SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

Grading System
Department of Electrical Engineering (EE)
Scheme of Examination w.e.f. 2017-18
III Semester / II Year

S. No.	Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Credit	Total Marks
			Theory			Practical							
			End Sem.	Mid Sem	Quiz, Assignment	End Sem	Lab work	Assignment / Quiz	L	T	P		
1	MA-112	MATHEMATICS –III	60	30	10				3	1		4	100
2	EE-302	FIELD-THEORY	60	30	10				3	1		4	100
3	EE-303	ELECTRICAL & ELECTRONICS MEASUREMENT & INSTRUMENTATION	60	30	10	20	20	10	3	1	2	5	150
4	EE-304	ANALOG ELECTRONICS	60	30	10	20	20	10	3	1	2	5	150
5	EE-305	NETWORK ANALYSIS	60	30	10	20	20	10	3	1	2	5	150
6	EE-306	JAVA				50	50	50			2	1	150
7	EE-307	CRITICAL THINKING					50	50			2	1	100
8	EE-308	SELF STUDY (SEMINAR & GROUP DISCUSSION)					50	50			2	1	100
TOTAL			300	150	50	110	210	180	15	5	12	26	1000

L: Lecture **T: Tutorial** **P: Practical**

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Department of Electrical Engineering (EE)
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IV Semester / II Year

S. No.	Subject Code	Subject Name	Maximum Marks Allotted						Hours / Week			Credit	Total Marks
			Theory			Practical							
			End Sem.	Mid Sem	Quiz, Assignment	End Sem	Lab work	Assignment / Quiz	L	T	P		
1	EE-401	ELECTRICAL ENGG. MATERIALS	60	30	10				3	1		4	100
2	EE-402	ELECTRICAL MACHINES-I	60	30	10	20	20	10	3	1	2	5	150
2	EE-403	DIGITAL ELECTRONICS CIRCUIT	60	30	10	20	20	10	3	1	2	5	150
4	EE-404	POWER SYSTEM – I	60	30	10	20	20	10	3	1	2	5	150
5	EE-405	NUMERICAL TECHNIQUE COMOUTER PROGRAMMING	60	30	10				3	1		4	100
6	EE-406	ELECTRICAL WORKSHOP				50	50	50			2	1	150
7	EE-407	MENTAL ABILITY APPTITUDE					50	50			2	1	100
8	EE-408	SELF STUDY (SEMINAR & GROUP DISCUSSION)					50	50			2	1	100
TOTAL			300	150	50	110	210	180	15	5	12	26	1000

L: Lecture **T: Tutorial** **P: Practical**

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Grading System
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S. No.	Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Credit	Total Marks
			Theory			Practical							
			End Sem.	Mid Sem	Quiz, Assignment	End Sem	Lab work	Assignment / Quiz	L	T	P		
1	EE-501	FUNDAMENTAL OF POWER ELECTRONICS	60	30	10	20	20	10	3	1	2	5	150
2	EE-502	ELECTRICAL MACHINE-II	60	30	10	20	20	10	3	1	2	5	150
3	EE-503	MICROPROCESSOR & MICROCONTROLLER	60	30	10	20	20	10	3	1	2	5	150
4	EE-504	UTILIZATION OF ELECTRICAL ENERGY	60	30	10				3	1		4	100
5	EE-505	RENEWABLE ENERGY SOURCE	60	30	10				3	1		4	100
6	EE-506	INDUSTRIAL TRAINING				30	50	50			2	1	130
7	EE-507	ELECTRICAL ENGG. SIMULATION LAB.				20	50	50			2	1	120
8	EE-508	SELF STUDY(SEMINAR & GROUP DISCUSSION)					50	50			2	1	100
TOTAL			300	150	50	110	210	180	15	5	12	26	1000

L: Lecture **T: Tutorial** **P: Practical**

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

Grading System
Department of Electrical Engineering (EE)
Scheme of Examination w.e.f. 2017-18
VI Semester / III Year:

S. No.	Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Credit	Total Marks
			Theory			Practical							
			End Sem.	Mid Sem	Quiz, Assignment	End Sem	Lab work	Assignment / Quiz	L	T	P		
1	EE-601	POWER SYSTEM ENGINEERING -II	60	30	10	20	20	10	3	1	2	5	150
2	EE-602	CONTROL SYSTEM	60	30	10	20	20	10	3	1	2	5	150
3	EE-603	ELECTRICAL DRIVES	60	30	10	20	20	10	3	1	2	5	150
4	EE-604	SOFT COMPUTING TECHNIQUES	60	30	10				3	1		4	100
5	EE-605	ENERGY CONSERVATION & MANAGEMENT	60	30	10				3	1		4	100
6	EE-606	ENGINEERING DESIGN PROJECT				50	50	50			2	1	150
7	EE-607	ETHICS & VALUES					50	50			2	1	100
8	EE-608	SELF STUDY (SEMINAR & GROUP DISCUSSION)					50	50			2	1	100
TOTAL			300	150	50	110	210	180	15	5	12	26	1000

L: Lecture **T: Tutorial** **P: Practical**

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

Grading System
Department of Electrical Engineering (EE)
Scheme of Examination w.e.f. 2017-18
VII Semester / IV Year

S. No.	Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Credit	Total Marks
			Theory			Practical							
			End Sem.	Mid Sem	Quiz, Assignment	End Sem	Lab work	Assignment / Quiz	L	T	P		
1	EE-701	ELECTRICAL MACHINE DESIGN	60	30	10	20	20	10	3	1	2	5	150
2	EE-702	ADVANCE ELECTRICAL MACHINE	60	30	10	20	20	10	3	1	2	5	150
3	Refer table below	ELECTIVE-I	60	30	10				3	1		4	100
4	Refer table below	ELECTIVE-II	60	30	10				3	1		4	100
5	Refer table below	ELECTIVE-III	60	30	10				3	1		4	100
6	EE-703	POWER SYSTEM ELECTRICAL DESIGN LAB				20	20	10			2	1	50
7	EE-704	MAJOR PROJECT – I				50	50	50			2	1	150
8	EE-705	ENTERPRENEURSHIP					50	50			2	1	100
9	EE-706	SELF STUDY(SEMINAR & GROUP DISCUSSION)					50	50			2	1	100
TOTAL			300	150	50	110	210	180	15	5	12	26	1000

