.
3. Kalsi H S, Electronic Instrumentation, Tata McGraw Hill, New Delhi.
4. Rangan CS, Sarma GR, Mani VSV, Instrumentation Devices and Systems, Tata McGraw Hill, New Delhi.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.405 ENGINEERING MATERIALS SCIENCE Credits-3 2-1-0

Module I

Gaseous dielectrics: lonisation and decay process-ionisation by electron collision, Townsend's first ionization coefficient, photo-ionisation, ionisation by metastables, electron detachment, decay by recombination, decay by attachment-decay by diffusion.

Cathode process: Photo electric emission, electron emission by positive ions and excited atom impact, field emission, Townsend's second ionization coefficient.

Electric breakdown in gases: Townsend's criterion for breakdown, the sparking potential, Paschen's law - effect of space charge, the Streamer mechanism, breakdown voltage characteristics in uniform field, penning effect, surge breakdown voltage, time lag, statistical and formative time lags.

Electro-negative gases: Production, properties and application of SF_6 gas, high voltage breakdown and arc phenomenon in SF_6 and its mixtures with nitrogen. Breakdown in high vacuum, application of vacuum insulation.

Corona discharge: Negative point-plane corona, Trichel pulses, positive point corona.

MODULE II

Liquid dielectrics: Conduction and breakdown in pure liquids and commercial liquids, suspended particle theory, cavitation and bubble theory, thermal breakdown, stressed oil volume theory, treatment and testing of transformer oil, properties of transformer oil and synthetic oil used in transformers.

Solid dielectrics: Classification based on temperature, breakdown in solid dielectrics, intrinsic breakdown, electro-mechanical breakdown - breakdown by treeing and tracking. Thermal breakdown, electro-chemical breakdown, cavity breakdown, internal partial discharges - a b c equivalent circuit, degradation of capacitor insulation by partial discharges. Properties of polyethylene and cross-linking polyethylene and polypropylene films. Properties and applications of paper, rubber, plastic, wood, mica, ceramic and glass as dielectric materials.

Elementary idea of life of insulation: Exponential and inverse power law models, constant stress test, accelerated life test methods.

MODULE III

***Magnetic materials*:** Dia, para, ferro, antiferro and ferri magnetism, magnetic anisotrophy, magnetostriction. B-H curve, reversible and irreversible regions, hysteresis loop for soft and hard magnetic materials, annealing, properties of grain oriented silicon steel. Properties and application of iron, alloys of iron, and harden alloys.

Materials for resistors: Properties of copper, aluminium and its alloys, silver, gold, Nickel, Molybdneum and Tungsten.

Non-linear resistors: Thyrite and ZnO.

Semi-conductor materials: Classification - properties and applications of silicon, germanium, diamond, graphite, selenium, silicon carbide, gallium arsenide, indium, antimonide, gallium phosphide, cadmium compounds as semi conducting materials, merits of semiconductor materials for use in electrical engineering.

Fuses: Different types of fuses and materials used.

Superconductivity: Superconducting elements and compounds, Soft & hard superconductors, applications of superconductivity.

References:

1. Fundamentals of gaseous ionization and plasma electronics: Essam Nassar, Wiley Series.
2. Electrical degradation and breakdown in polymers: Dissado L. A. and Fothergill J.C., British Library cataloging.
3. High Voltage Engineering: M.S. Naidu and V. Kamaraju, Tata McGraw-Hill.
4. SF_6 and vacuum insulation for high voltage applications: M.S. Naidu and V.N. Maller, Khanna Publishers.
5. Electrical Engineering Materials: Dekker A.J. Prentice Hall of India Ltd.
6. Electrical Engineering Materials: Indulkar C.S. and Thiruvenkidam S., S. Chand & Co.
7. Physics of Dielectric Materials: Tareev B., MIR Publishers.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.406 POWER SYSTEM ENGINEERING – I Credits-4 2-2-0

Module - I

Resistance, inductance and capacitance of three phase transmission lines - symmetrical and unsymmetrical spacing - double circuit lines - bundled conductors - effect of earth on transmission line capacitance - performance of transmission lines.

Representation of lines - short and medium lines - equivalent Pi and T networks. Long lines - equivalent circuit of a long line.

Representation of power system components - single line diagram - impedance and reactance diagrams, per unit quantities - selection of base quantities - advantages of per unit system.

Distribution systems - DC distribution: Types of DC distributors - DC distribution calculations: Concentrated and Uniform loading - AC distribution: AC distribution calculations, Methods of solving AC distribution problems.

Module - II

Conductors and cables - types of conductors - copper, aluminium and ACSR conductors - Volume of conductor required for various systems of transmission - Choice of transmission voltage, conductor size - Kelvin's law -types of cables - insulation resistance - voltage stress - grading of cables - capacitance of single core and 3 - core cables - current rating.

Mechanical features of transmission lines – sag - sag template.

Insulators - Different types. Voltage distribution, grading and string efficiency of suspension insulators.

Corona - disruptive critical voltage - visual critical voltage -power loss due to corona. Factors affecting corona - interference on communication lines.

Module- III

Economic aspects — Cost of generation — significance of diversity factor, load factor - plant factor - Power factor considerations - Methods of power factor improvement.

AC traction - Traction motors - Principle of operation - characteristics - Multiple unit motors -Traction mechanics - main line, suburban service requirements - Speed-time graph - Specific energy consumptions

Heating and welding - Resistance furnace - Design of beating element - Temperature control by different methods - Electric arc furnace - Induction Heating – Dielectric heating - Electric welding.

Text Book:

1. B.R. Gupta: “Power system Analysis and Design”, Wheeler publishers, 1993.
2. H Partab ; “Art and Science of Utilisation of Electrical Energy”, DhanpatRai & Sons.

References :

1. A.R, Bergen &Vijay Vittal : “Power System Analysis”, 2/c, Pearson Edn.2001.
2. Wadhwa, “Electrical Power system”, Wiley Eastern Ltd. 1993
3. Nagarath & D.P. Kothari, “Power System Engineering”, TMH Publication, 1994.
4. A. Chakrabarti, ML.Soni, P.V.Gupta, V.S.Bhatnagar, “A text book of Power system Engineering”, Dhanpat Rai, 2000.
5. J.B. Gupta, “A course in Electrical Power”, Katharia and sons, 2000.
6. Grainer J.J, Stevenson W.D, “Power system Analysis”, McGraw Hill, 1994.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.407 ELECTRICAL DRAWING Credits-4 0-0-4

1. ISI symbols for Electrical System: 1 sheet.
2. Machine Drawing basics: Representation of screws, bolts and nuts, eye bolt and stud bolt, keys and keyways.
3. Flange Coupling, ball bearing, roller bearing.
4. Automobile wiring diagram: 1 sheet
5. 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.
6. Transformer: (2 sheets)
   Sectional plan and elevation of core type and shell type single phase transformer.
   Sectional plan and elevation of three phase transformer.
7. Induction Motor, (2 sheets)
   Sectional elevation and end views of squirrel cage induction motor.
   Sectional elevation and end views of slip ring induction motor.
8. Synchronous Machines: (3 sheets)
   Dimensional sketches of hub, spider
   Half sectional elevation and end views of salient pole and turbo alternators.
9. Single circuit and double circuit transmission towers for 66 kV, 110 kV and 220 kV.

Reference

1. Electrical Engineering Drawing, KL Narang, Satya Prakashan, New Delhi.

2. Electrical Engineering Drawing, SK Bhattacharya
3. Electrical Machine Design, Sahney A.K.

Note: The question paper shall contain two parts, in Part A, there will be three questions of 20 marks each out of which two should be answered. In Part B, there will be three questions of 30 marks each out of which two should be answered.

03.408 ELECTRICAL MACHINES LABORATORY –1 Credits-4 0-0-4

1. OCC of dc generator – Crictical Resistance and crictical speed
2. Load characteristics of dc shunt and compound generators
3. Load test on dc series motor
4. Load test on DC shunt motor
5. Swinburne's and Retardation tests on dc machine.
6. Hopkinson's test
7. Separation of losses in dc machines.
8. Polarity and transformation ratio test on a single phase transformer
9. OC and SC test on single phase transformer - equivalent circuit -predetermination of regulation and efficiency.
10. Sumpner's test on two single phase transformers
11. OC and SC test on three phase transformer
12. Parallel operation of two single-phase transformers
13. Separation of losses in a single phase transformer

03.501 Engineering Mathematics – IV 3-1-0 4 Credits

(Common to all branches)

MODULE 1: Complex Analysis-Differentiation

Differentiation of functions of complex variable-Analytic functions-Cauchy-Riemann Equations(cartesian only)-Harmonic function-Orthogonal system-velocity potential

Conformal mapping-Mapping by $w=1/z, w=z^2$, $w=e^z$, $w=z+1/z$, $w=\sin z$, $w=\cos z$.

Bilenear Transformation-fixed points-Problems to find the transformation when three points and their images are given.

MODULE 2:Complex Analysis-Integration

Line integrals-simple problems-Statements of Cauchy's integral theorem,Cauchy's integral formula-Formula for higher derivatives-Evaluation of integrals using the above results.

Taylor series and Laurent's series(no proof)-simple problems.

Singularities-Residues-Cauchy's Residue theorem(no proof)-problems.

Evaluation of real definite integrals of the following types:

$\int_0^{2\pi} f(\sin\theta,\cos\theta)d\theta$, $\int_0^{\infty} [f(x)/F(x)]dx$, $\int_0^{\infty} [\sin mx/f(x)]dx$, $\int_0^{\infty} [\cos mx/f(x)]dx$

MODULE 3: Probability and statistics

Random variable-continuous and discrete distribution-mean and variance-

Binomial distribution-mean and variance-fitting a Binomial distribution-Problems.

Poisson distribution-Poisson distribution as a limiting case of the Binomial distribution-mean and variance-Problems.

Normal distribution-Properties-Problems

Curve fitting-Fitting of a straight line and a second degree parabola,by the method of least squares.

Testing of Hypothesis-Types of errors-Null hypothesis-level of significance-Confidence limits-Large sample tests-testing of proportion of attributes-confidence limits for unknown mean-test of significance for means of two large samples-Use of Student's t distribution for small sample tests-Significance test of a sample mean-Significance test of difference between sample means.

References:

1.Higher Engineering Mathematics:B.S.Grewal,Khanna Publishers

2.Engineering Mathematics,Vol.2:S.S.Sastry,Prentice Hall of India(P)Ltd.
3.Complex Variables Theory And Applications:H.S.Kasana,Prentice Hall of India(P)Ltd
4.Advanced Engineering Mathematics:Michael D Greenberg,Pearson Education
5.Probability and Statistics for engineers ;Miller & Freund ,Pearson Education

Note:

The question paper consists of two parts. Part A (40 marks). Ten compulsory questions of 4 marks each. Part B (60 marks).Students must answer one out of two questions from each module.Each question carries 20 marks.

