

SCHEME OF INSTRUCTION AND SYLLABI

B.TECH DEGREE IN

ELECTRICAL AND ELECTRONICS ENGINEERING

EFFECTIVE FROM 2010-2011

National Institute of Technology Delhi

(NIT DELHI)

NATIONAL INSTITUTE OF TECHNOLOGY DELHI
SCHEME OF INSTRUCTION & EVALUATION
ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)

I B.Tech I – Semester
(Effective from the Academic Year 2006-2007)

Course No.	Course	L	T	P	Credits
MH 101	Mathematics - I	4	0	0	4
PH 101 CY 101	Physics / Chemistry	4	0	0	4
EC 101 EE 101	Elements of Electronics Engineering/ Elements of Electrical Engineering	3	0	0	3
ME 101 CE 102	Elements of Mechanical Engineering / Environmental Studies	3	0	0	3
CS 101 CE 101	Problem Solving & Computer Programming/ Engineering Mechanics	4	0	0	4
MH 102 ME 102	English for Communication / Engineering Graphics	3 / 2	0	2 / 3	4
PH 105 CY 105	Physics Lab / Chemistry Lab	0	0	3	2
CS 102 ME 103	Problem Solving & Comp. Programming Lab / Workshop Practice	0	0	3	2
	TOTAL	21/20	0	8/9	26
EA 101	Extra Academic Activity (mandatory) NSS / NCC / Games & Sports	0	0	3	--

I B.Tech II – Semester

Course No.	Course	L	T	P	Credits
MH 151	Mathematics - II	4	0	0	4
CY 101 PH 101	Chemistry/ Physics	4	0	0	4
EE 101 EC 101	Elements of Electronics Engineering/ Elements of Electrical Engineering	3	0	0	3
CE 102 ME 101	Environmental studies/ Elements of Mechanical Engineering	3	0	0	3
CE 101 CS 101	Engineering Mechanics/ Problem Solving & Computer Programming	4	0	0	4
ME 102 MH 102	Engineering Graphics / English for Communication	2/3	0	3/2	4
CY 105 PH105	Chemistry Lab / Physics Lab	0	0	3	2
ME103 CS 102	Workshop Practice / Problem Solving & Comp. Programming Lab	0	0	3	2
	TOTAL	20/21	0	9/8	26
EA 151	Extra Academic Activity (mandatory) NSS / NCC / Games & Sports	0	0	3	--

SCHEME OF INSTRUCTION
(For The batch admitted in 2006-2007, Grade System)

IV B.Tech. (EEE) I-Semester

Sl.No.	Course No.	Course Title	L	T	P	Credits
1	ME 446	Industrial Management	3	0	0	3
2	EE 401	Solid State Drives	3	1	0	4
3	EE 402	HVDC & Flexible AC Transmission Systems	3	1	0	4
4	EE 403	MicroProcessors Lab	0	0	3	2
5	EE 404	Electrical Simulation Lab	0	0	3	2
6		Elective I	3	0	0	3
7		Elective-II	3	0	0	3
8	EE 441	Seminar	0	0	3	1
9	EE 449	Project Work	0	0	3	2
		Total	15	2	12	24
			29			24

Elective I – 3 credits

EE 411:Electrical machine modeling and analysis

EE 412:Distribution system planning and automation

EE 413:Power system stability and control

Elective II – 3 credits

EE 414: Computer methods in power Systems

EE 415: Extra high voltage AC transmission

EE 416: AI techniques in electrical engineering

IV B.Tech. (EEE) II-Semester

Sl.No.	Course No.	Course Title	L	T	P	Credits
1	EE 451	Power Systems Lab	0	0	3	2
2	EE 452	Power Electronics & Drives Lab	0	0	3	2
3		Elective I	3	0	0	3
4		Elective-II	3	0	0	3
5		Elective-III (Global)	3	0	0	3
6		Elective IV	3	0	0	3
7	EE 499	Project Work	0	0	6	4
		Total	12	0	12	20
			24			20

Elective-I: – 3 credits

EE 462 Electric Traction.

EE 463 Power System Deregulation

Elective-III: – 3 credits

EE 468 New Enterprise Creation & Management Management

ME 466 Alternate Sources of Energy

EC 480 Fuzzy logic system and Neural Networks

MM 462 Surface Engineering

CH 564 Environmental Engg and Pollution Control

CS 463 Computer Graphics

MH 451 Operation Research

Elective – II : – 3 credits

EE 464 Real Time Control of Power System

EE 465 Power Quality

Elective-IV: – 3 credits

EE 466 Switched Mode Power Conversion

EE 467 High voltage engineering

CE Disaster Mitigation and

SYLLABUS

MH 101

MATHEMATICS - I

(4-0-0)4

Matrix Theory: Elementary row and column operations on a matrix, Rank of matrix – Normal form – Inverse of a matrix using elementary operations –Consistency and solutions of systems of linear equations using elementary operations, Gauss Seidal iteration method - linear dependence and independence of vectors - Characteristic roots and vectors of a matrix - Caley-Hamilton theorem and its applications, Calculation of dominant eigen value by iteration - Reduction to diagonal form - Reduction of a quadratic form to canonical form – orthogonal transformation and congruent transformation. **Differential Calculus:** Rolle’s theorem; Mean value theorem; Taylor’s and Maclaurin’s theorems with remainders, Expansions; Indeterminate forms; Asymptotes and curvature; Curve tracing; Functions of several variables, Partial Differentiation, Total Differentiation, Euler’s theorem and generalization, maxima and minima of functions of several variables (two and three variables) – Lagrange’s method of Multipliers; Change of variables – Jacobians. **Ordinary differential equations of first order:** Formation

of differential equations; Separable equations; equations reducible to separable form; exact equations; integrating factors; linear first order equations; Bernoulli's equation; Orthogonal trajectories. Ordinary linear differential equations of higher order : Homogeneous linear equations of arbitrary order with constant coefficients - Non-homogeneous linear equations with constant coefficients; Euler and Cauchy's equations; Method of variation of parameters; System of linear differential equations.

TEXT BOOK:

1. R.K.Jain and S.R.K.Iyengar : Advanced Engineering Mathematics, Narosa Publishing House, 2002.

MH 151

MATHEMATICS - II

(4-0-0)4

Laplace Transformation: Laplace transform - Inverse Laplace transform - properties of Laplace transforms - Laplace transforms of unit step function impulse function and periodic function - convolution theorem - Solution of ordinary differential equations with constant coefficients and system of linear differential equations with constant coefficients using Laplace transform. Integral Calculus: Fundamental theorem of integral calculus and mean value theorems; Evaluation of plane areas, volume and surface area of a solid of revolution and lengths. Convergence of Improper integrals – Beta and Gamma integrals – Elementary properties – Differentiation under integral sign. Double and triple integrals – computation of surface areas and volumes – change of variables in double and triple integrals. Vector Calculus : Scalar and Vector fields; Vector Differentiation; Level surfaces - directional derivative - Gradient of scalar field; Divergence and Curl of a vector field - Laplacian - Line and surface integrals; Green's theorem in plane; Gauss Divergence theorem; Stokes' theorem.