L: Lecture T: Tutorial P: Practical

ELECTIVE-I	EE-7101	EE-7102	EE-7103
	EHV AC & DC TRANSMISSION	DIGITAL ELECTRONICS &LOGIC DESIGN-II	FLEXIBLE AC TRANSMISSION SYSTEM
ELECTIVE-II	EE-7201	EE-7202	EE-7203
	COMPUTER APPLICATIONS TO POWER SYSTEM	ADVANCED ELECTRICAL DRIVES	ADVANCED CONTROL SYSTEM
ELECTIVE-II	EE-7301	EE-7302	EE-7303
	HIGH VOLTAGE ENGINEERING	ADVANCED POWER ELECTRONICS	SCADA SYSTEM & APPLICATION

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VIII Semester/ IV Year:

S. No.	Subject Code	Subject Name	Maximum Marks Allotted						Hours/ Week			Credit	Total Marks
			Theory			Practical							
			End Sem.	Mid Sem	Quiz, Assignment	End Sem	Lab work	Assignment / Quiz	L	T	P		
1	EE -801	MAJOR PROJECT - II	—	—	—	300	150	150			16	16	600
2	EE-802	COMPREHENSIVE VIVA	—	—	—	200	50	50			6	6	300
3	EE- 803	SELF STUDY (SEMINAR & GROUP DISCUSSION)	—	—	—		50	50			4	4	100
TOTAL						500	250	250			26	26	1000

L: Lecture **T: Tutorial** **P: Practical**

MA112-ENGINEERING MATHEMATICS III

Unit -1

Functions of complex variables: Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula, Singular Points, Poles & Residues, Residue Theorem, Application of Residues theorem for evaluation of real integrals

Unit -2

Errors & Approximations, Solution of Algebraic & Transcendental Equations (Regular Falsi Newton-Raphson, Iterative, Secant Method), Solution of simultaneous linear equations by Gauss Elimination, Gauss Jordan, Crout's methods , Jacobi's and Gauss-Siedel Iterative methods

Unit -3

Difference Operators, Interpolation (Newton Forward & Backward Formulae, Central Interpolation Formulae, Lagrange's and divided difference formulae), Numerical Differentiation and Numerical Integration.

Unit -4

Solution of Ordinary Differential Equations(Taylor's Series, Picard's Method, Modified Euler's method,Runge-Kutta Method, Milne's Predictor & Corrector method), Correlation and Regression, Curve fitting (Method of Least Square).

Unit -5

Concept of Probability: Probability Mass function, Probability density function. Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution, Gamma Distribution, Beta Distribution, Testing of Hypothesis ,Students t-test, Fisher's z-test, Chi-Square Method

Reference:

(i) Numerical Methods using Matlab by J.H.Mathews and K.D.Fink, P.H.I.
(ii) Numerical Methods for Scientific and Egg. Computation by M.KJain, Iyengar and RK Jain, New Age International Publication
(iii) Mathematical Methods by KV Suryanarayan Rao, SCITECH Publuication
(iv) Numerical Methods using Matlab by Yang, Wiley India
(v) Probability and Statistics by Ravichandran, Wiley India
(vi) Mathematical Statistics by George R., Springer

EE302-FIELD THEORY

Unit-1

Cartesian, cylindrical & spherical co-ordinate systems, scalar & vector fields, gradient, divergence & curl of a vector field, Divergence theorem & Stokes's theorem, concept of vectors. Electrostatic Fields – Coulomb's law, electric field intensity due to different charge distribution viz. line charge, sheet charge, Field due to continuous volume – electric potential, properties of potential function, potential gradient equipotential surfaces, line of force, Gauss law, applications of Gauss law, Gauss law in point form method of images.

Unit-2

Laplace's & Poisson's equations, solution of Laplace's equation, Electric dipole, dipole moment, Potential & electric field intensity due to dipole, Behavior of conductors in an electric field. Conductor & insulator, electric field inside a dielectric, polarization, Boundary value conditions for electric Field, Capacitance & Capacitances of various types of capacitors, Energy stored and energy density in static electric field, Current density, conduction & convection current density ohms law in point form, equation of continuity.

Unit-3

Static Magnetic Field, Biot-Savart's law, Magnetic Field intensity due to straight current carrying filament, circular, square and solenoidal current carrying wire, Relationship between magnetic flux, flux density & magnetic Field intensity; Ampere's circuital law and its applications, magnetic Field intensity due to infinite sheet and various other configurations, Ampere's circuital law in point form, Magnetic force, moving charge in a magnetic field, Lorentz Force on straight and long current carrying conductors in magnetic field, force between two long & parallel current carrying conductors. Magnetic dipole & dipole moment, a differential current loop as dipole, torque on a current carrying loop in magnetic field, Magnetic Boundary conditions.

Unit-4

Scalar magnetic potential and its limitations, Vector magnetic potential and its properties, vector magnetic potential due to different simple configurations; Self and Mutual inductances, determination of self & mutual inductances, self inductance of solenoid, toroid coils, mutual inductance between a straight long wire & a square loop. Energy stored in magnetic Field & energy density, Faraday's Law, transformer & motional EMFs, Displacement current, Maxwell's equations as Generalization of circuit equations, Maxwell's equation in free space, Maxwell's equation for harmonically varying Field, static and steady fields, Maxwell's equations in differential & integral form.

Unit-5

Electro Magnetic Waves : Uniform plane wave in time domain in free space, Sinusoidally time varying uniform plane wave in free space, Wave equation and solution for material medium, Uniform plane wave in dielectrics and conductors, Pointing Vector theorem, instantaneous, average and complex poynting vector, power loss in a plane conductor, energy storage,

Polarization of waves, Reflection by conductors and dielectric – Normal & Oblique incidence, Reflection at surface of a conducting medium, surface impedance, transmission line analogy.

Reference Books:

1. Mathew N.O Sadiku; Elements of Electromagnetic; Oxford.
2. P.V. Gupta; Electromagnetic Fields; Dhanpat Rai.
3. N.N. Rao; Element of Engineering Electromagnetic; PHI.
4. William H. Hayt; Engineering Electromagnetic; TMH.
5. John D. Kraus; Electromagnetic; TMH.
6. Jordan Balmian; Electromagnetic wave & Radiating System; PHI.
7. David K. Cheng; Fields and Wave Electromagnetic; Addison Wesley.
8. S.P. Seth; Electromagnetic Field ;Dhanpat Rai & Sons

EE303- ELECTRICAL & ELECTRONICS MEASUREMENT AND INSTRUMENTATION

Unit-1

Measurement and Error

Accuracy and precision, sensitivity resolution, Error & Error analysis, Effect of temperature, Internal friction, Stray field, Hysteresis and Frequency variation & method of minimizing them, Loading effects, due to shunt connected and series connected instruments, calibration curve, Testing & calibration of instruments.