03.502 Engineering electromagnetics Credits-3 2-1-0

Module - I

Vector analysis – vector algebra - cartesian co-ordinate system - cylindrical co-ordinate system - spherical co-ordinate systems - dot and cross product - vector field.

Coulomb's law & electric field intensity - field due to a continuous volume charge distribution - line charge - sheet of charge - flux density - Gauss law – applications – Divergence – Maxwell's first equation - divergence theorem.

Concepts of electric potential, potential difference and energy - line integral -potential field of a point charge - system of charges - conservative property -potential gradient - electric field due to a dipole - energy density.

Conductors and dielectrics - current and current density - continuity of current -conductor properties and boundary conditions - method of images - boundary conditions for perfect dielectric materials. Capacitance - capacitance of co-axial cable - two wire line.

Module - II

Poisson's and Laplace's equations - examples - uniqueness theorem.

Steady magnetic field - Biot-Savart's law - Amperes circuital law - Curl-Stokes theorem - magnetic flux and flux density - scalar and vector magnetic potentials. Magnetic forces - force between differential current elements - magnetic boundary conditions - potential energy. Inductance of a co-axial cable - torroidal coil.

Module - III

Time varying fields and Maxwell's equations - Faradays laws - displacement current - Maxwell's equations in point form-integral form. Uniform plane wave -wave motion in free space - perfect dielectrics - poynting vector - poynting theorem - propagation in good conductors - skin effect.

Reflection of Uniform plane waves – standing wave ratio – transmission lines – transmission line equations – transmission line parameters.

Text book

1. William H. Hayt, Jr., “Engineering electro-magnetics”, Tata McGraw Hill Edn.

References

1. David K. Cheng, “Field and wave electromagnetics”, Pearson Edn. Pte. Ltd.
2. P.V. Gupta, “Introductory course in electron-magnetic fields”, Dhanpat Rai & Sons.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.503 ELECTRICAL MEASUREMENTS – II Credits-3 2-1-0

Module - I

Magnetic Measurements - measurement of flux and permeability - flux meter -Hall effect - Gauss meter. Ballistic Galvanometer - Principle - calibration -applications. Determination of BH curve and hysterisis loop, Lloyd Fisher square — measurement of iron losses

Illumination - Definition of solid angle, Candella, Luminous flux, Luminous intensity, illumination, luminance - Laws of illumination - Inverse square law and Lamberts Cosine Law - Measurement of Candle power - Photometric bench, Bunsen and Lummer Brodhun Photometer heads - Measurement of illumination Macbeth illuminometer - Distribution of Candle Power - Polar curve - Determination of mean spherical candle power by Rosseau's construction - Integrating spheres.

Module - II

Instrument transformers: Need of instrument transformers. Theory of current transformer - Phasor diagram, expression for ratio error and phase angle. Theory of potential transformer - Phasor diagram - expression for ratio error and phase angle error, design consideration for minimisation of errors - variation of error with burden of

instrument transformer, precaution while using current transformers. Testing of current transformers - mutual inductance method and Biffs method. Testing of potential transformers (absolute method only).

High voltage measurements. Measurement of high dc voltages - series resistance - microammeters - resistance potential divider - generating voltmeters - measurement of high ac voltages - electrostatic voltmeters - sphere gaps - high frequency and impulse voltage measurements with CRO using resistance and capacitance dividers. Peak voltmeter - Impulse voltage generators.

High current measurements - DC Hall effect sensors - high current AC magnetic potentiometers.

Module - II

Cathode Ray Oscilloscope. Principle of operation - Block diagram of general purpose CRO. Operation of cathode ray tube - electrostatic focussing and deflection - types of screens - vertical deflecting system - vertical amplifier - delay lines - purpose and principle. Horizontal deflection system - basic sweep generator – synchronization – triggering - principle of delayed sweep - XY mode of operation of CRO. Lissajous patterns - applications of CRO - determination of frequency and phase angle - double beam CRO.

Measurement of rotational speed - tachogenerators

Signal Generators - Basic standard signal generator (sine wave), modern signal generator - Function Generator

Textbook:

1. Sawhane A.K., "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpath Rai & Co. 1992.
2. Golding EW & Widdies : Electrical Measurements & Measuring Instruments, Fifth Edition, Wheeler & Co, 1991.

References

1. Albert D. Helfrick & William D. Cooper: "Modern Electronic Instrumentation and Measurement Technique", Prentice Hall of India, 1992.
2. Naidu M.S. & Kamarai K., "High Voltage Engineering", TMH, 2nd Edition, 1993.
3. Melwille B., "Stout: Basic Electrical Measurements", Prentice Hall of India, 1992.
4. Kalsi HS, "Electronic Instrumentation", Tata McGraw Hill, New Delhi.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.504 Power Electronics Credits-4 2-2-0

Module – I

SCRs – Structure – VI characteristics – gate control – two transistor analogy – voltage and current ratings – dynamic characteristics – $\frac{di}{dt}$ and $\frac{du}{dt}$ ratings – commutation – series and parallel connections of SCRs.

Gate characteristics of SCR – single pulse triggering – carrier triggering – isolation using pulse transformers and opto couplers – triggering circuits – synchronization – R and RC triggering circuits – UJT triggering circuits – Triac – characteristics – gate triggering modes – Diac triggering circuits for triacs in phase control – device operation and VI characteristics of GTO, Power MOSFET, IGBT, RCT and MCT.

Module – II

SCR circuits for phase controlled rectification – half wave and full wave converters – Semi-converter and full converter with R, RL and RLE loads – output voltage expression – effect of free wheeling diode inverter operation.

Three pulse and six pulse converters – output voltage expression for m-pulse converter – 3 ϕ fully controlled bridge converter – effect of source inductance.

Module – III

Choppers – step down and step up choppers – chopper circuits – voltage and current commutated choppers – output voltage control.

Inverters – voltage source inverters – basic parallel inverters – basic series inverters – voltage control in inverters – pulse width modulation – multiple pulse width modulation – sinusoidal pulse width modulation – harmonics in inverters – three phase full bridge inverters – 120^o and 180^o conduction mode.

REFERENCES

1. Muhammad H. Rashid, "Power Electronic Circuits, Devices and Applications", Pearson education, Asia 2003.

2. Jay P. Agarwal, “Power Electronic Systems – Theory and Design”, Prentice Hall, New Jersey, 2001.
3. M.D. Singh, K.B. Khanchandani, “Power Electronics””, Tata McGraw – Hill, New Delhi, 1998.
4. G.K. Dubey, S.R. Doradla, A. Joshi, R.M.K. Sinha, “Thyristorised Power Controllers”, Wiley Eastern Ltd., 1986.
5. Ned Mohan et.al., “Power Electronics, Converters, Application and Design”, John Wiley and Sons.
6. P.S. Bimbhra, “Power Electronics”, Khanna Publishers.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03-505 ELECTRICAL MACHINES – II Credits-3 2-1-0

Module - I

Alternators - constructional features of high speed cylindrical rotor and low speed salient pole machines - synchronous speed, AC windings - single layer and double layer - different types of single layer windings - double layer winding - lap winding - wave winding - short chord winding - integral slot and fractional slot winding. 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. Theory of cylindrical rotor machines - armature reaction - synchronous impedance - voltage regulation - determination of regulation by EMF, MMF, Potier and ASA method - short circuit ratio.

Module - II

Theory of salient pole synchronous machines - direct axis and quadrature axis synchronous reactances - Blondel's two reaction theory - phasor diagram and calculation of voltage regulation - determination of Xd and Xq by slip test. Parallel operation of alternators - performance of two alternators operating in parallel synchronizing 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 - III

Synchronous machines on infinite bus bars - power angle diagrams - V curves and inverted V curves - synchronous condenser - load angle - power flow equations for cylindrical and salient pole machines - power Vs power angle diagram - Reluctance power - maximum power transfer - Stability limit - Control of active and reactive power in synchronous machines on infinite busbars. Electrical and mechanical load diagrams - Hunting in synchronous machines - natural frequency of oscillations - damper windings. Symmetrical short circuits – steady state transient, and sub-transient reactances - time constants - Brushless alternators operation – Principle of operation - constructional features - excitation methods and voltage regulation – Brushless permanent magnet motor.

REFERENCES

1. MG Say, “Performance and design of AC machines”, Pitman & ELBS
2. Bimbra P.S., “Electrical Machines”, Khanna Publishers
3. Nagarath and Kothari D.P., “Theory of AC machines”, Tata McGraw Hill, New Delhi)
4. B R Gupta, Vandana Singhal, “Fundamentals of Electric Machines”, New Age International.
5. Alexander S Langsdorf, “Theory of alternating current machinery”, Tata Mcgraw Hill, New Delhi.
6. Theodore Wildi, “Electrical Machine Drives and Power Systems”, Pearson Edn. Asia 2001.
7. Dunac C. Hanselman, “Brushless permanent magnet motor design”, McGraw – Hill Inc.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.506 (Elective – I) I.1. COMPUTER ARCHITECTURE 3.1.0

Module 1

Basic Operational concepts - Von-Neumann architecture, Bus structure - monobus and multibus structures, PCI Bus, Addressing methods. Instruction formats - Instruction sequencing.

Processing unit - fundamental concepts - single bus organisation of CPU - multiple bus organisation of CPU, memory read and memory write operations - Data transfer using registers. Execution of a complete instruction - sequencing of control signals.

Computer Arithmetic - Constructing an arithmetic logic unit - A 32 bit ALU, Basic Operations - Signed and unsigned addition - carry look ahead adder, subtraction, Multiplication algorithm - Booths algorithm, Division algorithm.

Module - II

Control unit - hardwired control and micro-programmed control - grouping of control signals - microinstruction with next field address - Pre-fetching of microinstructions -Emulation.

Input/output organisation - Organisation of interrupts - vectored interrupts - Setting of priorities - Interrupt masking - Servicing of multiple input/output devices - Polling and daisy chaining schemes. Direct memory accessing(DMA). I/O channels (introduction only). I/O interfacing - Interfacing I/O devices to memory, processor and operating systems, I/O overheads in various methods of data transfer. Bus standards - IEEE standards – SCSI.

Module - III

Main memory unit - Memory organisation - memory cells - dynamic memories -multiple module memory - Memory interleaving - Cache memory - principles -elements of cache design - mapping function - associate mapping - set associative mapping - fully associative mapping - aging.

Advanced computer architecture - Organisation of multi-user computer system. Principles of RISC machines - Overview of parallel processor, multiprocessor and bit-slice architecture. Pipelining, Overview of data-flow architecture.

TEXT BOOKS

1. V. Carl Hamacher, "Computer Organisation", McGraw-Hill Publishing Company, 2002.
2. Hennessy & Patterson, Computer Organisation and design, "Harcout Asia Pte Ltd., 2000.
3. Stallings, " Computer Organisation and Architecture".