TEXT BOOK:

1. R.K.Jain and S.R.K.Iyengar : Advanced Engineering Mathematics, Narosa Publishing House, 2002

MH 201

MATHEMATICS - III

(3-1-0)4

Fourier Series: Expansion of a function in Fourier series for a given range - Half range sine and cosine expansions Fourier Transforms : Complex form of Fourier series - Fourier transformation - sine and cosine transformations - simple illustrations. Z-transforms : Inverse Z-transforms – Properties – Initial and final value theorems – convolution theorem - Difference equations – solution of difference equations using z-transforms Partial Differential Equations: Solutions of Wave equation, Heat equation and Laplace's equation by the method of separation of variables and their use in problems of vibrating string, one dimensional unsteady heat flow and two dimensional steady state heat flow including polar form. Complex Variables: Analytic function - Cauchy Riemann equations - Harmonic functions - Conjugate functions - complex integration - line integrals in complex plane - Cauchy's theorem (simple proof only), Cauchy's integral formula - Taylor's and Laurent's series expansions - zeros and singularities - Residues - residue theorem, evaluation of real integrals using residue theorem, Bilinear transformations, conformal mapping.

TEXT BOOKS:

1. R.K.Jain and S.R.K.Iyengar : Advanced Engineering Mathematics, Narosa Publishing House, 2002
2. Erwyn Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition.

**EE211
0)4**

NETWORK ANALYSIS

(3-1-

Circuit elements and relations- Network Graphs And Analysis- Time Domain Analysis - Applications of Laplace Transforms In Circuit Theory- Laplace transforms- Initial conditions- convolution integral- Steady State Analysis Of Circuits For Sinusoidal Excitations- Series, Parallel, Series-parallel, nodal and mesh analysis of circuits- Resonance And Locus Diagrams- Resonance-Selectivity- bandwidth-tuned circuits- Network Theorems.

TEXT BOOKS:

1. M.E. Van Valken Burg : Network Analysis, 3rd Edition, PHI, 2002
2. G.K. Mithal and Ravi Mittal : Network Analysis, Khanna Publications, 1998

**EE 212
3)2**

BASIC ELECTRICAL ENGINEERING LABORATORY

(0-0-

Measurement of resistances of DC machine- Verification of Kirchoff's laws-Superposition theorem- Measurement of electrical quantities in AC circuits-OC, SC and load Tests on transformer-3-ph Induction Motor- VI characteristics of lamps-OCC of DC Generator and speed control of DC motor- Testing of Energy meter- Measurement of self and mutual inductances, three phase power .

Reading Skills: Practice in reading a wide range of texts with a view to improving their reading comprehension, and also grammar and vocabulary. Reading Comprehension, Reading a Novel, Note Making, Interpretation of Non Verbal Data Writing Skills: Practice in Written Communication with a view to enabling independent, original and creative writing. Construction of Sentences and Paragraphs Writing for Correspondence (letters, memos, emails, and fax) Professional Writing (Process Writing , Technical Description , and Report Writing) Speaking and Listening Skills (Laboratory Work) Practice in Speaking and Listening Activities with a view to improving their oral and listening skills. Individual speech sounds, Stress and Intonation patterns Conversations Group Discussions, Facing Interviews

TEXT BOOKS

1. Leo Jones and Richard Alexander, New International Business English CUP, UK 2006
2. Thomas N Huckin and Leslie & Oslen, Technical Writing and Professional Communication, Mc Graw Hill 2004

MH351 ENGINEERING ECONOMICS AND ACCOUNTANCY

(3-0-0)3

Introduction to Engineering Economics – Fundamental concepts-Time value of money – Cash flow and Time Diagrams – Choosing between alternative investment proposals –Methods of Economic analysis (Pay back, ARR, NPV, IRR and B/C ratio).The Effect of borrowing on investment –Equity Vs Debt Financing – Concept of leverage-Income tax and leverage. Depreciation and methods of calculating depreciation (Straight line, Sum of the years digit method, Declining Balance Method, Annuity Method, Sinking Fund method.) National Income Accounting – Methods of Estimation – Various Concepts of National Income –Significance of National Income Estimation and its limitations. Inflation-Definition-Process and Theories of Inflation and Measures to Control. New Economic Policy 1991 (Industrial policy, Trade policy, and Fiscal policy). Impact on Industry. Accounting Principles, procedure-Double entry system – Journal, ledger, Trial balance – Cash Book – Preparation of Trading and Profit and Loss account – Balance Sheet.Cost Accounting - Introduction-Classification of costs – Methods of Costing-Techniques of Costing – Cost sheet and preparation cost sheet – Breakeven Analysis – Meaning and its application, Limitation.

TEXT BOOKS:

1. Henry Malcom Steinar-Engineering Economics Principles, McGraw Hill Pub
2. Dewett K.K., “Modern Economic Theory”, Sultan Chand & Co.
3. Agrawal AN, “Indian Economy” Wiley Eastern Ltd, New Delhi
4. Jain and Narang” Accounting Part-I” , Kalyani Publishers

EE101 ELEMENTS OF ELECTRICAL ENGINEERING

(3-0-0)3

DC Circuits-Kirchhoff's Laws, Network theorems. AC Circuits- Phasors, complex quantities, Series, series-parallel and three phase ac circuits, measurement of power. Magnetic Circuits-Definitions of magnetic quantities, Concept of self and mutual impedances. Single Phase Transformers-Principle of operation, emf equation, equivalent circuit, auto transformer. DC Machines-Principle of operation, emf and torque equations of generators and motors, speed control and starting methods. Three Phase Induction Motor-Principle of operation, torque-speed and efficiency calculations, starting methods- Measuring Instruments-MC, MI and DM type instruments, energy meter.

TEXT BOOK:

1. Edward Hughes, ELBS, Electrical Technology – 6th Edition, 2001

EE201 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

(3-1-0)4

Construction- principle of operation- torque and errors in Analog Voltmeters, Ammeters, Wattmeters, Power factor meters and Energy meters- DC and AC Bridges- Instrument transformers- transducers- electronic instruments like displays, CROs, Waveform analyzers and Harmonic distortion analyzers.

TEXT BOOKS :

1. A.K. Sawhney – A course in Electrical Measurements and Electronic Measurements and Instrumentation – Dhanpat Rai and Sons.
2. W.D. Cooper and A.D. Helfrick – Modern Electronic Instrumentation and Measurement Techniques, PHI 2002.