Galvanometers – Theory & operation of ballistic galvanometer, D'Arsonal galvanometer, galvanometer motion & damping, Sensitivity, Flux meter, Vibration galvanometer, Spot deflection galvanometer. Definition of analog & digital instruments, Classification of analog instruments, their operating principle, Operating force, Types of supports, Damping, Controlling.

Unit-2

Different types of Ammeter & Voltmeter

PMMC, MI, Electrodynamometer, Hotwire, Electrostatic, Induction, Rectifier, Ferro dynamic & Electro-thermic, Expression for control & deflection torque, their advantages, disadvantages & error, Extension of range of instruments using shunt & multiplier.

Unit-3

Instrument Transformers

Potential and current transformers, ratio and phase angle errors, testing of instrument transformers, Difference between CT and PT, errors and reduction of errors.

Measurement of power: Power in AC and DC Circuit, Electrodynamometer type of wattmeter, Construction, theory, operation & error, Low power factor & UPF wattmeter, Double element and three element dynamometer wattmeter, Measurement of power in three phase circuit, one, two & three wattmeter method, Measurement of reactive power by single wattmeter, Measurement of power using CTs & PTs.

Unit-4

Measurement of Energy

Single phase induction type energy meter – construction & operation – driving and braking torques –errors & compensations – Testing by phantom loading and using R.S.S. meter- Three phase energy meter – Tri-vector meter – Maximum demand meter, Ampere hour meter. Potentiometer – DC potentiometer standardization – Lab type Crompton's potentiometer, application of DC potentiometer, AC polar type and coordinate type potentiometer, their construction and applications.

Unit-5

Miscellaneous Instruments & Measurements

Power factor meter, Single phase and three phase Electro-dynamometer type & moving iron type. **Frequency meter** – Vibrating reed, Resonance type & Weston type, Synchronoscope, Ohmmeter – series & stunt type, Multi-meter, Megger & Ratio meter.

Resistance Measurement – Classification of low, medium & high resistance – Voltmeter, Ammeter, Wheatstone Bridge, Kelvin's double bridge & loss of charge methods for resistance measurement, Earth resistance measurement.

Magnetic Measurement – B-H Curve, Hysteresis Loop determination, Power loss in sheet metal – Lloyd Fischer square for measurement of power loss.

Reference Books:

1. E W Golding & F C Widdis; Electrical Measurement & Measuring Instruments; Wheeler Pub.
2. A.K. Sawhney; Electrical & Electronic Measurements & Instrument; Dhanpat Rai & Sons Pub.
3. Buckingham & Price; Electrical Measurements; Prentice Hall

List of Experiments:

1. Measurement of low resistance using Kelvin's Double bridge
2. Measurement of medium resistance using Whetstone's bridge
3. Measurement of high resistance by loss of charge method
4. Measurement of Insulation resistance using Megger
5. Measurement of earth resistance by fall of potential method and verification by using earth tester.
6. Measurement of power in a single phase ac circuit by 3 voltmeter/ 3 Ammeter methods.
7. Calibration of a dynamometer type of wattmeter with respect to a standard/Sub Standard wattmeter.
8. Calibration of an induction type single phase energy meter.
9. Calibration of a dynamometer type of wattmeter by Phantom Loading method.
10. Measurements using Instrument Transformers.
11. Study of various types of Indicating Instruments.
12. Measurement of Power in three phase circuit by one, two & three Wattmeter's.

EE304- ANALOG ELECTRONICS

Unit-1

Semiconductor device, theory of P-N junction, temperature dependence and break down characteristics, junction capacitances, Zener diode, Varactor diode, PIN diode, LED, Photo diode, Transistors BJT, FET, MOSFET, types, working principal, characteristics, and region of operation, load line biasing methods,. Transistor as an amplifier, gain, bandwidth, frequency response, Various applications of diode and special diodes.

Unit-2

Small signal analysis of transistor (low frequency) using h-parameters, thermal runaway and thermal stability.

Unit-3

Feedback amplifier, negative feedback, voltage-series, voltage shunt, current series and current Shunt feedback, Sinusoidal oscillators, L-C (Hartley-Colpitts) oscillators, RC phase shift, Wien Bridge and Crystal oscillators. Power amplifiers, class A, class B, class A B, C amplifiers, their Efficiency and power Dissipation, Push pull and complimentary push pull amplifier.

Unit-4

Switching characteristics of diode and transistor turn ON, OFF time, reverse recovery time, transistor as switch, Multivibrators, Bistable, Monostable, Astable multivibrators. Clippers and Clampers, Differential amplifier, calculation of differential, common mode gain and CMRR using h- parameters, Darlington pair, Boot strapping technique. Cascade and cascade amplifier.

Unit-5

Operational amplifier characteristics, slew rate , bandwidth, offset voltage ,basic current, application inverting , non inverting amplifier , summer , average, differentiator, integrator, differential amplifier, instrumentation amplifier , log and antilog amplifier , voltage to current and current to voltage converters , comparators Schmitt trigger , active filters, 555 timer and its application.

References:

1. Nashelsky & Boysted; Electronic Devices and Circuits; PHI
2. Millman Halkias; Electronic Devices and Circuits; McGraw- Hill
3. Achuthan MA and Bhatt KN; Fundamentals of semiconductor devices; TMH
4. Neamen Donald; Semiconductor Physics and devices
5. Millman & Grabel; Micro Electronics; McGraw-Hill
6. Bogart; Electronic Devices and Circuits; Universal Book Stall, New Delhi
7. Millman & Halkias; Integrated Electronics; McGraw- Hill.
8. Tobey; OP- Amps their design and Application
9. R.A. Gaikward; OP- Amp and linear Integreted circuit; PHI
10. D. Raychowdhary and Shail Jain; Linear Integrated Circuits

11. Botkar; Integrated Circuits; Khanna
12. Clayton; Applications of linear Integrated circuits

List of experiments (Expandable):

1. V-I Characteristics of different types of Diodes.
2. Applications of diodes and Design of various clipping and clamping circuits.
3. Design half & full wave rectifier
4. Design & Analysis of transistor amplifier in CE, CB & CC configuration.
5. Design & Analysis of JFET Amplifier.

EE305-NETWORK ANALYSIS

Unit-1

Introduction to circuit elements R,L,C and their characteristics in terms of linearity & time dependant nature, voltage & current sources controlled & uncontrolled sources KCL and KVL analysis, Nodal & mesh analysis, analysis of magnetically coupled circuits, Transient analysis :- Transients in RL, RC&RLC Circuits, initial conditions, time constants. Steady state analysis- Concept of phasor & vector, impedance & admittance, Network topology, concept of Network graph, Tree, Tree branch & link, Incidence matrix, cut set and tie set matrices, dual networks, and Dot convention, coupling coefficient, tuned circuits, Series & parallel resonance.