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.506 (Elective – I) I.2 SUPERCONDUCTIVITY AND APPLICATIONS 3-1-0

Module I

Discovery - Early history - Meissner Effect - Superconductor as a Thermodynamic phase - Perfect Diamagnetism- Supercurrents - penetration depth - Magnetic Phase Diagram - Critical field and Critical temperature - Type II Superconductors - Flux Quantization - Josephson Effects and Tunnelling - SQUID- superconductivity and superfluidity- Materials superconducting at Liquid Helium Temperatures- High-T_c Cuprates - General features of Cuprate superconductors - Copper-free oxide superconductors - Preparation of materials.

Module II

Theories - The London equation - Ginzburg-Landau Theory - The BCS Theory-The first Cuprate family - The Normal (Metallic) state of Cuprate superconductors - Electronic structure of Cuprates - Relevant orbitals and a two-band model -Phonon mechanism - spin fluctuations - Excitonic Mechanisms - Interlayer Tunnelling - Low-temperature (Liquid He) superconductors - High temperature superconductors - pressure induced structural changes in superconducting compounds - The classical superconductors - BSCCO2223 - Thin film superconductors - 1-2-3 superconductor - Thallium, barium, calcium, copper and oxygen compound - Hg-Ba-Cu-O System – $YBa_2Cu_3Se_7$.

Module III

3-D images derived magnetic resonance images - Superconducting Magnetic Energy Storages (SMES) - Actively shielded transportable SMES Systems - High temperature superconductors and their potential for utility applications - Design of air-core superconducting power transformer for cable transmission system - High temperature superconducting magnetic motor - Superconducting power generation - Power systems of the future - Superfast magnetically levitated train-Superconducting quantum interference device (SQID) – Supercomputers - Superconductors in defence application - Advantages of HTSC - ore refining (magnetic separators) - Magnetic shielding - Large Physics machines (colliders, fusion confinement) – semiconductor - superconductor hybrids (A-D converters) -Active Superconducting elements (FETs) – Optoelectronics - Matched filters.

Text Books

1. Superconductivity Today by T V Ramakrishnan and C N R Rao published by Wiley Eastern Limited, New Delhi, 1993.
2. Superconductivity by Charles P Poole, Jr, Horacio A Farach, Richard J Creswick, Published by Academic Press, New York, 1996.
3. Superconducting Magnets by M N Wilson published by Clarendon Press, Oxford, 1983.
4. Superconducting Quantum Electronics (ed.) by V Kose, Springer Verlag, Berlin, 1989.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.506(Elective-I) I.3 Operations Research 3-1-0

Module – I

Definition of OR, Modeling in OR, general methods of solving OR models, Scientific methods in OR.

Mathematical formulation of Linear Programming Problem, Graphical solution, Simplex Algorithm and its applications, use of artificial variables, quality, economic interpretation, degeneracy and elementary sensitivity analysis.

The transportation problem, mathematical formulation, initial feasible solution by VAM method, degeneracy, unbalanced transportation problem.

Assignment problem, mathematical formulation, the assignment algorithm, unbalanced assignment problems.

Module – II

Replacement model, types of replacement problem, problem of choosing between two machines, determination of best replacement age of machine using present worth and discount rate, group replacement.

Game theory – definition of a game, pay-off, two person zero sum game, graphical solution, application in marketing, advertisement etc.

Decision theory – decision under risk – expected value of profit or loss, expected variance criterion, decision trees, decisions under uncertainty – the Laplace criterion, the mini-max criterion, minimax regret criterion, Hurwicz criterion.

Inventory problems, the economic lot size system, Newspaper boy problem, purchase, inventory model with price breaks.

Module – III

Network analysis, project scheduling by PERT – CPM, Arrow head representation, calculation of criterial path, probability and cost consideration in project scheduling. Construction of the time chart-resource leveling, queuing theory, basic elements of the queuing model problems connecting (m/m/I) and (m/m/k) – Problems – various applications in commercial subjects.

REFERENCES

1. B.S. Goel and S.K. Mittal, "Operations Research".
2. Frederick S. Hiller and Generald J. Lieberman, "Operations Research", CBS Publishers & Distributors, Delhi.
3. Frank S. Budnick, Dennis McLeavey and Richard Mojena, "Principles of Operations Research for Management", AITBS Publishers, Delhi.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.506 (Elective – I) I.4. NEW AND RENEWABLE SOURCES OF ENERGY 3-1-0

Module I

Renewable and non-renewable sources of energy - Brief review of conventional sources of energy - Energy production and world energy consumption - Greenhouse effect and global warning.

Solar energy option - Thermal conversion - Design, fabrication and performance of flat plate collectors - Description of solar thermal devices (stills, water heaters, furnaces, cookers and refrigerators) - Solar thermal power generation systems - thermal storage.

Photovoltaic conversion - Conceptual description of photovoltaic effect - Electrical characteristics of silicon PV cells and modules - Solar cell materials and prospects - Instruments for measurement of solar radiation - Empirical equations for predicting availability of solar radiation.

Module - II

Wind energy - Wind turbines - Horizontal axis and vertical axis wind 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.

Ocean thermal energy conversion (OTEC) - Principles - Methods of power generations - Heat exchangers - Basic ideas about other practical considerations.
Tidal power - Basic principles - Power generation - Limitations of tidal generation.

Module - III

Biomass: Extracting energy from bio-fuels - Direct combustion, gasification, pyrolysis, 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 considerations.
Recent trends (only brief description expected): Fuel cell, hydrogen energy, alcohol energy, nuclear fusion, power from satellite stations.

REFERENCES:

1. Renewable energy resources - John W. Twidell and Anthony D. Weir, English Language Book Society (ELBS), 1996.
2. Renewable energy - power for sustainable future - Edited by Godfrey Boyle, Oxford University Press in association with the Open University, 1996.
3. Renewable energy sources and their environmental impact - S. A. Abbasi and Naseema Abbasi, Prentice-Hall of India, 2001.
4. Non-conventional sources of energy - G.D. Rai, Khanna Publishers, 2000.
5. Solar energy utilization - G.D. Rai, Khanna Publishers, 2000.
6. Renewable and novel energy sources - S.L. Sab, MI. Publications, 1995.
7. Energy Technology - S. Rao and B.B. Parulekar, Khanna Publishers, 1999.
8. Direct Energy Conversions - George Sutton - McGraw Hill Publications.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.507 ELECTRONIC CIRCUITS LAB Credits-4 0-0-4

PART-A

1. Characteristics of a PN junction diode (silicon) and zener diode.
2. R-C differentiating, integrating, clipping and clamping circuits (using diodes or transistors) -Transfer characteristics.
3. Stabilized power supply using series regulator.
4. Characteristics of an NPN transistor (Marking out the three regions of operation and the limits of operation).
5. Characteristics of a JFET (Draw the equivalent circuit).
6. Design and testing of a Common Emitter amplifier (Plotting frequency response and obtaining bandwidth).
7. Design and testing of a common source JFET amplifier (Measurement of input impedance, output impedance, voltage gain and current gain).
8. Design and testing of R-C phase shift oscillator (using transistor).
9. *Optional - Simulation of some of the above experiments using PSPICE.*

PART-B

1. Input, output and transfer characteristics - determination of threshold voltage and noise margins of TTL and CMOS IC's (use CRO).
2. Half adder and full adder circuits using NAND gates - verification of truth tables.
3. Study of Flip Flops (RS,D and JK) and verification of truth tables.
4. Design and testing of monostable and astable multivibrators using ICs. (74121 for monoshot and 555 for astable)
5. BCD to decimal decoder, BCD to 7 segments decoder, and BCD to binary converter.
6. Nibble multiplexer and 1 to 8 decoder / demultiplexer.
7. 4 bit magnitude comparator using IC 7485/CMOS equivalent and 4 bit adder/ subtracter using IC 7483/ CMOS equivalent.
8. Modulo-N ripple counter and synchronous counter
9. Shift register and ring counter using TTL or CMOS IC's
10. *Optional - Simulation of some of the above experiments using VHDL.*

Note: From the above list, a minimum of 14 experiments may be chosen, depending on the facility available in the institution, and taking at least 6 from each part.

03.508 MEASUREMENTS AND INSTRUMENTATION LAB Credits-4 0-0-4

1. Measurement of active and reactive power
2. Calibration of Ammeter using Slide wire potentiometer
3. Measurement of unknown resistance-
   (a) Low resistance using Kelvin Double Bridge
   (b) Medium *&* high resistance using Wheatstone Bridge
4. Calibration of single-phase energy meter (a) direct loading, (b) phantom loading
5. Calibration of three-phase energy meter
6. Magnetization curve of (a) Ring specimen and (b) Transformer
7. Simulation of hysterisis loop on a CRO
8. Calibration of Voltmeter using Vernier potentiometer
9. Study of Op-Amps: Summer, Integrator & Comparator circuits using Op-Amp
10. Seep Generator
11. Level director & zero crossing detector circuits using Op- Amp
12. Design and testing of inverting and non inverting amplifier using Op-Amp 741 having given gain
13. Obtain Slew rate of given Op- Amp
14. Resistance -temperature characteristics of thermistors
15. Wein bridge oscillator using Op-Amp
16. (a)Characteristics of optocoupler (b) Design and setting up of a Schmitt trigger using Op-Amp.

03.601 NUMERICAL TECHNIQUES & COMPUTER PROGRAMMING Credits-4 2.2.0

Module - I

Review of data-types, input/output statements and control statements

Introduction to classes, Declaring and using classes, class members, creation and destruction of objects, accessing data members, returning a reference, "Cost" objects and member functions.

Classes and Dynamic memory allocation - New, delete operators, "this" pointer, Static members, friends, array of class objects

Inheritance and polymorphism: Derived class, and base class, derived class constructors, over-riding member functions, public and private inheritance, virtual functions, polymorphism, multiple inheritance, classes within classes.

Operator overloading: Overloading unary operator, overloading binary operator, data conversion.

Module II

Error, accuracy and stability of numerical methods, sources of errors and safeguards against errors- machine accuracy - round-off and truncation errors: absolute error, relative error and percentage error.

Solution of linear equations by Gauss and Gauss Jordan elimination. LU decomposition and its applications. Computation of determinant-inversion of matrix - eigen values and eigen vectors - practical problems.

Interpolation and definitions - Newton's formula for interpolation - error in Newton's interpolation polynomial.

Numerical solution of ordinary differential equations - Euler's method - modified Killer's method - Runga-Kutta methods.

Module III

Numerical integration - Newton's Cote's formula - Trapezoidal rule- Simpson's 1/3 rule.

Solution of transcendental polynomial in one variable - iteration methods- Newton's method - Regula-Falsi method- Bisection method.