EE202

CIRCUIT THEORY-I

(3-1-

0)4

Circuit elements and relations- Network Graphs And Analysis- Time Domain Analysis - Applications of Laplace Transforms In Circuit Theory- Laplace transforms- Initial conditions- convolution integral- Steady State Analysis Of Circuits For Sinusoidal Excitations- Series, Parallel, Series-parallel, nodal and mesh analysis of circuits- Resonance And Locus Diagrams- Resonance-Selectivity- bandwidth-tuned circuits- Introduction to Pspice

TEXT BOOKS:

1. M.E. Van Valken Burg : Network Analysis, 3rd Edition, PHI, 2002
2. G.K. Mithal and Ravi Mittal : Network Analysis, Khanna Publications, 1998
EE203 *ELECTRIC AND MAGNETIC FIELDS* (3-1-0)4

Electrostatic fields- charge and Coulomb's law- flux density and gauss law- potential and potential difference- p.f. due to different types of charges- boundary conditions- Laplace and Poisson's equations- uniqueness theorem- definition of capacitance- introduction to finite element analysis of capacitance. Magnetostatic fields- ampere law- Biot Savart law- vector magnetic potential- magnetic boundary conditions- energy stored in magnetic field – inductance calculations- relation between b and h, self and mutual inductance time VARYING FIELDS- Modified Ampere law- Maxwell equations- Electromagnetic energy

TEXT BOOKS:

1. William H.Hayt Jr. & John A.Buck "Engg. Electromagnetics", TMH, 7th Edition
2. Karl E.Lonngren, Sava V.Savov "Dundamentals of Electromagnetics with MATLAB"PHI publication.
3. Nathan Ida & P.A.Bastos "Electromagnetics and Calculation of Fields" Springer Verlag Publishers

EE251

CIRCUIT THEORY – II

(3-1-0)4

Network theorems and applications- network thorems and their applications in solution of networks- network functions and two port networks-driving point functions- concept of two-port networks- poles and zeroes of network functions and their influence on circuit behavior- fourier transforms and fourier series- trigonometric fourier series of repetitive waveforms- amplitude and phase spectrum – fourier coefficients-synthesis of single –port networks- positive real functions hurtwitz polynomials, realization of passive lc –rl and rc networks using foster and caner forms- passive filters and attenuators- classification- low pass and high pass filters- attenuators.

TEXT BOOKS:

1. M.F. Van Valkan Burg : Network Analysis – 3rd edition, PHI Pub, 2002
2. GOPAL – G. Bhise & Prem Chadha : Engineering Network Analysis and Filter Design, Umesh Publications, 2000.

EE252

ELECTRICAL MACHINES --- I

(3-1-0)4

DC machines- windings- characteristics of different types of dc machines- applications- armature reaction- commutation process- speed control methods of shunt and series motors- losses and efficiency calculations- testing of machines- need for starters- amplidyne and metadyne single phase transformers- emf equation- phasor diagrams- equivalent circuits- regulation and efficiency calculations- separation of no- load losses – dot convention- load sharing and parallel operation- auto transformer- principle and applications three phase transformers- types of connections- use of tertiary winding- scott connection of transformers for phase conversion. tapchanging transformers- concepts of tap changing – on –load and off-load tap changers, single phase and three phase induction regulators and moving coil regulators.

TEXT BOOKS :

1. P. S Bimbhra - Electrical Machinery - Khanna Publishers, 2002
2. A.E Fitzgerald, Charles Kingsley, Stephen D Umans – TMH Publishers, 6th Edn, 2003.

EE253
0)4

EE253

POWER SYSTEMS – I

(3-1-

Introduction - generation of electric power -conventional sources (qualitative) – general layout of power system- characteristics of steam, hydro, nuclear and gas power plants- non conventional sources (qualitative)- ocean, tidal, wind, solar, fuel cells, geo-thermal etc.economics of generation- introduction- definitions- cost of electrical energy- fixed and running costs- tariffs.a.c. distribution-introduction- ac distribution- 1-ph, 3-ph(3-wirw and 4-wire) systems- busbar arrangement- selection of site for substation.overhead line insulators- introduction- types of insulators- potential distribution- testing of insulators.insulated cables- introduction- insulation- grading of cables- overhead lines versus underground cables- types of cables.inductance and capacitance calculations of transmission lines -inductance and capacitance of lines-composite conductors- transposition- bundled conductors.corona- introduction- corona loss- factors affecting corona loss- interference between power and communication lines.

TEXT BOOKS :

1. W.D.Stevenson – Elements of PS Analysis 4/e, Mc Graw Hill, 1984.

2. C.L. Wadhwa – Generation, Distribution and Utilization of Electrical Energy, New Age International, 2002
3. C.L. Wadhwa – Electrical Power Systems, 3/e, New Age International, 2003
4. Rakosh Das Begamudre - Energy Conversion System, New Age International, 2000

EE254

ELECTRICAL MEASUREMENTS LAB

(0-0-3)2

Kelvin's double bridge - Schering bridge : Determination of loss-angle of a capacitor - Calibration : Wattmeter, energy meter- Determination of errors of potential transformer- Determination of hysteresis loss- Maxwell's inductance – capacitance bridge – to measure resistance and inductance of the given unknown impedance- Determination of errors of current Transformers- Anderson's Bridge to measure self inductance & internal resistance of a coil - Measurement of Temperature, Pressure, Displacement and strain using transducers

Introduction- system- types of control systems-feedback and its effects. mathematical modelling of physical systems: mathematical modeling-concept and use of transfer function- transfer function from block diagrams and signal flow graphs- state variable analysis of linear dynamic systems- state variables, dynamic equations- controllability and observability-time domain analysis of control systems- introduction- time domain indices, steady state error constants, error series, concept of bipo stability- routh-hurwitz criterion- effect of p, pi & pid controllers. root locus techniques- introduction- root loci theory- frequency domain analysis of control systems- introduction- polar plots, nyquist stability criterion- frequency domain indices- bode plots- m&n circles- nichols charts

design of compensators- need of compensators, design of lag and lead compensators using bode plots.

TEXT BOOKS

1. B.C. Kuo : Automatic Control Systems – PHI, 7th Edition, 2004
2. I.J. Nagarath & M.Gopal : Control Systems Engineering (2nd Edition) — New Age Pub.Co.

EE302

ELECTRICAL MACHINES --- II

(3-1-0)4

Induction machines- principle of operation- phasor diagrams- equivalent circuits- torque, speed and slip- losses and efficiency- testing-determination and predetermination of performance parameters- methods of starting- speed control- phase advancers- principle of induction generator- double cage induction motors- construction, principle of operation, characteristics, equivalent circuit and applications- synchronous machines- principle of operation, classification, emf equation, winding factors, excitation schemes, armature reaction, synchronous reactance, phasor diagram, load characteristics, methods of predetermination of regulation. calculation of direct and quadrature axis reactance, power-angle characteristics, regulation calculations, synchronization and synchronizing power- synchronous motors- phasor diagrams, variation of current and power factor with excitation, hunting and its suppression, excitation circles, power circles, determination and predetermination of v and inverted v curves, methods of starting, comparison with induction motor, applications, losses and efficiency calculations.

TEXT BOOKS :

1. P. S Bimbhra - Electrical Machinery - Khanna Publishers, 2002
2. A.E Fitzgerald, Charles Kingsley, Stephen D Umans – TMH Publishers, 6th Edn, 2003.

0)4

EE303

POWER SYSTEMS – II

(3-1-

Performance of lines- representation of lines-equivalent representation of a long line- A, B, C, D constants, Ferranti effect, power flow-voltage control- introduction – methods of voltage control- compensation in power systems- concepts of load compensation- compensation of lines-per unit representation of power systems per unit quantities- advantages of per unit system- travelling waves on transmission lines- production of traveling waves- line connected to a cable- reflection and refraction at t-junction- attenuation of travelling waves- overvoltage protection and insulation coordination- causes of over voltages- insulation apparatus- insulation coordination- symmetrical components and fault calculations-significance of sequence components, sequence impedances and sequence networks, fault calculations, sequence network equations- reactors and their location- short circuit capacity of a bus.