Unit-2

Network Theorems for AC & DC circuits- Thevenin's & Norton's, Superposition's, Reciprocity, Compensation, Substitution, Maximum power transfer, and Millman's theorem, Tellegen's theorem, problems with dependent & independent sources.

Unit-3

Frequency domain analysis – Laplace transform solution of Integro-differential equations, transform of waveform synthesized with step ramp, Gate and sinusoidal functions, Initial & final value theorem, Network Theorems in transform domain.

Unit-4

Concept of signal spectra, Fourier series co-efficient of a periodic waveform, symmetries as related to Fourier coefficients, Trigonometric & Exponential form of Fourier series.

Unit-5

Network function & Two port networks – concept of complex frequency, Network & Transfer functions for one port & two ports, poles and zeros, Necessary condition for driving point & transfer function. Two port parameters – Z, Y, ABCD, Hybrid parameters, their inverse & image parameters, relationship between parameters, Interconnection of two ports networks, terminated two port networks.

Reference Books:

1. M.E. Van Valkenburg, Network Analysis, (PHI)
2. F.F.Kuo, Network Analysis.
3. Mittal GK; Network Analysis; Khanna Publisher
4. Mesereau and Jackson; Circuit Analysis- A system Approach; Pearson.
5. Sudhakar & Pillai; Circuit & Networks- Analysis and Synthesis; TMH
6. Hayt W.H. & J.E. Kemmerly; Engineering Circuit Analysis; TMH
7. Decarlo lin; Linear circuit Analysis; Oxford
8. William D Stanley : Network Analysis with Applications, Pearson Education
9. Roy Choudhary D; Network and systems; New Age Pub
10. Charles K. Alexander & Matthew N.O. Sadiku: Electrical Circuits :TMH
11. Chakraborti :Circuit theory: Dhanpat Rai

12. B.Chattopadhyay & P.C.Rakshit; Fundamental of Electrical circuit theory; S Chand
13. Nilson & Riedel , Electric circuits ;Pearson

List of Experiments:

1. To Verify Thevenin's Theorem.
2. To Verify Superposition Theorem.
3. To Verify Reciprocity Theorem.
4. To Verify Maximum Power Transfer Theorem.
5. To Verify Millman's Theorem.
6. To Determine Open Circuit parameters of a Two Port Network.
7. To Determine Short Circuit parameters of a Two Port Network.
8. To Determine A,B, C, D parameters of a Two Port Network
9. To Determine h parameters of a Two Port Network
10. To Find Frequency Response of RLC Series Circuit.
11. To Find Frequency Response of RLC parallel Circuit.

EE401-ELECTRICAL ENGG. MATERIALS

Unit I

Conducting Material: Classification and main properties, High resistivity alloy: Constant Mangann,Nichrome, Electrochemical, properties of copper, Aluminum, steel tungsten, Molybdenum, Platinum, Tantalum, Niobium, Mercury, Nickel, Titanium, Carbon, Lead, thermal, Bimetals, thermocouple, materials, specific resistance, conductance, variation of resistance with temperature, super conductors.

Unit II

Semi Conductor Materials: General conception, variation of electrical conductivity, Elements having semiconductor properties, general application, hall effect, energy levels, conduction in semiconductors, Intrinsic conduction, impurity conduction, P and N type impurities, electrical change, Neutrality, Drift, Mobility current flow in semi conductors P-N junction formation by alloying, Elasing (forward and reverse) of P-n junction, Reverse separation current, Zener effect, Junction, capacitance, hall defects and hall coefficients.

Unit III

Magnetic Materials: Details of magnetic materials, reduction between B.H. and ı, soft and hard magnetic materials. Di-magnetic, Para magnetic and Ferromagnetic materials, electrical sheet steel, cast iron. Permanent magnetic materials. Dynamic and static hysteresis loop. Hysteresis loss, eddy current loss, Magnetization, magnetic susceptibility, coercive force, core temperature, rectangular hysteresis loop, Magnet rest square loop core materials, iron silicon, Iron alloys.

Unit IV

Insulating Materials: General electrical mechanical and chemical properties of insulating material, Electrical characteristics volume and surface resistivity complex permittivity loss, and dielectric loss, equivalent circuits of an imperfect dielectric polarization and polarisability classification of dielectric.

Unit V

Mechanical Properties: Classification insulating materials on the basis of temperature rise. General properties of transformer oil, commonly used varnishes, solidifying insulating materials, resins, bituminous waxes, drying oils, Fibrous insulating materials, wood, paper and cardboard, insulating textiles, varnished adhesive tapes, inorganic fibrous material and other insulating materials, such as mica, ceramic, Bakelite, ebonite, glass, PVC, rubber, other plastic molded materials.

References:

1. TTTI Madras; Electrical Engineering Materials; TMH.
2. Electrical Engineering Material s & Devices; John Allison; TMH
3. Materials for Electrical Engineering: B.M. Tareev
4. Anderson; Di-Electrics:
5. Kortisky; Electrical Engineering Materials:
6. Indulkar and S. Thruvengadem; Electrical Engineering Materials; S. Chand
7. Dekkor AK; Electrical Engineering Materials; PHI.

EE402- ELECTRICAL MACHINES-I

Unit-I

Transformer-I

Working principle, e.mf. equation, construction, phasor diagrams, equivalent circuit, voltage regulation, losses, separation of hysteresis and eddy current losses, efficiency, tests: open circuit and short circuit, load, Sumner's test, Condition for maximum efficiency and regulation, Power and distribution transformer, all day efficiency, Excitation phenomenon, Autotransformer: working, advantages , its equivalent circuit and phasor diagram.

Unit II

Transformer-II

Three phase transformer: its construction, groups and connections, their working and applications; Scott-connection, Parallel operation of Transformers, application, advantages, requirement and load sharing; Tap changers, cooling, conservator and breather. Pulse and high frequency transformers.