Numerical solution of partial differential equations - Solution of Laplace equation -Solution of Poisson's equation.

REFERENCES

1. B.H. Flower, "An Introduction to Numerical Methods in C++", Oxford University Press, 2000.
2. W.H. Press, S.A. Teukolsky, W.T. Vetterling, B.P. Flannery, "Numerical Recipes in C++" 2ed, Cambridge University Press, 2002.
3. W.T. Vetterling, W.H. Press, S.A. Teukolsky, B.P. Flannery, “Numerical Recipes Example Book (C++)", 2 ed., Cambridge University Press, 2002.

4. Krishnamurthy E. V. & Sen S.K.: “Computer Based Numerical Algorithms”, Wiley Eastern.
5. Carnahan, Luther & Wilkes: “Applied Numerical Methods”, John Wiley, New York, 1971.
6. Robert Lafore, "Object Oriented Programming in C++"

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.602 MICROPROCESSORS & APPLICATIONS Credits-4 2-2-0

Module – I

Introductory concepts:- Internal architecture of 8085 microprocessors – Address, data and control buses. General and special purpose registers – pin out diagram.

Review of semiconductor memory – RAM and EPROM memories – static RAM – Memory chip capacity. Memory map – Input and output devices –I/O map.

Instruction set of 8085. Instruction format – opcodes and operands – Addressing modes – Classification of instructions – data manipulation, program branching and status management instructions. 8 bit and 16 bit arithmetic and logic instructions.

Assembly language programming – assembler directives – assemblers and cross assemblers – program debugging. Development of standard programs in assembly language – code conversion, sorting and BCD arithmetic – binary and BCD multiplication.

Module – II

Setting up of counters, time delays and pulse generators. Stack and Subroutines – conditional CALL and RETURN instructions – stack operations. Timing and control unit – Machine cycles and clock states – fetch and execute cycles – Timing diagram for instruction and data flow.

Input / Output subsystems – Methods of data transfer – synchronous and asynchronous data transfer, Programmed data transfer – interrupt driven data transfer – interrupt service subroutines – interrupt structure of 8085 – polled and vectored interrupts – timing diagram of interrupt operation. DMA data transfer – cycle stealing . Peripheral interfacing – Basic interfacing concepts – Interfacing memory – Address decoding – Programmable I/O ports – Programmable peripheral interface PPI 8255. Applications.

Module – III

Case study – microprocessor based tmperature control consisting of 8085 CPU, 2K RAM, 2K EPROM, PPI 8255, 8 bit A/D converter and LEDs to indicate normal, high and low temperature.

Microcontrollers – 8051 family – internal architecture – difference between 8031, 8051 and 8751, I/O port configuration, timer/counter of MCS51, advantages of microcontrollers.

REFERENCES

1. Gaonkar : Microprocessor, Architecture, Programming and Applications, Wiley Eastern Ltd. New Delhi, May 1992.
2. Mathur A : Introduction to Microprocessors, Tata Mc Graw Hill, New Delhi, 1992.
3. Ram : Microprocessors & Applications.
4. Naresh Grover, Microprocessors

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.603 ELECTRONIC INSTRUMENTATION Credits-3 2-1-0

Module - I

Process Control - block diagram, identification of elements, sensor time response - first and second order response. Description of control valves, actuators and current to pressure converter.

Transducers - definition - primary and secondary transducers.

Process instrumentation - Temperature measurements - resistance temperature detectors, thermistors and thermocouples - associated signal conditioning circuits. Optical pyrometers, infrared thermometry.

Measurement of humidity - resistive type and capacitive type transducers Measurement of fluid flow - electromagnetic flow meters - ultrasonic flow meters Displacement transducers - LVDT - principle, gray code encoders Measurement of force and pressure - strain gauges - semiconductor strain gauge - bridge configuration of

strain gauges - load cells - piezoelectric transducers, Torque measurement Programmable logic controllers - basic structure, operation

Module - II

Review of operational Amplifier circuits - precision rectifier, ZCD, current to voltage converter, phase shifter, Instrumentation amplifier using three Op-Amps, isolation amplifier using opto-coupler.

Filters: active filters - frequency response of major active filters - Butterworth low pass, high pass and band pass filter - comparison between Butterworth and Chebyschev filters.

Display devices - LED, LCD and EPID

Regulated power supplies using linear ICs - regulator ICs 723, 78XX, 79XX, 317. Voltage controlled oscillator, PLL IC 565 and its applications.

Module - III

Data converters - Digital to analog converter - ladder networks - settling time of DAC, description of DAC 081C.

Analog to digital converters - successive approximation, dual slope and simultaneous converters, conversion time. Resolution, quantisation error, gain error and linearity error of ADCs. Description of ADC chip AD670.

Digital multimeters - resolution in digital meters. Digital measurement of frequency, phase angle, time interval - electronic energy meter. Principle of digital storage oscilloscope - block schematic, sampling and storage.

Data acquisition systems - block diagram, signal conditioning, sampling rate, sample and hold, analog multiplexing.

REFERENCES

1. Robert F. Coughlin & Fredrick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6th Edition, Pearson Education, 2001
2. Ramakant S. Gayakward, "Op-amps and Linear Integrated Circuits", Pearson Education/ PHI, 2002
3. Curtis D. Johnson, "Process Control Instrumentation Technology", Pearson Education, 2003.
4. Kalsi H.S., "Electronic Instrumentation", Tata McGraw-Hill, New Delhi
5. Murray D. V.S., Transducers and Instrumentation", Prentice Hall of India, 2003.
6. Albert D. Helfrick and William D. Cooper, "Modern Electronic Instrumentation Devices and Systems", Prentice Hall of India, 1992.
7. Rangan C.S., Sarma G.R., and Mani V.S.V., "Instrumentation Devices and Systems", Tata McGraw Hill, 1992.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.604 ELECTRICAL MACHINES III (E) Credits-3 2-1-0

Module - I

3-phase induction motor, constructional features - slip ring and cage types - theory of induction motor with constant mutual flux - slip - phasor diagram - expression for mechanical power and torque - torque-slip characteristics - starting torque - full load and pull out torque - equivalent circuit. Circle diagrams - tests on induction motors for determination of equivalent circuit and circle diagram Harmonics - harmonic revolving fields in 3-phase cage motor - harmonic induction and harmonic synchronous torques - cogging - crawling and noise production in cage motors - remedial measures. Effect of unbalance in supply voltage - Boucherot's double cage motor - analysis by equivalent circuit - approximate current locus - torque-slip curves.

Module - II

Starting of induction motors - DOL starter - auto transformer starter - star-delta starter -rotor resistance starter. Inter lock and over load protection - comparison of different starting methods. Starting current and starting torque. Speed control - pole changing, stator voltage control – V/f control, Cascaded Control - rotor resistance control. Methods of braking - Induction generator - principle - phase relations - phasor diagram – circle diagrams - applications - comparison with synchronous generators. Self-excited induction generator - Synchronous induction motor - circle diagram.

Module - III

Single-phase induction motor - double field revolving theory - equivalent circuit - torque slip curve - starting - split phases-stating- shaded pole repulsion starting- applications. AC Commutator motors - single phase series motor - construction - phasor diagram - universal motor- single-phase repulsion motor -principle- simplified phasor diagram. Compensated types - applications.

Linear induction motor – principle – different types – end effects – applications – magnetic levitations – induction type regulator – principle and applications.

REFERENCES

1. Say M.G, Performance and design of ac machines, ELBS and PITMAN
2. Langsdorf A S - Theory of AC machines, Tata McGraw Hill, New Delhi
3. Fitzgerald and Kingsly - Electrical machinery, McGraw Hill
4. Cyril W Lander- Power Electronics, McGraw Hill International Edition
5. D.R. Gupta, Vandana Singhal, fundamentals of Electric Machines, New Age International
6. Open Shaw Taylor E - , "Performance and design of AC commutator motors".
7. Theodore Wilde, "Electrical Machines, Drives and Power System", Pearson Ed. Asia 2001.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.605 POWER SYSTEM ENGINEERING II Credits-3 - 2-1-0

Module - I

Power system faults - symmetrical faults - short circuit MVA - current limiting reactors, Symmetrical components - sequence impedances and sequence networks of generators, transformers and transmission lines. Unsymmetrical faults - single line to ground, line to line, line to line to ground faults -consideration of prefault current.

Module - II

Circuit breakers - Arc voltage, Arc interruption - Restriking voltage and Recovery voltage, Resistance Switching, Current chopping, Interruption of capacitive current

Classification of Circuit Breakers: Oil circuit Breaker - Air Blast Circuit Breaker, Air Break Circuit Breaker, SF_6 Circuit Breaker, Vacuum Circuit Breaker, Operating Mechanism, Selection of Circuit Breakers - High voltage dc Circuit Breakers, Rating of Circuit Breakers - Testing of Circuit Breakers

Fuses: Fuse Characteristics, Types of Fuses, Selection of Fuses

Protective relays - Introduction - Zones of Protection - Primary and Back up Protection - Essential qualities of protection - Classification of Protective relays - Basic Relay Terminology - Types of Electromagnetic relays - Over current protection - Distance protection - Pilot relaying schemes

Module - III

AC Machines Protection: Generator: Stator, rotor and other miscellaneous protections - Transformer Protection: Percentage Differential Protection, Overheating Protection - Buchholz Relay - Protection against magnetizing inrush current – earth fault protection of power transformer – overfluxing protection - Bus zone protection: Differential current protection, High impedance relay scheme - Frame Leakage Protection

Static relays - Merits and Demerits - Types of Amplitude and Phase Comparators Microprocessor based Protective relays: Block schematic and flow charts of over current relay, impedance relay and directional relay.

TEXTBOOK

1. Badri Ram & A N Vishwakanna. "Power System Protection and Switchgear, TM H, 1994
2. IJ.Nagrath, D.P.Kothari, "Power system Engineering", TMH, 1994.

REFERENCES

1. C .L. Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy Wiley Eastern Ltd., 1993
2. S.S.Rao, "Switchgear & Protection", KhannaPublishers, 1986
3. B Ravindranath & M Chander, "Power System Protection and Switchgear, Wiley Eastern Ltd, 1997.
4. M, V. Deshpande, "Switchgear and Protection", TMH, 1997.
5. Grainer JJ, Stevenson W.D, "Power system Analysis", McGraw Hill, 1994
6. P Switchgear Handbooks

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.606 (Elective – II) (1) ENERGY CONSERVATION AND MANAGEMENT 3-1-0

Objective: This subject provides essential input to equip graduate engineers suitable to take up responsibility of an energy manager in any organization.

Module - I

Global energy scenario and need for energy conservation - Energy intensity -Energy - GDP coupling - General principles of energy management and energy management planning. Establishing energy database - Energy audit - Identifying, evaluating and implementing feasible energy conservation opportunities - energy audit report.