TEXT BOOK

1. W.D. Stevenson : Elements of Power system Analysis – McGraw Hill International Student Edition.
2. C.L. Wadhwa: Electrical Power Systems – New Age International Pub. Co., 3rd Edition, 2001.
3. Hadi Scadat: Power System Analysis – TMGH

EE304

MICROPROCESSORS AND APPLICATIONS

(3-1-0)4

Introduction to 8086 processor architecture- 8086 family assembly language programming- addressing modes, instruction formats, development steps- 8086 hardware- 8086 in minimum and maximum mode- interrupts- 8086 interrupt structure, types, responses, interrupt service procedures, applications- interfacing the 8086- memory interfacing – addressing memory banks and timing parameters- i/o interfacing – types of i/o data transfer- programmable peripheral devices- 8255 – modes of operation, interfacing i/o devices to 8255- 8251 – usart – modes of operation and interface to rs-232c- interfacing dac and adc- pic microcontrollers- introduction to 16 – bit pic micro controllers –architecture, programming, interfacing and applications

TEXT BOOKS:

1. A.K. Ray & Burchandi: Advanced Microprocessors and Peripherals, TMH, 2003
2. Douglas V. Hall : Microprocessors and Interfacing, (TMH), 1992.
1. Ajay V. Deshmukh : Microcontrollers – Theory and Applications, TMH

EE305**ELECTRICAL MACHINES LAB-I****(3-1-0)4**

Determination of open circuit characteristic of D.C. machine, Determination of Load characteristics of D.C. generators, Speed control of D.C. motors using Armature control and Field control methods, Brake test on D.C. Shunt motor & Swinburne's Test, Fields test on two identical D.C. Series machines, Retardation test on D.C. machines to determine moment of Inertia, Hopkinson test on two identical D.C. machines, O.C. and S.C. tests on single phase transformer, Load test on single phase transformer, Sumpners test on two single phase transformers, Scott connection of single phase transformers, Separation of no load losses of a single phase transformer

*EE306**CIRCUITS LAB**(0-0-3)2*

Frequency response of second order RLC series circuit, Time response of second order RLC series circuit, Open circuit, Short circuit and ABCD parameters of two port networks, Verification of Kirchhoff's laws and Tellegen's Theorem, Verification of superposition and Thevenin's Theorem, Verification of Maximum power transfer and Reciprocity Theorems, Phase lead network and Polar plots of Phasors I , V_R , V_C and V_{RC} , Measurement of active and reactive powers of a 3-phase network using two wattmeters, Simulation of Frequency response of second order RLC series circuit using PSPICE, Simulation of Time response of second order RLC series circuit using PSPICE, Verification of superposition and Thevenin's Theorem using PSPICE

*EE351**POWER SYSTEM OPERATION AND CONTROL**(3-1-0)4*

Load flow studies- introduction- bus classification- load flow equations- iterative methods –fast decoupled methods –system data for load flow study-, $p - q$ control- effect of synchronous machine excitation – power angle of a synchronous machine, specification of bus voltages. capacitor banks, control by transformers- economic operation of power systems- distribution of load between units within a plant and system- calculation of loss coefficients- load frequency control- introduction, load frequency problem, $p-f$ control channel- $q-v$ control channel- mathematical models of power system- $p-f$ control of single and two control areas- power system stability- the stability problem, swing equation, equal area criterion- methods to improve steady state and transient stability- voltage stability. power system deregulation(qualitative treatment)- introduction- power system restructuring models- responsibilities and functions of independent system operator (iso) – iso models- available transfer capability(atc)- market power- congestion management- ancillary services.

TEXT BOOKS

1. W.D. Stevenson : Elements of power system analysis, McGraw Hill, 3rd Edition, 1998.
2. Olle I. Elgerd : Electric Energy Systems Theory – An introduction, TMGH 1973.
3. Kankar Bhattacharya, MHJ Bollen, JE Daalder: Operation of Restructured Power Systems, Kluwer Academic Pub.,USA.

*EE352**POWER ELECTRONICS**(3-1-0)4*

Introduction- concepts of power electronics, scope and applications, types of power converters- phase controlled rectifiers- introduction, principles of phase-controlled converter operation- analysis with and without free wheeling diode of $r,r-l$ and rlc load. single phase and three phase dual converters- d.c. choppers- introduction, basic principles of step-down and step-up operation, chopper classification, limitations of single-stage conversion, introduction to forward and flyback converters- inverters- introduction, principle of operation, performance parameters, voltage control of single phase inverters – single and multiple pulse width modulation- a.c. voltage controllers- introduction, principle of operation of single phase voltage controllers for $r,r-l$ & $r-l-e$ loads- cycloconverters-

TEXT BOOKS

2. M.H.Rashid – Power Electronics – circuits, devices and applications, PHI,2002
3. P.S.Bimbhra – Power Electronics, Khanna Publishers, New Delhi, 2002

EE353**POWER SYSTEM PROTECTION****(3-1-0)4**

protective relays- introduction, need for power system protection, effects of faults, evolution of protective relays, zones of protection, primary and backup protection, essential qualities of protection, classification of protective relays and schemes, current transformers, potential transformers, basic relay terminology- operating principles and relay construction- electromagnetic relays, thermal relays, static relays, microprocessor based protective relays- overcurrent protection- time-current characteristics, current setting, over current protective schemes, directional relay, directional earth fault relay- distance protection- impedance relay, reactance relay, mho relay, input quantities for various types of distance relays, effect of arc resistance, power swings, line length and source impedance on the performance of distance relays, selection of distance relays- switched distance schemes, auto re-closing- pilot relaying schemes- wire pilot protection, carrier current protection- ac machines and bus zone protection- static relays- amplitude and phase comparators, static over current, directional, differential and distance relays, multi input comparators, concept of quadrilateral and elliptical relay characteristics, microprocessor based relays- advantages, over current relays, directional relays, distance relays- circuit breakers- introduction, arcing in circuit breakers, arc interruption theories, re-striking and recovery voltage, types , ratings and selection of circuit breakers- testing-fuses-introduction, fuse characteristics, types of fuses, application of hrc fuses, discrimination.

TEXT BOOKS:

1. Badriram and D.N. Vishwakarma-Power System Protection and Switchgear, TMH
2. J.Lewis Blackburn "Protective Relaying Principles and applications" Marcel and Dekker Publishers.

EE354

ELECTRICAL MACHINES --- III

(3-1-0)4

Single phase induction motors- principle of operation, double revolving field theory, speed-torque characteristics, equivalent circuit, phasor diagrams, starting methods, speed control methods, applications- single phase synchronous motors- construction, principle of operation and applications of reluctance motors, hysteresis motors, sub-synchronous motors- a c series motors- construction, principle of operation, phasor diagrams and characteristics of single phase and three phase ac series motors, simple and compensated motors, universal motors and their applications, problems on all the above motors. schrage motor- construction, principle of operation, speed and power factor control, applications- special purpose machines- construction and principle of operation of stepper motors, permanent magnet dc motors, brushless dc motors, linear induction motors and their applications, problems- multi winding transformers- construction, equivalent circuits, determination of equivalent circuit parameters, voltage regulation, efficiency calculations- energy efficient machines (qualitative treatment only): construction, basic concepts, losses minimization and efficiency calculations of energy efficient ac machines- super conducting machines (qualitative treatment only): construction, principle of operation and basic concepts

TEXT BOOKS :

1. E. Fitzgerald, Charles Kingsley and Stephen D. Umans : Electric Machinery , TMGH.6th Edition, 2002.
2. P.S. Bimbhra : Generalized Theory of Electrical Machines, Khanna Pub. 1997.