Unit III

Three phase Induction Motor-I

Working principle, construction, comparison of slip ring and squirrel cage motors, steady state analysis, phasor diagram and equivalent circuit, power flow diagram, torque-speed and power-speed characteristics, Losses and efficiency, No load and block rotor test, circle diagram

Unit IV

Three phase Induction Motor-II

Starting of squirrel cage and slip ring motors, power factor control, Cogging & Crawling, Double cage &Deep bar Indication Motor, impact of unbalanced supply and harmonics on performance, speed control, braking, Induction Generator. Applications

Unit V

Single Phase Motors:

Single Phase Induction motor; double revolving field theory, equivalent circuit and its determination, performance calculation, starting methods and types of single phase Induction motors: their working principle and applications, comparison with three phases Induction Motor. Single phase A.C. series motor, Servo motors, Linear Induction Motor

Reference Books:

1. M. G. Say, Alternating Current Machines', (5th Ed.) ELBS, 1986.
2. V.Del Toro, "Electrical Machines & Power Systems", 1985, Prentice-Hall, Inc., Englewood Cliffs.
3. V.Del Toro, "Electromechanical Devices for Energy Conversion & Control Systems", PHI Pvt. Ltd., 1975.Text Books:
4. Electrical Machines by Nagrath and Kothari (TMH).
5. A.C. Machines by Langs dorf (McGraw-Hill)
6. Electrical Machines by Dr.P.S.Bimbhra (Khanna).
7. Electrical Machines by Ashfaq Hussain. (Dhanpat Rai).

List of Experiments (expandable)

Experiments can cover any of the above topics, following is a suggestive list:

1. Perform turn ratio and polarity test on 1-phase transformer
2. Perform load test on a 1-phase transformer and plot its load characteristic
3. Perform OC and SC tests on a 1-phase transformer and determine its equivalent circuit. Also find its efficiency and regulation at different load and power factor.
4. Perform OC and SC tests on a 3-phase transformer and determine its equivalent circuit. Also find its efficiency and regulation at different load and power factor.
5. Perform Sumner's test on two 1-phase transformer and determine its efficiency at various load.
6. Perform No-load and block rotor test on a 3- phase IM and determine its equivalent circuit.
7. Perform load test on a 3- phase IM and plot its performance characteristics.
8. Study various types of starters used for 3- IMs.
9. Perform No-load and block rotor test on a 1- phase IM and determine its equivalent circuit.

EE403-DIGITAL ELECTRONICS CIRCUITS

Unit I

(A) Number System: Various number systems-decimal, Binary, Hex and Octal with mutual conversion, binary arithmetic in computers, addition, subtraction, multiplication and division.
(B) Binary Codes: Weighted, non-weighted codes, error detecting and correcting codes, Alphanumeric codes, ASCII codes

Unit II

Boolean Algebra & Logic Hardware
(A) Boolean Algebra: AND, OR, NOT, NAND, NOR, EXOR, operations and gates, laws of Boolean algebra, reduction of Boolean expression, logic diagram, universal building blocks, Negative logic
(B) Logic hardware "Diode as switch, Bipolar transistor as switch FET as switch, MOSFET (Depletion and Enhancement mode) IC Technology, MSI, LSI, VLSI, logic specification, logic Families (DTL, TTL, ECL, MOS, CMOS)

Unit III

Combinational circuits and system
(A) Combinational logic: Minterms and maxterms, Truth table and Karnaugh mapping, reduction of Boolean expression with SOP, POS and mixed terms, incompletely specified functions Multiple output minimization, variable mapping, minimization by labular/ Quine Mc cluskey Method.
(B) Encoders, Decoders, Multiplexers, Demultiplexers, code convertors, Binary address Digital Comparator, parity checker/ generator, programming logic Array (PLA)

Unit IV

Sequential circuits
(A) State tables and diagrams, flip flop and its various types- JK, RS, T, D, pulse and edge Triggered flip flops transition and excitation tables, timing diagrams. **(B)** Shift registers: Series and parallel data transfer, ripple counters, synchronous counters, Modulo N counter design, Up down counters, Ring

Unit V

Memory & A/D Conversion
(A) Semiconductor ROM, Bipolar and MOS RAM, organization of RAM memory subsystem. Timing circuit, clock circuit and IC Timer.
(B) Analog/ Digital conversion: Digital to analog conversion, dual slope integration successive Approximation, parallel and parallel/ series conversion, converter specifications.

Reference Books:

1. An Introduction to Digital Computer Design by V. rajaraman and T. Radhakrishnan, 3rd Edn. PHI.
2. Digital Principles and Applications by A.P. Malvino and B.P. Leach, 4th Edn. McGraw Hill.
3. Digital computer Fundamentals by T.C. Bratee, 6th Edn. McGraw Hill.
4. Pulse, Digital and switching circuits-Millman

Text Books:

1. Digital Electronics by WH Gothmann, 2nd Edn. PHI.

EE404-POWER SYSTEM-I

Unit I

General consideration on various sources of energy, energy conversion employing Steam, energy conversion using water gas turbine

a) MHD generation
b) Solar generation
c) Wind power station
d) Geothermal power generation.

Unit II

Thermal, nuclear and gas power station:

Block diagram of thermal power station, selection of site. Different types of auxiliaries used in thermal power station. Nuclear Power Station: Different types of reactors and fuels, safety methods, waste disposal.

Unit III

Gas Power Station:

Block diagram, gas cycles, combined cycle power plants. Comparison between these power stations

Hydro Power Station:

Choice of site, block diagram including surge tank and penstock, Hydrographs, flow duration curve. Types of turbines, base load and peak load power station.

Unit IV

Economic aspects of power plant operations:

Definitions load factor, demand factor and Diversity factor. Calculation of cost of generation, fixed charges, interest and depreciations, Methods of Depreciation. Tariffs: Different types of tariffs, power factor improvement.

Unit V

Economic Scheduling of Power Stations:

Economic operation of power system, criteria of loading of power plants with and without transmission loss, load dispatching in power system, co-generation and coordination of power plants.

Reference:

1. G.R.Nagpal,"Power Plant Engineering", Khanna Publisher
2. S.N. Singh Electric Power Generation. PHI.
3. M.V.Deshpandey,"Modern Design of Power Station"

EE405- NUMERICAL TECHNIQUE COMPUTER PROGRAMMING

UNIT -I

Numerical solution of algebraic and transcendental equations: Bisection method, Newton's method of false position, secant method, Newton Raphson method, iteration method

UNIT -II

Solution of linear simultaneous equations: Gauss elimination method, gauss Jordon method, Jacobi's iteration method, gauss siedal iteration method.

UNIT- III

Finite differences: Difference operators and relations between them, Newton's forward and backward interpolation formulae, central difference interpolation formulae by stirling and Bessel, Lagrange's and Newton divided, difference formulae for unequal intervals, curve fitting, least square method..

UNIT- IV

Numerical differentiation and integration: Differentiation formulae derived from interpolation formulae, Newton cote's Quadrature formulae, trapezoidal rule, Simpson's 1/3 and 3/8 rules, Boole's rules, waddles rule, Gaussian Quadrature formulae.

UNIT -V

Numerical solution of ordinary & partial differential equations: Taylor series method, Picard's method, Euler's method, modified Euler's method, runge's method, runge kutta's method, predictor – corrector methods by Milne and Adam bash forth, Finite difference approximation of partial derivatives, solution of Laplace equations by standard 5 point formula, solution of one dimensional heat flow equations by crank Nicolson method.