Module II

The energy management profession - Thermodynamics and energy - Energy efficiency analysis - Coefficient of performance - Energy effectiveness. Management of heating, ventilating and air-conditioning (HVAC): principles, opportunities and case studies. Management of process energy: principles, opportunities and case studies. Management of electrical load and lighting - Management opportunities with electric drives, lighting, heating and electrolytic systems - Electrical load analysis - Peak demand control.

Module III

Financial evaluation of energy projects : Evaluation of proposals - Payback method - Average rate of return method - Internal rate of return method - Present value method - Life cycle costing approach.

Least cost power planning; end-use oriented energy scenario - DEFENDUS strategy.

Use of computers in energy management (description about basic ideas only); co-generation of electricity.

TEXT-BOOKS

1. Industrial energy conservation - Charles M. Gottschalk - John Wiley & Sons, 1996.
2. Energy management principles - Craig B. Smith - Pergamon Press.

REFERENCES:

1. IEEE recommended practice for energy management in industrial and commercial facilities, IEEE std 739 - 1995 (Bronze book).
2. Optimizing energy efficiencies in industry - G.G. Rajan, Tata McGraw Hill, Pub. Co., 2001.
3. Energy management - Paul O'Callaghan - McGraw Hill Book Co.
4. Energy management Hand Book - Wayne C.Turner - The Fairmount Press, Inc., 1997.
5. Energy Technology - S.Rao and B.B. Parulekar, Khanna Publishers, 1999.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.606(Elective – II) (ii) Biomedical Instrumentation (E) 3-1-0

Module - I

Action Potentials - propagation, bioelectric potentials

Electrodes, sensors and transducers - biopotential electrodes - electrodes for ECG, EEG, EMG and microelectrodes. Transducers for measurement of pressure, temperature and respiration rate. Measurement of heart rate and respiration rate. Measurement of blood pressure - direct and indirect methods. Blood flow measurement.

Module - II

Electrocardiography - principle, lead system, standards, block diagram of ECG machine - preamplifier, driver and recorder. Block diagram of computer aided ECG

Electroencephalography - lead system, position of electrodes, Block diagram and features

Electromyography - Block diagram of EMG recorder- frequency limitations Bedside monitors - block diagram

Module - III

Modern Imaging systems - Basic X-ray machine - CAT scanner - principle of operation, scanning components. Ultrasonic imaging - principle, types of ultrasound imaging, MRI scan(Principle only)

Therapeutic equipments - cardiac pacemakers, defibrillators, haemodialysis machine, artificial kidney, shortwave and microwave diathermy machines.

REFERENCES:

1. Handbook of Biomedical Instrumentation, RS Khandpur, TMH Publishing Company Ltd. New Delhi, 2000.
2. Introduction to Biomedical Equipment Technology, Joseph J. Carr, John M. Brown, Pearson Education(Singapore) Pte. Ltd., 2001.
3. Biomedical Instrumentation and Measurements, Leslie Cromwell, Prentice Hall of India Pvt. Ltd, New Delhi, 2000.
4. Biomedical Electronics and Instrumentation, S K Venkata Ram, Galgotia Publishing, New Delhi. 2000.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.606 (Elective – II) (iii) Software Engineering 3-1-0

Module - I

Introduction to Software Engineering - Scope of software engineering - Historical aspects - economic aspects - maintenance aspects - specification and design aspects, team programming aspects.

Software Engineering - a layered technology - process, method and tools. Software process models - prototyping models - incremental models - spiral models - water fall models.

Capability maturity model (CMM), ISO 9000.

Life cycle model - Phases in software development - requirement analysis - planning phase - project planning - objective - software scope - empirical estimation models -COCOMO, function point techniques, single variable model, staffing and personal planning.

Module - II

Risk management - risks - identification - risk projection - project planning and risk management. Software configuration management - configuration - identification - configuration control - software configuration management plans.

Design phase - design objective - principles - data flow analysis - top-down bottom-up strategies, design methodology.

Coding - programming practice, verification, size measures, complexity analysis, coding standards.

Testing - fundamentals - white box testing - control structure testing - black box testing - basis path testing - stress testing - robust testing - reliable testing - regression testing -spec based testing - coded walkthroughs and inspection - testing strategies - designing test cases.

Project delivery and Maintenance phase - management of maintenance.

Software Reuse - Software development for reuse - Software development with reuse. Application system portability - Introduction to "design patterns"

Module - III

Introduction to object oriented design - pros and cons of object orientation - object oriented analysis and design methodology. GUI design - advantages - types of user interfaces. Styles of human-computer interaction - Human-Computer interface design - interface design models - Task analysis and modeling - design issues - implementation tools.

Computer Aided Software Engineering (CASE) tools - Tool integration - object management - Analysis and design tools - programming tools - Integration and testing tools - Maintenance tools.

Introduction to Real-time Systems

Note:

Case study in software Engineering with a mini-project may be given as a semester assignment.

TEXTBOOK

1. Roger S Pressman," Software Engineering", Tata McGraw Hill

REFERENCES:

1. Ian Sommerville, "Software Engineering", Addison Wesley
2. Pankaj Jalote, "An integrated approach to Software Engineering", Narosa publishers.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.607 POWER ELECTRONICS LABORATORY 0-0-4

1. Study of Power devices- SCR, TRIAC, Power Transistor, Power MOSFET, IGBT, etc.
2. Characteristics of SCR.
3. Characteristics of Power MOSFET
4. Characteristics of IGBT
5. Phase control circuit using R and RC triggering.
6. UJT trigger circuit for single phase controlled rectifier.
7. AC voltage controller using Triac.

8. Regulated power supplies using 723
9. Study of PLL IC.
10. Ramp control trigger circuit.
11. Digital trigger circuit with carrier gating.
12. Single phase fully controlled SCR bridge circuit.
13. Triggering circuit for step down MOSFET chopper.
14. Triggering circuit for step down SCR chopper.
15. Triggering circuit for step down GTO chopper.
16. Triggering circuit for step down IGBT chopper.
17. Study of single phase Transistorized Inverter.
18. Study of dc motor control using converter.

Note : According to the facility available in the laboratory a minimum of 15 experiments should be conducted.

03.608 MICROPROCESSOR & SOFTWARE LABORATORY 0-0-4

Part A – Microprocessor Lab

1. Study of 8085 microprocessor kit
2. 8 and 16 bit data transfer using different addressing modes
3. Arithmetic operations in binary and BCD – addition, subtraction, multiplication and division
4. Sorting of arrays in ascending and descending order
5. Binary to BCD conversion and vice versa
6. Display of characters using 7 segment displays
7. Digital I/O using PPI – square wave generation
8. Interfacing D/A converter – generation of simple waveforms – triangular wave, ramp etc
9. Interfacing A/D converter

Part B – Software Lab

1. Simple programs using cin, cout, scanf, printf etc (familiarization . Example : Factorial computation, displaying Pascals triangle, palindrome checking , fibonacci sequence, checking for prime numbers etc.)
2. Programs using decision statements in C++ (Example : Bubble sorting, quick sorting programs etc)
3. Programs using control statements in C++
4. Functions – Pass by value, pass by reference, passing arrays
5. Handling Recursions.(Example : Towers of Hanoi problem)
6. File Handling programs (Example : Plotting a histogram of students academic record after reading from a file and then generating a report file, a dictionary program that checks the spelling of a given string and applies auto- correction using a data base diction file.)
7. Matrix manipulations – multiplication, inverse, determinants, transpose.
8. Comparison of methods for solution of differential equations – Eulers & Ranga Kutta
9. Comparison of methods for solution of linear equations – Gauss elimination, Gauss Jordan & Gauss- Siedel
10. Comparison of methods for solution of numerical integration – Trapezoidal & Simpsons
11. Comparison of methods for solution of transcendental polynomial in one variable – Bisection & Newton Raphson

03.701 INDUSTRIAL ENGINEERING & MANAGEMENT 2-1-0

Module I

Evolution of Scientific Management and Industrial Engineering. Functions of Management - Brief description of each function. System concept.

Types of Organisation structures such as line, staff, functional, project and matrix organisations.

Types of companies and their formation.

Personal Management - Objectives and functions - Recruitment, Selection, Training and Induction concepts and Techniques.

Accounting and financial Management - Principles of double entry-Preparation of Financial statements

Budget and budgetary control-Profit-Volume analysis.

Module II

Facilities Planning - Factors to be considered in site selection, layout planning, plant layout, Systematic layout planning, computerized layout planning techniques.

Introduction to Material Handling Principles.

Work study-Methods study and Time Measurement, Steps in methods improvement-Use of chart and diagrams.

Performance rating and Methods - Types of Allowances, computation of basic time and Standard time - Examples.
Wages and Incentives-System of Wage Incentive Plans, Job evaluation and Merit rating.

Module III

Industrial relations- Fatigue and methods of eliminating fatigue.

Industrial disputes-Settlement Machinery-collective bargaining-Trade unions-Workers participation in Industries in Indian context.

Labour welfare and social security-Industrial safety-Methods and Techniques.

Production Planning and Control-Functions and Objectives-job, batch, mass and continuous production-Economic lot size, Routing, Scheduling, Dispatching and Follow up. Materials Management – Importance, Inventory, Types of systems, selective inventory control techniques.

Quality Engineering-Quality control-Quality Vs. Cost concept, Control chart for variables and attributes-Introduction to ISO-9000 series(2000 version), ISO 14000 (2000 version) and Total Quality Management, Quality Information systems, Bench marking and Documentation.

Introduction to Marketing and its Environment - Marketing concept, Marketing mix.

References:

1. M. A. Sahaf : *Management Accounting Principles & Practices,* Vikas Publications Pvt. Ltd.
2. Grant and Levenworth : *Statistical Quality Control* , TMH
3. Krafewski: *Operations Management,* Pearson Education 6th Edn.
4. Introduction to Work Study – ILO
5. Besterfield : *Total Quality Management,* Pearson Education.
6. Richard L Francis & John A White: *Facility Layout & Location,* Prentice Hall
7. Kotler: *Marketing Management,* Pearson Education.
8. Roger G Schroedu: *Operations Management,* Mc Graw Hill.
9. Monappa : *Industrial Relations,* TMH
10. Stephen P Robbins, David A Decenyo: *Fundamentals of Management,* Pearson Education.

Question Paper

The question paper shall consist of two parts. Part I is to cover the entire syllabus, and carries 40 marks. This shall contain 10 compulsory questions of 4 marks each. Part II is to cover 3 modules, and carries 60 marks. There shall be 3 questions from each module (10 marks each) out of which 2 are to be answered.