EE355

CONTROL SYSTEMS LAB

(0-0-3)2

Speed-torque characteristics of AC servo-motor, Study of effects of feedback, Time-response of first and second order systems, Frequency-response of second order system, Study of PID controller, Design of lag and lead compensator, Study of synchro, Determination of transfer function of a DC motor, Design of PID controller, Study of feed-forward control, Design of two loop systems

EE356

ELECTRICAL MACHINES LAB – II

(0-0-3)2

Determination of Equivalent circuit parameters of three phase induction motor, Brake test on 3-phase induction motor, Circle diagram of 3-phase induction motor, Speed control of 3-phase induction motor , Single phase operation of 3-phase induction motor, Separation of losses of 3-phase induction motor, Regulation of 3-phase alternator by synchronous impedance method, Regulation of 3-phase salient pole alternator by slip test, Regulation of 3-phase alternator by Z.P.F. method, Parallel operation of alternators, Determination of V and inverted V curves of 3-phase synchronous machine, Characteristics of 3-phase Schrage motor No load and load Characteristics of an amplitudyne, Determination of equivalent circuit parameters of single phase induction motor

EE401

SOLID STATE DRIVES

(3-1-

0)4

Introduction- electrical drives, parts of electrical drives, advantages of electric drives, losses, measures of energy conservation in electrical drives. dynamics of electrical drives- fundamental torque equation, components of load torque, load characteristics, modified torque equation, speed-torque convention & multi-quadrant operation, calculation of time and energy loss in transient operation- equivalent values of drive parameters, steady state stability, load equalization. d.c. motor drives- starting, braking, speed control –dual converter fed d.c motor, chopper controlled d.c. drives. a.c. motor drives- starting methods, speed control –static scherbius, static kramer drives. vsi and csi fed induction motor drives. types of braking methods closed loop controlled drives- current limit control, current guided control, closed loop speed control, pi controllers, pll controlled drives.

TEXT BOOKS

1. G.K. Dubey: Fundamentals of Electric Drives – Narosa Publishers,1998.
2. Vedam Subramanyam: Electric Drives concepts & Applications – (TMH),1999.

HVDC transmission- introduction- comparison of ac and HVDC- HVDC transmission analysis of HVDC converters - pulse number- analysis with and without overlap- converter bridge characteristics- converter and HVDC system control- principles of dc link control- starting and stopping of dc link, power control- harmonics & filters_– introduction- generation of harmonics- types of ac filters. power flow analysis in ac/dc systems - general modeling of dc links, solutions of ac- dc power flow- flexible ac transmission systems(FACTS)- concept of FACTS - flow of power in an ac system- dynamic stability consideration- basic types of FACTS controllers- static shunt compensators - svc & statcom - objectives of shunt compensation- methods of controllable var generation- switching converter type var generators-basic operating principle and control approaches- static series compensators - gcsc,tssc,tsc & sssc - objectives of series compensator, variable impedance type series compensators:- basic operating control schemes- power angle characteristics- control range and va rating- external control- combined compensators

TEXT BOOKS

1. K.R. Padiyar: HVDC Power Transmission System, New Age Intl. Co, 2002.
2. N.G. Hingorani and L.Gyugyi: Understanding FACTS, Standard Publishers, Distributors, New Delhi,1995.

Simple Assembly language programs and coding of instructions- Programming exercises involving looping counters, time delays, subroutines strings operation- Interfacing of 8255 and applications- Simple programs- Generation of square waveform, Interfacing of binary switches and LED display- Matrix key board interfacing and display of scrolling character, Interfacing of 8254- Simple exercises- Checking of 8254 in different modes of operation, Interfacing of 8251 and serial data transfer- Interfacing of ADC - Interfacing of DAC – To obtain square wave /saw tooth wave at output of DAC- Programming exercises on 8051 micro controller- Programming exercises on 8097 micro controller- Interfacing of seven segment display- Display of a message through HEX key board

C/C++ Programming Exercises- Solution of load-flow equations using Gauss-Seidel and Newton Raphson method- Simulation and operations on sparse matrices- Solution of Differential equations : Swing curve of a synchronous machine- Problems on matrix algebra – Factorisation Methods, Eigen value Analysis. MATLAB AND SIMULINK Simulation and analysis of first and second order circuits – transient response and frequency response- Design and tuning of P, PI and PID controllers for the stability of second order system- Design of control parameters to improve stability of a feedback control system – Bode plots and Root locus- Speed control of separately excited DC Motor drive system using symmetrical optimization method- Solution of Laplace equations for Electrostatic field calculation.PSpice Exercises Study of Diode rectifiers, Fully controlled thyristor rectifiers, Choppers and Switched mode power supplies, Single phase and Three phase PWM Inverters Power system exercises Symmetrical component analysis- Calculation of voltage regulation and efficiency of shorts, medium and long Artificial lines- Simulation of travelling wave phenomenon in long transmission lines using EMTP- Simulation of long transmission line and determination of reactive power requirement and control- Exercises on PSIM, EDSA and EMTP packages, NISA, Proteus, VSM, SPARD Softwares.

Voltage regulation and efficiency of long transmission line- Reactive power control of long transmission line- A, B, C, D constants of long transmission line- Operating characteristics of Static differential Relay- Operating characteristics of IDMT over current relay- Symmetrical component analyzer- Fault studies on DC Network Analyzer- Sequence reactances of power system elements and fault studies- Reactive power control using Tap changing transformer- Simulation of long line and reactive power control in EMTP- Measurement of High AC Voltages using Sphere gap- Tracking and Treeing test on surface of solid insulation- Determination of breakdown strength of oil- Generation of different impulse waveforms- Determination of breakdown characteristics of air gap- Simulation of AGC (Single & two – area) using MATLAB (simulink) & design of PID controllers for AGC- Simulation of Power System stabilizers for SMIB & MMPS Systems- Design of Fuzzy Logic controllers for Power System stability enhancement.

Study of characteristics of power semiconductor switching devices (SCR, Triac, MOSFET, IGBT)- Study of two-pulse fully controlled rectifier feeding R, RL and RLC (DC-motor) loads- Study of a six-pulse half controlled rectifier feeding R, RL and RLE loads- Study of a six-pulse fully controlled rectifier feeding R and RL loads- Closed-loop control of a six-pulse fully controlled rectifier- Study of a 1-phase inverter with square wave, quasi-square wave and SPWM control- Speed control of induction motor with V/f control method using 3-phase inverter- Open –loop control of a separately excited DC motor drive with a 6-phase fully controlled rectifier- Study of characteristics of a class –D commutated thyristorized step-down chopper- Study of AC chopper with R and RL loads to achieve power control- Study of performance of a PWM controlled AC-DC converter- Study of performance of a 1-phase cyclo-converter.