Text books:

1. Numerical method in Engg. And science by B S Grewal (Khanna publishers).
2. Numerical method by Jain, Iyeger (Wiley Eastern Ltd).

Reference books:

1. Numerical method for mathematics, science & engg by John Mathews (Prentice Hall of India, New Delhi)
2. Introduction & methods of numerical analysis by S D Sastry (Prentice Hall of India, New Delhi)

EE501-FUNDAMENTAL OF POWER ELECTRONICS

Unit-I

Advantages and application of power electronic devices characteristics, Symbol & application of power diodes, power transistors, GTO, Triac, Diac, Power MOSFET, IGBT, LASCR, Fast recovery diode, schottey diode MCTs. Principle of operation of SCR, Two transistor analogy, brief idea of construction of SCR, Static characteristics of SCR, Condition of turn on & off of SCR Gate characteristics, Method for turning on of SCR, Turnoff methods, different commutation techniques (Class A,B,C,D,E, & F Commutation) firing of SCR, Use of pubic transformer and opto isolator in firing, Resistance firing Ckt, Resistance capacitance firing circuit, UJT firing cut, and ramp triggering, firing for 3-Φ circuit. SCR rating & protection of SCR over voltage, over current, Superior firing, Design of snubber circuit and protection of gate of SCR, heating, cooling & mounting of SCR series and parallel operation of SCR, String efficiency & problem associated with series and parallel operation of SCR

Unit-II

Operation and analysis of single phase (Half wave & Full Wave) and multiphase (Three Phase) uncontrolled and controlled rectifier circuit with resistive, resistive & inductive load (continuous & non continuous conduction, few small & very large inductive loads) and RLE loads. Estimation of average load voltage and load current for above rectifier circuits active and reactive power input. Effect of freewheeling diode and source inductance on performance of these rectifier circuits. Comparison of midpoint & Bridge rectifier circuits.

Unit-III

Series and parallel inverter, Voltage source & current source inverter, Single phase and three phase bridge inverter, Self cumulated inverters,, Mc- murray & MC murray bed ford inverters, Voltage control of single phase and three phase bridge inverter, Harmonics & their reduction techniques.

Unit-IV

Principle of chopper operation, Various control strategies in chopper, Step up & step-up/step down choppers, chopper configuration (Type A,B, C,D, & E), Steady state analysis of chopper circuits, Current & voltage commutation of chopper circuits Jones & Morgens chopper

Unit-V

Single phase (mid point & bridge configuration) and three phase cyclo convertor configuration and operating principles. AC voltage controllers (using SCRs & Traics) single phase full wave controller with R and RL load, Estimation of RMS load voltage, RMS load current and input power factor, three phase AC voltage controller (Without analysis) Dual converter Switched mode voltage regulator buck, Boost, Buch & Boost, Ck regulators.

References:

1 M.H. Rashid, Power Electronics Circuits, Devices and Applications, Pearson
2 Educations, Singapore, 1993.
3 M Ramamurthy, An Introduction to transistor and their application, Affiliated East-West Press.
4 P.C. Sen., Power Electonics, TMH.
5 M.D. Singh, K.B. Khanchandani, Power Electronics, TMH, Delhi, 2001.
6 Chakravarti A. Fundamental of Power Electronics and Drives, Dhanpat Ray & Co.,

EE502-ELECTRICAL MACHINE-II

Unit-I

D.C. Machine-I
Basic construction of DC machines; types of DC machines and method of excitation; lap and wave windings; Emf equation; armature reaction and methods of limiting armature reaction; Commutation process and methods for improving commutation; Basic performance of DC generators and their performance characteristics, Metadyne and Amplidyne, permanent magnet DC motors; Brush less dc motors,

Unit-II

D.C. Machine-II
Basic operation of DC motors; Torque equation; Operating characteristics of DC motors, Starting of DC motors- 2point, 3 point and 4 point starters; speed control of DC motors; losses and efficiency of DC machines; testing of DC machines, direct testing, Swinburne's test and Hopkinson's test. Application of DC machines

Unit-III

Synchronous Machine-I
Construction; types of prime movers; excitation system including brushless excitation, polyphase distributive winding, integral slot and fractional slot winding, Emf equation, generation of harmonics and their elimination; armature reaction; synchronous reactance and impedance, equivalent circuit of alternator, relation between generated voltage and terminal voltage, voltage regulation of alternators using synchronous impedance, mmf, zpf and new A.S.A method.

Unit-IV

Synchronous Machine-II
Salient pole machines; two reaction theory equivalent circuit model and phasor diagram; determination of X_d and X_q by slip test; SCR and its significance; regulation of salient pole alternator, power angle equation and characteristics; synchronizing of alternator with infinite busbar,parallel operation and load sharing; synchronizing current, synchronizing power and synchronising torque coefficient; synchroscopes and phase sequence indicator; effect of varying excitation and mechanical torque,.

Unit-V

Synchronous machine-III
Synchronous motor operation, starting and stopping of synchronous motor, pull in torque, motor under load power and torque, reluctance torque, effect of excitation, effect of armature reaction, power factor adjustment, V curves, inverted V curves, synchronous motors as power factor correcting device, super synchronous and sub synchronous motors, hunting and damper winding

efficiency and losses. Analysis of short circuit oscillogram, determination of various transient, sub transient and steady reactances and time constants, expression of transient and sub transient reactances in terms of self and mutual inductances of various winding, short circuit current, equivalent circuit. Single phase synchronous motors- hysteresis motor, reluctance motor. Repulsion motor, stepper motor, switched reluctance

List of Experiments (expandable)

Experiments can cover any of the above topics, following is a suggestive list:

1 To plot magnetization characteristic of a separately excited DC generator
2. To perform load test on DC generators.
3. To perform load test on DC series and shunt motor
4. To perform Swinburne's test on a DC machine and find out its efficiency under full load
5 To conduct Hopkinson's test on a pair of DC shunt machine.
6. To perform OCC and SCC test on an alternator and determine its regulation.
7. To determine regulation of alternator using mmf and zpf methods.
8. To synchronise alternator with infinite bus bar.
9 To plot V and inverted V curves for a synchronous motor
10. To find Xd and Xq of salient pole synchronous machine by slip test.
11 To Determine negative sequence and zero sequence reactance of an alternator.
12 To determine sub transient direct axis and quadrature axis synchronous reactances of salient pole machine.