03.702 CONTROL SYSTEMS 2-2-0

Module - I

Open loop-and closed loop control systems: Transfer function -T.F of simple, Mechanical and Electromechanical systems - Force-voltage and force-current-analogy - block diagram representation - block diagram reduction - signal flow graph - Mason's gain formula - characteristics equations - concept of stability -stability of feedback systems - Routh's stability criterion. Control system components: Electrical systems - DC-AC servo motor - synchro-magnetic amplifier series and parallel connections - Basic principle of operation and transfer function of gyroscope - stepper motor - Tacho meters.

Module - II

Time domain analysis of control systems: Transient and steady state response -Time domain test signals - Time domain specifications - first and second order systems - impulse and step response - steady state error analysis - static error coefficient of type 0,1,2 systems - Dynamic error coefficient - PID controllers -Tradeoff between steady state and transient behavior - Root locus diagram -General rules for constructing Root loci-root analysis of control systems - effect of addition of poles and zeros.

Module - III

Frequency domain analysis: Introduction - Bode plot-Polar plot-Log magnitude v_s phase plot - Frequency domain specification - Non-minimum phase system -transportation lag-gain margin - phase margin - Nyquist stability criterion - stability analysis from bode plot - Compensation design - Realization of basic compensators - Cascade compensation in time domain and frequency domain.

TEXT BOOKS

1. Katsuhiko Ogata, “Modern Control Engineering”, Fourth edition, Pearson Education, New Delhi, 2002.
2. Nagarath I.J. and Gopal M., “Control System Engineering”, Wiley Estern, New Delhi.
3. Richard C. Dorf, Robert. H. Bishop, “Modern Control Systems”, Pearson Education, New Delhi – 9th Edition, 2001.

REFERENCES

1. Kuo B.C., "Automatic Control Systems", Prentice Hall of India, New Delhi, sixth edition, 1991.
2. Gibson & Tutter, "Control System Components", Mc Graw Hill.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.703 POWER SYSTEM ENGINEERING-III 2-1-0

Module 1

Load flow studies - network model formulation - formation of bus admittance matrix, Gauss, Gauss-Siedel, Newton-Raphson and Fast Decoupled methods, principle of DC load flow. Reactive power control-reactive power generation by synchronous machines, excitation control, synchronous compensators, reactors, capacitors, static compensators.

Economic Operation ; Distribution of load between units within a plant - transmission loss and function of plant generation - distribution of load between plants - Methods of computing penalty factors and loss coefficients - Automatic load dispatching.

Automatic Generation and Voltage Control: Load frequency control: single area and two area system - Load frequency control and economic dispatch control - Automatic voltage control

Module - II

Unit commitment: Introduction — Constraints on unit commitments: Spinning reserve, Thermal unit constraints - Hydro constraints - Unit commitment solution methods: Priory list methods and Dynamic programming Solution.

Power system stability - steady state, dynamic and transient stability-power angle curve-steady state stability limit Mechanics of angular motion-Swing equation - Point by Point method - RK method - Equal area criterion-application of equal area criterion, Methods of improving stability limits - Application of Shunt capacitor, Series Capacitor and Static Var Compensator (SVC) for improving Power System Stability.

Module - III

High voltage DC transmission - Advantages & disadvantages - Types of DC links -Analysis of converters - Power Flow in HVDC system - Constant Ignition Angle control - Constant Extinction angle control - Constant Current control - Actual control Characteristics - Frequency Control -Reactive volt ampere requirement of HVDC converters - Inter connection of HVDC transmission system to AC systems - Ground return - Circuit Breaking - Application of HVDC back to back links - HVDC developments in India

FACTS Introduction, Objectives - Basic types - Important FACTS devices - Static Var Compensator (SVC), Static Compensator (STATCOM), Thyristor Controlled Series compensator (TCSC), Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC)

Over voltages and insulation requirements - Generators of over voltages - Switching surges -Protection against over voltages - Surge diverters Insulation co-ordination propagation of surges -Termination in inductance and capacitance - Determination of system voltages produced by travelling waves - Bewly lattice diagram effects of line loss.

REFERENCES

1. B.R. Gupta, "Power System Analysis and Design", Wheeler Publishing Company, 2nd edition 1993.
2. B.M. Woody, "Electric Power Systems", John Wiley & sons, Newyork, 1987.
3. I. J.Nagarath, A P. Kothari, "Modern Power System Analysis", TMH. 1994.
4. A.R. Bergen & Vijay Vittal, "Power System Analysis", 2/e, Pearson Edn. 2001.
5. W. D. Stephenson, "Elements of Power System Analysis, TMH, 1982
6. T.J.E Miller, "Reactive Power Control in Electric Systems", John Wiley & sons, Newyork.
7. Alton, J. Wood, Bruce. F. Wollenburg, "Power Generation, Operation & Control", John Wiley & Sons, 1984.
8. S N. Singh, "Electric Power Generation", Transmission and Distribution, PHI.
9. K.R. Padiyar, "High voltage DC Transmission", Wiley. 1993.
10. Kimbark, "Direct Current Transmission", Wiley, 1971.
11. S. Rao, "EHVAC & HVDC and Transmission", Khanna, 1996.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03-704 ELECTRONIC COMMUNICATION 2-1-0

Objective: To provide fundamental ideas of Electronic Communication Systems

Module - I: Radio Communication

Theory of amplitude modulation (AM) - generation of (block diagrams only) double sideband full carrier, double sideband suppressed carrier, single sideband suppressed carrier - propagation of electromagnetic waves - block diagrams of low power and high power AM transmission - AM receivers: straight receivers superhetrodyne receiver - choice of intermediate frequency - simple AVC circuit.
Theory of frequency modulation (FM) - sidebands - FM broadcasting - block diagrams of direct FM transmitter and Amstrong transmitter - FM receivers (balanced - slope detector and Foster-Seely discriminator only).
Carrier communication: General principles of multi-channel system and power-line carrier - terminal equipment. Electronic telephone exchange(basic idea only).

Module - II: Radar, Facsimile and Television

Basic principles of RADAR - block schematic of pulsed radar system - radar range equation - applications.
Facsimile transmission and reception - analog FAX transmission - digital FAX transmission
Television: TV standards - frequency bands - TV Cameras -TV picture tube -interlacing and synchronisation - bandwidth - composite video signal - TV receiver and transmitter block diagrams: black and white, color (PAL system only) - high definition television.

Module - III: Mobile Telephone service

Evaluation of mobile telephone - two-way communication services - cellular telephone: basic concepts, frequency reuse, interference cell splitting, sectoring, cell system layout, cell processing.
Analog cellular telephone: Basic concept, block diagram of analog cellular tranceiver.
Digital cellular telephone (basic concept) - code division multiple accessing (CDMA) - block diagram of global system for mobile (GSM) architecture -overview of personal communication satellite system (PCSS).

TEXT BOOKS:

1. George Kennedy, "Electronic communication systems", McGraw Hill [for module l & II]
2. Dennis Roddy and John Coolen, "Electronic communications", 4th Edition, Prentice Hall of India, 2002 [for module I & II].
3. Wayne Tomasi, "Electronic communication systems ", 4th edition, Pearson Education, 2001 [general and specifically for module - III].

REFERENCES

1. Frank. R, Dungan, "Electronic communication systems", 3rd edition, Vikas Publishing House, 2002.
2. Herbert Taub and Donald L. Schilling, "Principles of communication systems", McGraw Hill.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03-705 Seminar and Project 0-0-4

The Students shall do a project work, which can be the preliminary work of final project, and submit a report at the end of semester.
The students shall present a seminar on a topic which is of high relevance to Automobile Engineering. A report on seminar also shall be submitted at the end of the semester. 25% credit for Project, and 75% credit for Seminar.

03-706(Elective – III) 1. Modern Operating Systems (Elective) 3-1-0

Module - I

Introduction - Operating system as an extended machine - Operating system as a resource manager - Overview of different types of OS, Operating system concepts – overview. System calls - for process management - file management - directory management - Miscellaneous system calls. Operating system structure - monolithic systems - layered systems - virtual machines, client-server model.
Introduction to processes - The process model - creation - termination - hierarchies - states - implementation of process. Threads - thread model, thread usage, Implementing threads in user space and kernel, pop-up threads, Inter-process communication - race condition - critical sections - Mutual exclusion with busy waiting - sleep and wakeup - Semaphores, Mutexes, Monitors, and message passing.
Process Scheduling -Goals - First come first served scheduling - Shortest job first - Shortest remaining time next - Round robin scheduling - Priority scheduling - Multiple queues - Shortest process next - Guaranteed scheduling - Policy verses mechanism - Three level scheduling.

Deadlocks - Conditions for deadlock - deadlock modeling - ostrich algorithm - deadlock detection - recovery from deadlock - deadlock avoidance - resource trajectories - safe and unsafe states. Bankers algorithm for single and multiple resources - deadlock prevention. Other issues - two-phase locking - Non-resource deadlocks - starvation.

Module - II

Memory management - mono-programming without swapping or paging - Multiprogramming with fixed partitions. Modeling multi-programming, Analysis of multiprogramming system performance, relocation and protection, Swapping - Memory management with bit maps - Memory management with linked lists.

Virtual memory - Paging - Page tables – TLBs - Page replacement algorithms - Optimal page replacement algorithm - Not recently used algorithm - First-in first-out algorithm - Second chance page replacement algorithm - Clock algorithm - Least recently used algorithm - simulating LRU in software - the working set page replacement algorithm -Beladys anomaly, local verses global policies - page size.

Module - III

I/O - devices - device controllers - principles of I/O software - I/O software layers - Disks - formatting, disk arm scheduling algorithms, Error handling, Stable storage, RAID disks.

File Systems - file structure - file "types - file access - file attributes - file operations - Directories - single level directory systems - Two-level directory systems - hierarchical directory systems - path names, Directory operations, File system implementation - implementing files - file system layout - implementing directories - Shared files - Disk space management and reliability (in brief), file system performance.

Example file systems - MS-DOS and Unix.

Introduction to Distributed Operating systems.

TEXT BOOK:

1. Andrew S Tanenbaum – “Modem Operating systems" - Pearson Education, Asia 2002.

REFERENCES

1. IL. Peterson and A Silbershaltz, "Operating Systems
2. Madnik and Donovan, "Operating Systems" - McGraw Hill
3. P.K. Sinha, "Distributed Operating Systems"

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.706 (Elective – III) (2) COMPUTER AIDED POWER SYSTEM ANALYSIS 2-1-0

Module - I

Central Operation and Control of Power Systems: introduction, Control center of a Power System, Digital Computer Configuration, Automatic Generation Control - Operation without computers or AGC - Area Lumped Dynamic Model - State Estimation from Online Measurements.

Elements of Transmission networks: Phaser notation - Symmetrical component transformation. Overhead transmission line representation - Synchronous machine representation

Module - II

Bus Reference Frame: Injections and Loads, Formulation of Bus Impedance matrix for dements, without Mutual Coupling, Bus admittance matrix: Bus impedance matrix with mutual coupling. Inversion of YBUS for large systems: Tinney's Optimally ordered Triangular formulation, Iteration methods.