Statistics and Probability: Probability laws – Addition and Multiplication theorems on probability - Baye's theorem –Expectation, Moments and Moment generating function of Discrete and continuous distributions, Binomial, Poisson and Normal distributions, fitting these distributions to the given data, Testing of Hypothesis - Z-test for single mean and difference of means, single proportion and difference of proportions - t-test for single mean and difference of means, F-test for comparison of variances,. Chi-square test for goodness of fit. – Correlation, regression.**Numerical Analysis:** Curve fitting by the method of least squares. Fitting of (i) Straight line (ii) Second degree parabola (iii) Exponential curves.Lagrange interpolation, Forward, backward and central differences, Newton's forward and backward interpolation formulae, Gauss's forward and backward interpolation formulae, Numerical differentiation at the tabulated points with forward backward and central differences. Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule and Romberg integration. Taylor series method, Euler's method, modified Euler's method, Runge-Kutta method of 2nd & 4th orders for solving first order ordinary differential equations, Numerical solution of algebraic and transcendental equations by Regula-Falsi method Newton-Raphson's method.

Series Solution Classification of singularities of an ordinary differential equation - Series solution- Method of Frobenius - indicial equation - examples **Bessel and Legendre functions:** Bessel function of first kind Recurrence formulae Generating function Orthogonality of Bessel functions Legendre polynomial rodrigue's formula Generating function Recurrence formula Orthogonality of Legendre polynomials.

TEXT BOOKS:

1. S.C.Gupta and V.K.Kapoor : Fundamentals of Mathematical Statistics.
1. M.K. Jain S.R.K. Iyengar and R.K.Jain: Numerical methods for Scientific and Engineering Computation
2. Erwyn Kreyszig : Advanced Engineering Mathematics,

Magnetic materials : Dia, Para, Ferro, Anti ferro and Ferri magnetic materials .Soft and hard Magnetic Materials., tapes and Films. Semiconductors: Silicon Wafer Preparation, Different fabrication techniques involved in electronic chip in VLSI technology. Conductivity of Materials Electrical and thermal conductivity of materials, Bimetals High temperature materials, Thermocouples. Dielectric Materials : Field vectors, Polarization, Ferro electricity and Piezo electrics. Insulating Materials : Electrical, mechanical and thermal properties of Liquid, Solid, Fibrous Insulating materials, Glass, Ceramic, Mineral and Plastic materials

Text Books :

1. Materials for Electrical Engineering Tareev B.M , Higher School Pub. House Moscow.,1986.
2. Electronic Properties R. Rose, L.A. Shepard and J. Wulff – Wiley Eastren Pvt.Ltd, New Delhi.1986.

Introduction- organization and architecture – role of performance- system buses - bus interconnection – elements of bus design –pci bus systems- internal memory - key characteristics– hierarchical structure– memory organization schemes – cache memory – virtual memory –operating system support- demand paged memory management- arithmetic unit - data and operand types and representations –unsigned and signed binary addition, subtraction and multiplication – booth's algorithm. binary division – ieee 754 floating point representation- processing unit – data path- machine instruction characteristics – instruction sets – instruction formats – addressing modes- control unit- single bus organization of a processor and micro-operations – control of the cpu – hardwired control unit – microprogrammed control- input/output - external devices, hierarchies of i/o – structure and function of i/o processors, a typical desktop i/o system, introduction to embedded systems.

TEXT BOOK

1. William Stallings – Computer Organization and Architecture – Designing for performance, PHI, 5th Edition.

Electrical heating and welding- resistance, inductance and dielectric heating- resistance and arc welding- electrolysis process- principle of electrolysis, electroplating, metal extraction and metal processing, electromagnetic stirrs- illumination- terminology, laws, coefficient of utilisation and depreciation, polar curves, photometry, integrating sphere, sources of light, discharge lamps- basic principles of light control, types and design of lighting schemes- lighting calculations- electric traction - systems of electric traction and track electrification- mechanics of traction movement, speed – time curves for different service- adhesive weight and braking retardation, coefficient of adhesion- train lighting- systems of train lighting, special requirements - coach wiring, lighting by making use of 25kv ac supply.

TEXT BOOKS

1. H. Partab: Modern Electric Traction, Dhanpat Rai & Co, 1998.
2. E. Openshaw Taylor: Utilisation of Electric Energy, Orient Longman, 1988.

EE361

DIGITAL SIGNAL PROCESSING

(3-0-0)3

Signals and systems- discrete-time signals, discrete-time systems, convolution, difference equations- Fourier analysis- frequency response, filters, interconnection of systems, dtft, properties, applications- sampling- sampling, analog to digital conversion, digital to analog conversion, discrete-time processing of analog signals, sample rate conversion- z-transform definition of z-transform, properties, inverse z-transform, one-sided z-transform- transform analysis of systems- system function, systems with linear phase, all pass filters, minimum phase systems, feedback systems- discrete Fourier transform- dfs, dft, dft properties, sampling the dtft, linear convolution using dft- fast Fourier transform radix-2 fft algorithms, decimation in time, decimation in frequency- implementation of discrete-time systems- digital networks, structures for fir systems, structures for iir systems, lattice filters, finite word-length effects- filter design- filter specifications, fir filter design, iir filter design, filter design based on least squares approach.

TEXT BOOKS:

1. Monsoon H. Hayes - Schaum's outline of theory and problems in digital signal processing – TMGH – 2004
2. Salivahanan, Vallavaraj, Gnanapriya - Digital signal processing – TMGH – 2002
3. Sanjay Sharma - Digital signal processing – S. K. Kataria and Sons - 2005

EE362

COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

(3-0-0)3

Design of electrical and magnetic circuits of electrical machines- Mathematical equations for electric and magnetic circuits- formation of design of electric and magnetic circuits for electric machines- Design of Thermal Circuit of Electrical Machines- mathematical equations for thermal circuits- design of thermal circuits for electric machines- Design of Rotating Electrical Machines- Optimum Design procedures for AC and DC Machines- Criteria for optimization – flow Charts and Computer Programs-

TEXT BOOKS :

1. M.Ramamurthy – Computer aided Design of Electrical Equipment, East_West Press Pvt. Ltd. Madras, 1988.
2. C.G. Veinott – Computer aided design of F H P motors – Mc Graw Hill Pub. Co.

EE411

ELECTRICAL MACHINE MODELLING & ANALYSIS

(3-0-0)3

Basic principles for electric machine analysis- magnetically coupled circuits, em energy conversion- linearized machine equations-reference frame theory- equations of transformation- balanced steady state equations, variables observed from various frames- theory of symmetrical induction machines and synchronous machines- voltage and torque equations in machine variables- arbitrary reference frame variables- state-space model of induction machine in 'd-q' variables- park's transformation

TEXT BOOK

1. P.C. Krause "Analysis of Electric Machinery" – McGraw Hill, 1990.

EE412

DISTRIBUTION SYSTEM PLANNING AND AUTOMATION

(3-0-0)3

Distribution system planning- planning and forecasting techniques, load characteristics- definitions – load forecasting – load management – tariffs-distribution transformers- types – three phase and single phase transformers – connections, dry type and self protected type transformers – regulation and efficiency-sub transmission lines and distribution sub-stations- distribution substations –bus schemes – substation location and rating- primary systems - voltage drop and power loss calculations- capacitors in distribution systems- distribution system protection- distribution system automation- grounding

TEXT BOOK

1. Turan Gonen : Electric Power Distribution Engg., Mc Graw Hill, ISE., 1998.

EE413

POWER SYSTEM STABILITY AND CONTROL

(3-0-0)3

Synchronous machine modelling- park's transformation of flux linkages- operational impedances- time constants- basic models for power system studies- low and high order models- low frequency oscillation studies- steady state dynamic stability criteria- normal conditions- practical stability criteria- dynamic stability of smib system & mmp systems.- transient stability studies- stability analysis of multi machine

systems, effect of exciter and governor models, computer solution and flow charts. methods to improve stability- methods to improve steady state, dynamic stability (psss) transient and voltage stability.