Reference Books:

1. M.G. Say, Performance & design of AC machines, CBS publishers & distributors, Delhi, 3rd edition
2. A.E. Clayton & N.N. Nancock, the Performance & design of DC machines CBS publications & distributors, Delhi, 3rd edition
3. P.S. Bhimbra, Electrical Machinery, Khanna Pub.
4. P.S. Bhimbra, Generalized theory of Electrical Machines, Khanna publishers, Delhi,
5. Ashfaq Husain, Electric Machines, Dhanpat Rai, New Delhi
5. I.J. Nagrath & D.P. Kothari, Electric Machines, Tata McGraw Hill, New Delhi,
6. Syed A. Nasar, Electric Machines & Power Systems, Volume I, Tata McGraw Hill, New Delhi
7. A. E. Fitzerald, C. Kingsley & S.D. Umans , Electric Machinery Tata McGraw Hill ,New Delhi ,5th edition

EE503-MICROPROCESSORS & MICROCONTROLLERS

UNIT- 1

Microprocessor 8086: Introduction to 16-bit 8086 microprocessors, architecture of 8086, Pin Configuration, interrupts, minimum mode and maximum mode, timing diagram, Memory interfacing, Comparative study of Salient features of 8086, 80286 and 80386.

UNIT -2

Microprocessor 8086 programming: Instruction set of 8086, Addressing mode, Assembler directives & operations, assembly and machine language programming, subroutine call and returns, Concept of stack, Stack structure of 8086, timings and delays,

UNIT -3

Input-Output interfacing: Memory Mapped I/O and Peripherals I/O. PPI 8255 Architecture and modes of operation, Interfacing to 16-bit microprocessor and programming, DMA controller (8257) Architecture, Programmable interval timer 8254, USART 8251, 8 bit ADC/DAC interfacing and programming.

UNIT- 4

Microcontroller 8051: Intel family of 8 bit microcontrollers, Architecture of 8051, Pin description, I/O configuration, interrupts; Interrupt structure and interrupt priorities, Port structure and operation, Accessing internal & external memories and different mode of operations, Memory organization, Addressing mode, instruction set of 8051 and programming.

UNIT- 5

8051 Interfacing, Applications and serial communication: 8051 interfacing to ADC and DAC, Stepper motor interfacing, Timer/ counter functions, 8051 based thyristors firing circuit, 8051 connections to RS-232, 8051 Serial communication , Serial communication modes, Serial communication programming, Serial port programming in C.

List of Experiment:
Introduction

1. Introduction to 8086 & 8051 kit, hardware features & modes of operation.
2. Introduction to 8086 & 8051 kit, hardware features & modes of operation.
3. Technique of programming & basic commands of kit.
4. Instruction set of 8086 & 8051.

Assembly language programming of 8086 & 8051.

1. Write a program to add two 8-bit numbers.
2. Write a program to add two 16-bit numbers.

3. Write a program for 8-bit decimal subtraction.
4. Write a program to find 1's complement and then 2's complement of a 16-bit numbers.
5. Write a program to find larger of two numbers.
6. Write a program to shift an 8-bit number left by 2-bits.
7. Write a program to multiply two 16-bit numbers.
8. Write a program for factorial of given number by recursion.
9. Write a program to square of an 8-bit number.
10. Write a program to generate a square wave of 2 KHz Frequency on input pin.

Reference Books:

1. Hall Douglas V., Microprocessor and interfacing, revised second edition 2006, Macmillan, McGraw Hill.
2. A.K. Ray & K.M.Bhurchandi, Advanced Microprocessors and peripherals- Architecture, Programming and Interfacing, Tata McGraw – Hill, 2009 TMH reprint.
3. Kenneth J. Ayala, The 8086 microprocessor: programming and interfacing the PC, Indian -edition, CENGAGE Learning.
4. Muhammad Ali Mazidi and Janice Gillespie Mazidi, the 8051 Microcontroller and Embedded Systems, Pearson education, 2005.
5. Kenneth J. Ayala, the 8051 Microcontroller Architecture, III edition, CENGAGE Learning.
6. V.Udayashankara and M.S.Mallikarjunaswamy, 8051 Microcontroller: Hardware, Software & Applications, Tata McGraw – Hill, 2009.
7. McKinley, the 8051 Microcontroller and Embedded Systems – using assembly and C, PHI, 2006 / Pearson, 2006.
8. Microprocessor and Interfacing, I edition 2012, oxford press setnil kumar, Saravam Jeevanathan shah.

EE504-UTILIZATION OF ELECTRICAL ENERGY

Unit-1

Illumination Engineering

Nature of light, units, sensitivity of the eye, luminous efficiency, glare. Production of Light; Incandescent lamps, arc lamps gas discharge lamps- fluorescent lamps polar curves, effect of voltage variation on efficiency and life of lamps, Distribution and control of light, lighting calculations, solid angle, inverse square and cosine laws, methods of calculations, factory lighting, flood lighting and street lighting, Direct diffused and mixed reflection & transmission factor, refractors, light fittings.

Unit-2

Heating, Welding and Electrolysis

Electrical heating-advantages, methods and applications, resistance heating, design of heating elements, efficiency and losses control. Induction heating: core type furnaces, core less furnaces and high frequency eddy current heating, dielectric heating: principle and special applications, arc furnaces: direct arc furnaces, Indirect arc furnaces, electrodes, design of heating elements, power supply and control. Different methods of electrical welding, resistance welding, arc welding, energy

Storage welding, laser welding, electro beam welding, and electrical equipment for them. Arc furnaces transformer and welding transformers. Review of electrolytic principles, laws of electrolysis, electroplating, anodizing-electro-cleaning, extraction of refinery metals, power supply for electrolytic process, current and energy efficiency.

Unit-3

Traction

Special features of Traction motors, selection of Traction Motor, Different system of electric traction and their Advantages and disadvantages, Mechanics of train movement: simplified speed time curves for different services, average and schedule speed, tractive effort, specific energy consumption, factors affecting specific energy consumption, acceleration and braking retardation, adhesive weight

and coefficient of adhesion,

Unit-4

Electric Drives

Individual and collective drives- electrical braking, plugging, rheostatic and regenerative braking load equalization use of fly wheel criteria for selection of motors for various industrial drives, calculation of electrical loads for refrigeration and air-conditioning, intermittent loading and temperature rise curve.

Unit-5

Introduction to Electric and Hybrid Vehicles

Configuration and performance of electrical vehicles, traction motor characteristics, tractive effort, transmission requirement, vehicle performance and energy consumption.