Network fault and Contingency Calculations. Fault calculations using ZBUS, Fault Calculations using the YBUS Table of Factors, Contingency analysis in Power systems, Contingency studies using the YBUS table of factors.

Module - III

Power Flow on Transmission line Networks: Slack bus, ZBUS formulation for load flow equation ,Gauss and Gauss-Seidel Iteration using YBUS, Newton-Raphson method, Fast Decoupled Load Flow (FDLF), Adjustment of network operating conditions, Operational Power flow, programs.

Generation Base Power Setting: Economic dispatch of Generation without transmission line losses - Economic dispatch with line losses – Classical method to calculate loss coefficients, Loss-Coefficient calculation using YBus and sparse matrix techniques, Execution of the Economic dispatch, Utilising Load Flow Jacobian for the economic dispatch, Economic dispatch using shared Generators - Economic exchange of power between areas.

TEXT BOOK

1. G.L.Kusic, Computer Aided Power System Analysis, PHI, 1989

REFERENCES

1. LP. Singh, “Advanced Power System Analysis and Dynamics”, 3/e, New Age Intl, 1996.

2. J. Arriliga and N.R. Watson, Computer modelling of Electrical power systems, 2/e, John Wiley, 2001
3. Stagg and El Abiad, "Computer methods in Power system Analysis", McGraw Hill,1968.
3. I.J.Nagrath and D.P.Kothari, "Modern Power System Analysis", Tata McGraw Hill, 1980

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.706 (Elective – III) (3) ROBOTICS AND INDUSTRIAL AUTOMATIONS 2-1-0

Module – I

Introduction to robotics – Classification of robots.

Direct kinematics – Inverse kinematic problem – Inverse kinematics of a five – axis articulated robot – Inverse kinematics of a four – axis SCARA robot – inverse kinematics of a three – axis planer articulated robot. Trajectory planning – Continuous path motion.

Module – II

Robot control – state equations control methods. Robot vision – image representation – transformations. Robot programming languages.

Module – III

Robot applications.

Industrial automation – General layout. Typical examples.

TEXT BOOKS

1. Fundamentals of robotics – Analysis and control – Robot. J. Schilling – Prentice Hall of India 1996.
2. Mickell. P. Groover – Automation, Production and computer integrated manufacturing – Prentice hall of India 1992.
3. Introduction to Robotics (Mechanics and control), John. J. Craig, Pearson Education Asia 2002.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.707 ELECTRICAL MACHINES LABORATORY – II 0-0-4

1. Regulation of alternator by direct loading - Effect of prime mover speed and Generator Excitation.
2. Regulation of alternator by emf and mmf methods - Power Angle Calculation
3. Regulation of alternator by Potter and ASA methods
4. Slip test - regulation of salient pole alternator using two reaction theory
5. Synchronization of alternator to mains by dark lamp and bright lamp methods and control of reactive power - effect of normal excitation, under excitation & over excitation in an alternator connected to infinite bus V and inverted V curves.
6. Variation of starting torque with rotor resistance in slip-ring induction motors
7. Study of induction motor starters
8. Direct load test on three phase induction motor
9. No load and block rotor test on three phase induction motor - predetermination of performance characteristics and equivalent circuit
10. Pole changing induction motor - predetermination of performance characteristics
11. Load test on induction generator
12. Synchronous induction motor - V-curves - predetermination of field current
13. Characteristics of brushless dc motor
14. characteristics of single phase induction motor
15. V/f control of three phase induction motor

03.708 POWER SYSTEMS LAB 0-0-4

1. Power frequency testing of electrical equipment like insulators, fuses, AB switches, lightning arresters etc.
2. Determination of string efficiency of string insulators.
3. Calibration of HV measuring equipment using sphere gap
4. Impulse voltage on electrical equipment

5. Measurement of dielectric strength of solid and liquid insulating materials
6. Determine the characteristic , pick up time etc. of different types of electromagnetic relays
7. Determine the characteristic, pick up time etc. of different types of static relays.
8. Measurement of transient & sub transient reactance of synchronous machines
9. Measurement of capacitance using tan delta meter/scherring bridge
10. Measurement of earth resistance.
11. Study of power factor improvement
12. Testing of energy meter
13. Power measurement using current transformer & potential transformer
14. Testing of insulation of 3 core and 4 core cable
15. Load flow analysis-

    Newton Raphson Method
    Gauss Siedal Method
    Fast decoupled method
    (looped & radial system)
16. Short circuit studies – 3 phase LG, LL, LLG fault
17. Analysis of static Var compensators
18. Analysis of STATCOM
19. Analysis of Voltage stability of power systems
20. Power system modelling using MATLAB/ SIMULINK
21. Study of PSPICE simulation

03-801 ADVANCED CONTROL THEORY 2-1-0

Module - I

State space analysis of systems: Introduction to state concept - state equation of linear continuous time data systems, matrix representation of state equations. Phase variable and canonical forms of state representation- solution of time invariant autonomous systems- state transition matrix- relationship between state equations and transfer function. Properties of state transition matrix- controllability & observability. State feed back design via pole placement technique.

Module - II

Sampled data control system . Sampling process - Z transform method-solving difference equation by the Z transform method- pulse transfer function- system time response by Z transform method - analysis of the sampling process - data reconstruction and hold circuits - zero order hold circuit - Sampling theorem.

Stability of sampled data system - Routh Hurwitz criterion and Jury's test

Module - III

Nonlinear systems : Introduction- characteristics of nonlinear systems. Types of non-linearities. Describing function analysis - Determination of describing function of static nonlinearities (saturation and ideal relay only)- application of describing function for stability analysis of autonomous system with single nonlinearity, Liapunov Stability- definition of stability- asymptotic stability and instability - Liapunov methods to linear and nonlinear systems.

REFERENCES

1. Katsuhiko Ogata: “Modern Control Engineering”, fourth edition, Pearson Education, NewDelhi, 2002.
2. Nagarath I. J and Gopal M, “Control System Engineering”, Wiley Eastern, NewDelhi, 1992.
3. Gopal M, “Modern Control System Theory”, Wiley Eastern Ltd., New Delhi.
4. Kuo B.C, “Analysis and Synthesis of Sampled Data Systems”, Prentice Hall Publications.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.802 ELECTRICAL MACHINE DESIGN 2-2-0

MODULE-1

Principles of electrical machine design - General design considerations - specifications of machines - types of enclosures - types of ventilation - hydrogen cooling - heating - short time rating - overload capacity - temperature rise time curve - hot spot rating.

Review of properties of materials used in electrical machines.

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 – no. of turns - current density - conductor section - types of coils - insulation electric stress, Cooling of transformers - design of cooling tank and tubes.

Module - II

Field flux distribution curve - field form factor - magnetic leakage coefficient - 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 equation - specific loading - choice of speed and no 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 - design of field winding - excitation voltage - conductor cross section - height of pole - design of interpole - flux density under interpole - calculation of turns of interpole winding.

Module - III

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 water wheel and turbo alternators - cooling of alternators.

Design of three phase induction motors - main dimensions - stator design - squirrel cage and slip ring types - 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 design programs

TEXT BOOK

1. Sahney A.K, "A Course in Electrical Machine Design", Dhanpat Rai & sons, Delhi.

REFERENCES

1. M.V. Deshpande: "Design and Testing Of Electrical Machines", Wheeler Publishing
2. R.K. Agarwal: "Principles Of Electrical Machine Design", Esskay Publications, Delhi.
3. Ramamoorthy M. "Computer Aided Design of Electrical Equipment", East-West Press.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.803 Electrical System Design 2-2-0

Module – I

Role of National Electric Code (NEC) in the design of installations – symbols, standards and specifications, classification of voltages, scope and safety aspects applicable to low and medium (domestic) voltage installations. Electric services in buildings – general aspects of the design of electrical installations for domestic dwellings. Air-conditioning loads and its specifications – design and layout of installation for recreational or assembly buildings and cinema theatre – Kerala Cinema Regulation Act - 1958. Earthing – pipe and plate earthing (sketching only). Precommissioning lists of domestic installations.

Module – II

Medium and HV installations – selection of cables – guidelines for cable installation – basic criteria for selection of drives and its switchgear. Installation of induction motors. Selection and installation of transformers and switchgears – design of indoor and outdoor 11 KV substation upto 630 KVA. Selection of CT and PT. Metering and protection HT and LT breaker control panels . Short-circuit calculations – design of earthing system. Design of distribution systems with light power and motor loads. Standby generator – installation and its protection. Pre-commissioning tests of cables, transformers and generators.

Module – III

Design of illumination systems – types of luminaries – Yard lighting, street lighting and flood lighting. Design of lighting in auditoriums and halls. Energy conservation and efficiency in illumination of high-rise buildings – design of risinf mains. Distribution systems of high-rise buildings.

Single line diagram of substations and generating stations with different busbar configurations and control structures (only for drawing)

REFERENCES

1. National Electric Code, Bureau of Indian Standards publications, 1986.
2. Relevant Indian Standard – specifications (IS – 732, IS – 746, IS – 3043, IS – 900), etc.
3. Approved data and reference manuals (to be permitted to use in the exam hall).

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.804 DIGITAL SIGNAL PROCESSING 2-1-0

Module - I

Continuous time signals and systems, signals and spectra, line spectra and Fourier series, Fourier transform and continuous spectra. Time and frequency relations.

Discrete time signals and systems, periodic signals, discrete time Fourier transforms, properties of DTFT, response of discrete time LTI systems.

Module - II

The z transform, region of convergence, inverse z transform, properties, analysis of LTI systems using z transform, transient and steady state response, causality and stability - Schur Cohn stability.

Sampling of continuous time signals, reconstruction of band limited signal from its samples, aliasing, anti-aliasing filter design, ADC, sample and hold, zero order hold, first order hold, quantization, coding, analysis of quantization errors, DAC.

Module - III

Digital filter structures, signal flow graphs, basic network structures for IIR filters: Direct, cascade, parallel, lattice ladder, basic network structures for FIR filters: Direct, cascade, linear phase FIR filter, all pass filters.

Discrete Fourier transforms properties, circular convolution, and linear convolution using DFT.

Fast Fourier transform, decimation in time, decimation in frequency, Radix FFT, general computational considerations.