TEXT BOOK:

- 1 P.M. Anderson & A.A. Fouad: Power System Control and Stability, Iowa State University Press; 1981.
- 2 Prabha Kundur: Power Systems stability and Control, McGraw – Hill Inc New York, 1994.

EE414

COMPUTER METHODS IN POWER SYSTEMS

(3-0-0)3

Incidence and network matrices- introduction, graphs, incidence matrices formation of network matrix - y_{bus} by singular transformation- π -representation of off-nominal tap transformers- algorithms for formation of z_{bus} matrix- short _ circuit studies- introduction, short_ circuit calculations using z_{bus} , z_f^{abc} , y_f^{abc} , z_f^{012} , y_f^{012} matrices for various faults, example of short circuit calculations using z_{bus} for l-l-l and l-g faults- sparsity technique in load flow studies- sparsity technique for y_{bus} and gauss-seidal method- comparison of gs, nr, fdc models- distribution system load flow study- introduction to real - time control of power system- introduction- linear wls state estimation- d.c power flow based wls equations- scada- transient stability analysis- representation of power system elements- numerical integration methods- transient stability algorithm using modified euler's method and fourth order runge kutta method.

TEXT BOOKS

Stagg and El Abiad: Computer methods in power systems analysis, McGraw Hill ISE, 1986.

EE415

EHV AC TRANSMISSION

(3-0-0)2

Introduction to EHV AC Transmission- Calculations of line and ground parameters- Properties of bundled conductors- equivalent circuit of line model- Corona- corona loss formula factors affecting corona. Audible noise- radio interference, limits for radio interference fields, CIGRE formula- Over Voltage in EHV Systems- Switching surges- over voltages, insulation coordination design- Theory of reactive power control- steady state reactive power control theory- fundamental transmission line equation, surge impedance loading- Passive shunt compensation, control of voltage- Power System Grounding- Analysis of simple grounding systems, body currents due to touch and step voltages, grounding system safety assessment, Basic design of grounding, Mitigation of touch and step voltages, Design example of a substation grounding.

TEXT BOOKS:

- 1 Rakesh Das Begamudre : Extra High Voltage Ac Transmission Engineering, PHI (pub) 1991.
- 2 T.J.E.Miller : Reactive Power Control in Electric Systems, John Wiley & Sons, 1986

EE416

AI TECHNIQUES IN ELECTRICAL ENGINEERING

(3-0-0)3

Artificial neural networks- introduction- neural network models- architectures – knowledge representation– learning process – learning tasks- ann paradigms- back propagation, rbf algorithms- hopfield network-fuzzy logic- introduction– fuzzy sets - membership function – fuzzy logic – fuzzy inference-defuzzification methods- genetic algorithms- introduction-encoding –fitness function-reproduction operators-genetic modeling –genetic operators-cross over and mutation- generational cycle-convergence of genetic algorithm- applications of ai techniques- load forecasting – load flow studies – economic load dispatch – load frequency control –reactive power control – speed control of dc and ac motors.

TEXT BOOKS

- 1 S.Rajasekaran and G.A.V.Pai Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi, 2003.

MH451

OPERATIONS RESEARCH

(3-0-0)3

linear programming :formulation and graphical solution of lpp's. the general lpp, slack, surplus and artificial variables. reduction of a lpp to the standard form. simplex computational procedure, big-m method, two-phase method. solution in case of unrestricted variables. dual linear programming problem. solution of the primal problem from the solution of the dual problems. transportation problems :balanced and unbalanced transportation problems. initial basic feasible solution using n-w corner rule, row minimum method, column minimum, least cost entry method and vogel's approximation method. optimal solutions. degeneracy in transportation problems. queueing theory :poisson process and exponential distribution. poisson queues - model $(m/m/1):(\infty/\text{fifo})$ and its characteristics.elements of inventory control :economic lot size problems - fundamental problems of eq. the problem of eq with finite rate of replenishment. problems of eq with shortages - production nstantaneous, replenishment of the inventory with finite rate. stochastic problems with uniform demand (discrete case only).

TEXT BOOK :

1. Introduction to Operations Research by Kanti Swarup, Man Mohan & P.K.Gupta (Pub: Sultan Chand & Sons)

EE462**ELECTRIC TRACTION****(3-0-0)3**

Traction systems- methods of traction- electrification- traction mechanics- speed-time curve, calculation of tractive effort requirements- specific energy consumption, mechanics of train movement, coefficient of adhesion- traction motors- desirable characteristics of traction motors, suitability of series motor for traction, linear induction motor- traction motor control- control of dc traction motors, series-parallel control, shunt and bridge transition- braking- types of braking –plugging, rheostatic braking, regenerative braking of dc and three phase induction motors- power supply arrangements- major equipment at sub-station, design considerations of sub-stations- rectification equipment and semiconductor devices- cyclo-converters, choppers for variable frequency ac and variable voltage thyristor converters for hvdc- train lighting- special requirements of train lighting ac train lighting making use of 25kv ac supply- radio interference- principle of radio interference, origin of ri, method of propagation, factors to be considered in line design.

TEXT BOOK:

1. H.Partab : Modern Electric Traction, Dhanpat Rai & Sons

EE463**POWER SYSTEM DEREGULATION****(3-0-0)3**

Overview of key issues in electric utilities: introduction – restructuring models – independent system operator (ISO) – power exchange - market operations – market power – standard cost – transmission pricing – congestion pricing – management of inter zonal/intra zonal congestion. oasis: open access same-time information system: structure of oasis - posluing of information – transfer capability on oasis – definitions transfer capability issues – ATC – TTC – TRM – CBM calculations – methodologies to calculate ATC electricity pricing: introduction – electricity price volatility electricity price indexes – challenges to electricity pricing – construction of forward price curves – short-time price forecasting. power system operation in competitive environment: introduction – operational planning activities of ISO- the ISO in pool markets – the ISO in bilateral markets – operational planning activities of a genco ancillary services management. Introduction – reactive power as an ancillary service – a review – synchronous generators as ancillary service providers.

TEXT BOOKS:

1. Kankar Bhattacharya, Math H.J. Boller, Jaap E.Daalder, 'Operation of Restructured Power System' Klum,er Academic Publisher – 2001
2. Mohammad Shahidehpour, and Muwaffaq alomoush, - "Restructured electrical Power systems" Marcel Dekker, Inc. 2001
3. Loi Lei Lai; "Power system Restructuring and Deregulation", Jhon Wiley & Sons Ltd., England.