REFERENCES:

1. Alan V. Oppenheim, Alan S. Willsky and Lan T Young, "Signals and Systems", 2nd Edition, Pearson Education.
2. Emmanuel Ifeachor and Barrie Jervis, "Digital Signal Processing", 2nd Edition, Pearson Education, 2002.
3. B. Somanathan Nair, "Digital Signal Processing and Filter Design", Prentice Hall of India, 2003.
4. Proakis and Manolakis, "Digital Signal Processing - Principles, Algorithms and Applications", 3rd Edition, Prentice Hall of India, 2000.
5. Johnny R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall of India, 1992.
6. Alan V. Oppenheim and Ronald W Schafer, "Digital Signal Processing", 2nd Edition, Pearson Education, 1999.
7. Lonnie C. Ludeman, "Fundamentals of Digital Signal Processing", John Wiley & Sons.
8. Ambardar, "Analog and Digital Signal Processing", 2nd Edition, Thomson Learning, 1999.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03. 805 Power Semiconductor Drives 2-1-0

Module - I

Introduction to Power Semiconductor drives – block diagram choice of electrical drives – dc and ac drives – dynamics of motor load system – fundamental equations – classification of load torques – multiquadrant operation of drives – speed torque characteristics of fa---, pump, compressor hoist, fraction and coiler drives – steady state stability – closed loop control of drives.

Cycloconverters – basic principle step up and step down cycloconverts – single phase to single phase to single phase and three phase to single phase cycloconverters – frequency and voltage control – output voltage expression – application.

Module - II

DC motor drives – system model – methods of speed control – braking – speed control using controlled rectifiers – single quadrant, two quadrant and four quadrant operation – dual converter – application of dual converter for speed control of dc motor.

Chopper controlled dc drives – analysis of single quadrant chopper drives – two quadrant and four quadrant control of chopper fed dc drives.

Module – III

Three phase induction motor speed control – stator voltage control using ac voltage controllers – frequency control constant volt/Hertz operation – voltage source inverter drives – current source – inverter control of induction motor drives

Slip control of three phase induction motor – chopper control of rotor resistance – slip power recovery drives – speed control of synchronous motors – frequency control – constant volt/hertz operation – voltage source inverter drives.

REFERENCES

1. Muhammad H. Rahid, "Power Electronic circuits, devices and applications", Pearson education – Asia, 2003.
2. Dubey G. K., "Power Semiconductor Controlled Drives", Prentice Hall, New Jersey.
3. Bimal. K. Bose, "Modern Power Electronics and AC Drives", Pearson education, Asia, 2003.
4. N.K. De, P.K. Sen, "Electrical Drives", Prentice Hall of India, 2002.
5. Dewan S.B., G.R. Slemans, A. Straughen, "Power Semi-conductor Drives", John Wiley and Sons, 1984.
6. J.M.D. Murphy, "Thyristor Control of AC Drives", Paperman Press, 1973.
7. Ned Mohan et. al., "Power Electronics: Converters, applications and design", John Wiley and sons.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.806 (Elective – IV) (1.) Computer and Data Networks 3-1-0

Module - I

Uses of computer networks - Network hardware - Classification of networks - LAN - MAN - WAN (overview only) - Network software. Protocol hierarchical issues for the layers - interfaces and services - connection oriented and connectionless services - service primitives - relationship of services of protocol. Reference models - OSI reference model - TCP/IP reference model. Sampling theorms - Bandwidth - maximum data rate of channels.

The Physical layer

Transmission media - twisted pair - base band coaxial cables - broadband cables - fiber optics

The Data link layer

Design issues - services provided to the network layer - framing - error control - flow control - elementary data link protocols - unrestricted simplex protocol - simplex stop and wait protocol - simplex protocol for noisy channel.

Module - II

The medium access sub-layer

The channel allocation problem - static channel allocation - dynamic channel allocation - multiple access protocols - ALOHA - CSMA protocols - collision free protocols - limited contention protocols - CDMA. Introduction to IEEE 802 standards – 802.3.

The network layer

Design Issues - services provided to the transport layer - internal organisation of the network layer - comparison of virtual circuit and datagram subnets. Routine algorithms - optimality principle - shortest path routing - Dijekstra's algorithm - flooding - flow based routing - distance vector routing - link state routing - Hoffmans algorithm - hierarchical routing. Congestion control algorithms - principles - prevention policies - traffic shaping - leaky bucket and token bucket - flow specification - choke packets - load shedding - jitter control.

Module - III

The transport layer

The transport service - services provided to the upper layer - quality of service -transport layer primitives. Elements of transport protocols - Addressing - Establishing a connection - releasing a connection - flow control and buffering - multiplexing - crash recovery.

The Application layer

Basic ideas of network security - public key cryptography - RSA algorithm, DNS, SNMP, e-mail, www, Intranets and Internets.

REFERENCES:

1. Andrew S, Tanenbaum, "Computer networks", PHI.
2. Peterson *and* Davie, * Computer networks", Harcourt India Pte. Ltd.
3. Bertsekas D and Gallager, "Data networks", second edition Prentice Hall, 1992.
4. William Stalling, "Data and Computer Communication".

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.806 (Elective – IV) 2. Advanced Electronic Communication 3-1-0

Objective: To provide a background of advanced and fast developing electronic communication systems.)

Module - I: Microwave Satellite and Digital Communication

Microwave frequency bands - propagation characteristics and line-of-sight communication - repeater - microwave radio link systems - land-line and satellite -comparison - advantages and disadvantages - microwave application - Maser.

Principles of digital communication - basic principles of sampling and pulse code modulation (PCM) - block diagrams of PCM transmitter and receiver - digital microwave techniques - basic principles of PSK - basic principles of ISDN.

Module - II: Optical Communication, Spread spectrum communication

Optical communication - basic principles - types of optical fibres - losses in fibres - optical sources: light emitting diodes, injection laser diodes, optical detectors -comparison of LED and ILD - optical communication systems - direct detection and heterodyne receivers - advantages of coherent optical communication.

Spread spectrum communication - direct sequence or pseudo noise, frequency hopping, time hopping, hybrid and chirp spread spectrum systems - comparison of modulation methods - generation and detection of spread spectrum signals -and applications

Module - III: Computer Communication

Need for computer communication - basic principles of computer communication networks - data communication protocols - (elementary treatment of) open systems interconnection (OSI) protocol - multiple accessing - basics of TDMA, FDMA, CDMA, CSMA/ CD.

Inter-networking techniques (elementary treatment only) - Internet and ATM networks - important services provided by internet - TCP/IP - connecting to the internet - ISDN - types of MODEMs - Intranets.

TEXT BOOKS

1. Wayne Tomasi, "Advanced Electronic communication systems ", 5th edition, Prentice-Hall of India, 2002.

REFERENCES

1. Wayne Tomasi, "Electronic communication systems", 4th edition, Pearson Education, 2001.
2. Frank R.Dungan, "Electronic communication systems", 3rd edition, Vikas Publishing House.2002.
3. Gred Keiser, "Optical Fibre Communications ", McGraw Hill.
4. G.R.Cooper and C.D.McGillem, "Modern communications and spread spectrum", McGraw Hill.
5. Dennis Roddy and John Coolen, "Electronic communications", 4th Edition, Prentice-Hall of India, 2002.
6. Andrew S. Tanenbaum. "Computer Networks". 3rd edition. Prentice -Hall of India.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03-806 (Elective – IV) 3. HIGH VOLTAGE ENGINEERING 3-1-0

Module - I

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 - Cockcroft-Walton Voltage multiplier circuits. Ripple and regulation. Electrostatics machines – principles - Van de Graaff generator.

Generation of High AC voltages: Cascade transformers, resonant transformers- parallel and series resonant test systems.

Generation of High frequency high voltages- Tesla coil.

Generation of impulse voltages- Standard impulse wave shape - Basic circuits for producing impulse waves - Analysis of commercial impulse generator circuits -Wave shape control. Multistage impulse generators - Marx circuit - modified Marx impulse generator circuit - Components of multi-stage impulse generator. Generation of switching surges.

Generation of impulse currents- Definition of impulse current waveform - Circuit for producing impulse current waves.

Module - II

Over voltages in power system - Over voltages and their significance. Switching over voltages - origin and characteristics - switching over voltages in EHV and UHV systems. Insulation requirements of EHV line.
Protection of power system apparatus against over voltages. Surge arresters - dynamic volt-ampere characteristics and surge diverter operation characteristic. Connections and rated voltages of surge arresters. Thyrite and ZnO arresters. Protective devices against lightning over voltages - rod - rod gaps – over-head ground wires.
Control of over voltages due to switching - method of reducing switching over voltages.
Principle of insulation co- ordination on HV and EHV power systems: Insulation level of equipment. Insulation co-ordination of a substation. Insulation co- ordination of EHV system.

Module - III

Non-destructive testing of dielectric materials-Measurement of resistance, 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, transformers, surge arresters.
HV and EHV bushing design, selection, quality control, maintenance and diagnostic testing.
Biological and environmental aspects in EHV and UHV line design. Live line maintenance – Principles - common live line maintenance - Tools for live line maintenance.

TEXT BOOK

1. M.S.Naidu and V.Kamaraju. "High voltage Engineering", Tata Mc Graw Hill, New Delhi.

REFERENCES

1. Kuffel. E and Zaengal W. "High Voltage Engineering", Pergamon Press, Oxford.
2. Dieter Kind. "An Introduction to High Voltage Experimental Techniques", Wiley Eastern.
3. Diesendrof W. "Insulation Co-ordination in High Voltage Electrical Power Systems", Butterworth, London.
4. "Methods of High Voltage Testing", IS 2021-1976 IEEE Std - 4 - 1978.
5. C.L. Wadhwa "High Voltage Engineering", Wiley Eastern.

Note : The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice, One out of two or two out of four from each module).

03.807 Project and viva voce (Industrial visits) 0-0-4

Out of 100 marks for sessional work, 20 marks are to be given for the industrial visits, to be assessed based on reports presented.
Viva – voce examination may be based on project, seminar and industrial visits. (Six visits during five to eight semesters) and overall performance.

03.808 SYSTEMS AND CONTROL LAB 0-0-4

1. Predetermination and verification of frequency response characteristic of lag and lead networks.
2. Determination of transfer function of a DC motor.
3. Characteristics and transfer function of an ac servo motor.
4. Magnetic amplifier-control characteristics when connected in series, Parallel and parallel with feedback configuration.
5. Step response and frequency response of an R-L-C circuit.
6. Study of various types of synchros (TX, TR, TDX) and experiments using -them.
7. Study of controllers such as First order time lag, Integral, Proportional plus integral and proportional plus derivative plus time lag. Verification of gain and time constant.
8. Computer aided control system design using control system design software packages.
9. Study of the operation and characteristics of a stepper motor and its control using microprocessor.
10. Study of the performance characteristics of a typical temperature control system.
11. Study of the performance characteristics of a LVDT.
12. Simulation of FT using Op amps.
13. Waveform generation using Analog Computer Simulation.
14. Study of PID Controller action on DC servo motor.
15. Study of closed loop level control laboratory trainer.
16. Study of closed loop flow control laboratory trainer.
17. MATLAB exercises.
18. Familiarization of tool boxes.