EE464**REAL TIME CONTROL OF POWER SYSTEMS****(3-0-0)3**

Substation/ Generating Stations- Layout- Instrument Transformers and their importance in measurements and protection, parameters for Grid operation: Analog Points, Status Points, Alarms- RTU- SCADA Functions- Introduction to SCADA- Grid Operation & Control, need and advantages of SCADA- Control Functions- Man – Machine Communication :Operator's Console, VDU Display and its use, Operator Dialogs, Mimic Diagram Functions, Printing Facilities. Remote Terminal Unit (RTU) & Communication Practices- Major Components: RTU Panel, Interface Panel. D20M Main Processor, Analog Card, Status Card, Control Card, Modems-Types Of Communications- Types of Network Elements in LAN & WAN. Sub-load Dispatch Center(Sub-LDC)- Elements of SLDC- Workstations- Front end processor- Routers- Function of SLDC- Introduction to SCADA PROTOCOLS and Communication Standards for Electrical Power Systems-(Ref: www.dnp.org, www.modbus.org, www.kema.nl) Real Time Software- Classification- Structure- Tools-Language requirements of RTS Computer control of Electrical Power Systems- State Load Dispatch Center (SLDC): Inter Connectivity Of Sub-LDCs & SLDCs, Hierarchy of Data Transfer, Functions & Responsibilities of SLDC, Real Time Operation carried at SLDC. Southern Regional Load Dispatch Center (SRLDC)- Functions & Responsibilities of SRLDC, Operations carried at SRLDC, Overview of SCADA, Real Time operation in detail.

TEXT BOOKS

1. Power System control – Technology – by Torsten Cegrell, Prentice Hall International Ltd., 1986.
2. Real – Time Computer Control – by S. Bennett and D.A. Linkens (Editors), IEE Control Engineering series (24), peter Peregrinus Ltd., 1984.

EE465**POWER QUALITY****(3-0-0)3**

Introduction what is power quality? power quality – voltage quality -why are we concerned about power quality? the power quality evaluation procedure, terms and definitions general classes of power quality problems transients long-duration voltage variations short-duration voltage variations voltage imbalance waveform distortion voltage fluctuation power quality terms cbema and iti curves, Voltage sags and interruptions sources of saga and interruptions estimating voltage sag performance fundamental principles of protection solution at the end-user level motor – starting saga Transient over voltages sources of transient over voltages principles of over voltage protection devices for over voltage protection utility capacitor-switching transients utility system lightning protection managing ferro-resonance switching transient problems with loads computer tools for transients analysis Fundamentals of harmonics harmonic distortion voltage versus current distortion harmonics versus transients harmonic indexes harmonic sources from commercial loads harmonic sources from industrial loads locating harmonic sources effects

of harmonic distortion inter-harmonics-harmonic distortion evaluations principles for controlling harmonics harmonic filter design: a case study - standards of harmonics Long-duration voltage variations principles of regulating the voltage devices for voltage regulation utility voltage regulator application capacitors for voltage regulation end-users capacitors application regulating utility voltage with distributed resources flicker Power quality monitoring monitoring considerations historical perspective of power quality measuring instruments power quality measurement equipment assessment of power quality measurement data application of intelligent systems power quality monitoring standards

TEXT BOOKS:

1. Electrical Power Systems Quality Dugan Roger C Mc Graw Hill Santoso Surya Mc Granaghan Marks F. Beaty H. Wayre
2. Power Systems Quality Assessment J.Arillaga, N.R.Watson, S.Clon John Wiley
3. Power Quality C.Sankaran CRC Press

EE466 SWITCHED MODE POWER CONVERSION (3-0-0)3

DC/DC Converters- Basic topologies of buck, boost, buck-boost converters- forward, and fly-back converters, half and full bridge topologies, modeling of switching converters- Current Mode and Current Fed Topologies- Voltage mode and current mode control of converters- voltage and current fed converters- Resonant Converters- Need for resonant converters, types of resonant converters- Converter Transfer Functions- Application of state-space averaging to switching converters, derivation of converter transfer functions- Power Converter Design- Design of filter components for current sensing, ratings for switching devices, design of drive circuits for switching devices, considerations for PCB layout- Controller Design- Introduction, mechanisms of loop stabilization, conditional stability in feedback loops.

TEXT BOOK

1. Abraham I. Pressman: Switching Power Supply Design, Mc Graw Hill International, 2nd Edition, 1999.

EE467 HIGH VOLTAGE ENGINEERING (3-0-0)3

Electro static fields, their control and estimation- electric field intensity, classification of electric fields, control of electric field intensity generation of high dc and ac voltages- introduction, rectifier circuits, Cockroft- Walton voltage multiplier circuit, electrostatic generator, generation of high ac voltages by cascaded transformers, series resonant circuit. generation of impulse voltages and currents- definitions, impulse generator circuits- impulse current generation. measurement of high voltages and currents- introduction, sphere gap, electrostatic voltmeter, generating voltmeter, Fortescue method, voltage dividers, measurement of high dc, ac and impulse currents. high voltage testing of electrical equipment - testing of insulators, cables, bushings, power capacitors, power transformers and circuit breakers- IEC, ANSI, IEEE and Indian Standards for testing electrical equipment. non-destructive test techniques- high voltage schering bridge- partial discharges measuring techniques. breakdown mechanism of gaseous liquid and solid insulating materials

TEXT BOOKS:

1. Ravindra Arora & Wolfgang Mosch: High voltage Insulation Engineering, New Age International Publishers, 1997.
2. C.L. Wadhwa: High voltage Engineering, New Age International Publishes, 1998.

EE468 NEW ENTERPRISE CREATION & MANAGEMENT (3-1-0)4

Entrepreneur and entrepreneurship- establishing the small scale enterprise- operating the small scale enterprises- performance appraisal and growth strategies- management performance assessment and control, strategies for stabilization and growth, managing family enterprises

TEXT BOOKS

1. Holt: Entrepreneurship: New Venture Creation, PHI(P), Ltd.,2001.
- Madhulika Kaushik : Management of New & Small Enterprises, IGNOU course material, 1995.

MH 462 NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS (3-0-0)3

Ordinary Differential Equations : Multistep (explicit and implicit) methods for initial value problems, Stability and Convergence analysis, Linear nonlinear boundary value problems, Quazilinearization, Shooting methods Finite difference methods : Finite difference approximations for derivatives, boundary value problems with explicit boundary conditions, implicit boundary conditions, error analysis, stability analysis, convergence analysis. Partial Differential Equations: Classification of partial differential equations, finite difference approximations for partial derivatives and finite difference schemes for : Parabolic equations : Schmidt's two level, multilevel explicit methods, Crank-Nicolson's two level, multilevel implicit methods, Dirichlet's problem, Neumann problem, mixed boundary value problem. Hyperbolic Equations : Explicit methods, implicit methods, one space dimension, two space dimensions, ADI methods. Elliptic equations : Laplace equation, Poisson equation, iterative schemes, Dirichlet's problem, Neumann problem, mixed boundary value problem, ADI methods.

TEXT BOOKS:

1. M.K.Jain : Numerical Solution of Differential Equations, Wiley Eastern, New Delhi
2. G.D.Smith : Numerical Solution of Partial Differential Equations, Oxford Uni. Press