References:

1. Open Shaw, Taylor, .Utilization of electrical energy. Orient Longmans, 1962.
2. H. Pratap, Art and Science of Utilization of Electrical Energy.
3. Gupta, J.B., Utilization of Elect. Energy, Katarina and sons, New Delhi.
4. Garg, G.C., Utilization of Elect. Power and Elect. **ELECTRICAL ENGG. SIMULATION LAB.** Traction.
5. N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect. Traction, New Age International.
6. Hancok N N, Electric Power Utilization, Wheeler Pub.
7. Mehrdad, Ehsani, Yimin Gao,Sabastien.E. Gay,Ali Emadi, "Modern electric, hybrid Electric and fuel cell vehicles", CRC Press.

EE505- RENEWABLE ENERGY SOURCE

Unit - 1

Renewable Energy Systems
Energy Sources, Comparison of Conventional and non-conventional, renewable and non-renewable sources. Statistics of world resources and data on different sources globally and in Indian context. Significance of renewable sources and their exploitation. Energy planning, Energy efficiency and management.

Unit – 2

Wind Energy System
Wind Energy, Wind Mills, Grid connected systems. System configuration, working principles, limitations. Effects of wind speed and grid conditions. Grid independent systems - wind-battery, wind diesel, wind-hydro biomass etc. wind operated pumps, controller for energy balance. Small Hydro System Grid connected system, system configuration, working principles, limitations. Effect of hydro potential and grid condition. Synchronous versus Induction Generator for standalone systems. Use of electronic load controllers and self excited induction generators. Wave Energy System: System configuration: grid connected and hybrid systems.

Unit - 3

Solar Radiation
Extraterrestrial solar radiation, terrestrial solar radiation, Solar thermal conversion, Solar Photo tonic System Solar cell, Solar cell materials, efficiency, Characteristics of PV panels under varying insulation. PV operated lighting and water pumps, characteristics of motors and pumps connected to PV panels Energy System:. Biomass System configuration, Biomass engine driven generators, feeding loads in stand-alone or hybrid modes, Biomass energy and their characteristics.

Unit – IV

Energy from oceans
Ocean temperature difference, Principles of OTEC, plant operations, **Geothermal Energy** Electric Energy from gaseous cells, Magneto-hydro generated energy, Non hazardous energy from nuclear wastes, Possibilities of other modern non-conventional energy sources.

Unit - V

Electric Energy Conservation
Energy efficient motors and other equipment. Energy saving in Power Electronic controlled drives. Electricity saving in pumps, air-conditioning, power plants, process industries, illumination etc. Methods of Energy Audit.

Measurements systems; efficiency measurements. Energy regulation, typical case studies, various measuring devices analog and digital, use of thyristers.

References:

1. John Twidell & Toney Weir, Renewable Energy Resources, E & F N Spon.
2. El-Wiki, Power Plant Technology, McGraw Hill.
3. Rai G D, Non-conventional Energy Resources, Khanna.
4. F Howard E. Jordan, "Energy-Efficient Electric Motor & their Application-II", Plenum Press, New York, USA.
5. Anna Mani, "Wind Energy Resource Survey **in** India-Ill", Allied Publishers Ltd., New Delhi,
6. S.P. Sukhatme: Solar Energy, TMH-4e,
7. Dr. A. Ramachandran, Prof B.V Sreekantan & M F.C. Kohli etc, "TERI Energy Data Directory & Year book 1994-95", Teri Tata Energy Research Institute, New Delhi

EE601-POWER SYSTEM ENGINEERING-II

Unit -1

Introduction: Problems associated with modern interconnected power Systems, deregulation, power systems restructuring, distributed generation, congestion, available transfer capacities, pricing of energy and transmission services.

Unit -2

Power flow studies: Formulation of static power flow equations and solutions using Gauss-Seidel, Newton Raphson and FDLF methods, comparison of these methods, Economic operation of power system - Economic dispatch, Emission dispatch, line loss, ITL, economic dispatch using lagrangian multiplier method.

Unit-3

MW Frequency control: Coherency, control area, modeling of speed control mechanism, load damping, block diagrammatic representation of single and two area interconnected system, static and dynamic response, .optimum parameter adjustment.

Unit-4

MVAR Voltage control Problem: Difference in control strategy over MW-f control, characteristics of an excitation system, DC AC and static excitation system, General block diagram representation of voltage regulators.

Unit-5

Power System Stability: Steady state, dynamic and transients stability, Swing equation, equal area criterion, solution of swing equation using step by step method modified Euler's method and Rnge-Kutta method, methods of improving transient stability.

Reference Books:

1. Modern Power System Analysis-by I.J. Nagrath & D.P. Kothari Tata Mc Graw – Hill Publication Company Ltd 2nd edition.
2. A Chakravarti Power System Analysis: Operation and Control PHI Learning 3rd edition
3. Reactive power Control in Electric Systems-by T.J.E. Miller, John Wiley & Sons.
4. Electrical Power Systems-by C.L. Wadhwa New Age International (P) Limited Publishers, 2nd edition 1998.
5. Elgerd O.I., "Electric Energy Systems Theory", TMH, New Delhi, Second Edition 1983.
6. Prabha Kundur, "Power system stability and control", Mc-Graw Hill Inc, New York, 1993.
7. Taylor C.W., "Power System Voltage Stability", Mc-Graw Hill Inc, New York, 1993.

8. Nagrath IJ, Kothari D.P., "Power System Engineering", Tata Mc-Graw Hills, New Delhi 1994.
9. Weedy B.M. "Electric Power System" John Wiley and Sons, 3rd edition.
10. P.S.R. Murthy, "Power System Operation and Control", B S Publications
11. Power Generation, Operation and Control by A.J. wood and B.F. Wollenberg John Wiley & Sons Inc. 1984.
12. T.K. Nagsarkar, M.S. Sukhiza, -"Power System Analysis", Oxford University Press.
13. Economic Operation of Power Systems- by L.K. Kirchmayer Wiley Eastern Ltd.

List of Experiments:

1. To develop a program in Mat-Lab for information of Y-bus matrix for N bus system.
2. Load flow solution for 3-bus system using Gauss- Seidel, Newton Raphson and FDLF methods up to 3 iteration.
3. Load flow solution for IEEE 6-bus and 30-bus system in Mat-Lab using Newton Raphson method.
4. Assessment of transient stability of a single machine system.
5. Effect of compensation on voltage profile of IEEE 6-bus system.
6. Study of any software tools (PSCAD,EDSA, Mi POWER, ETAP etc)

EE602-CONTROL SYSTEMS

Unit-1

Modeling of dynamic systems: Electrical, Mechanical and hydraulic systems, Concept of transfer function, Simulation of differential equations in analog computer, State space description of dynamic systems: Open and closed loop systems, Signal flow graph, Mason's formula, Components of control systems: Error detectors (Synchros & Potentiometer), Servomotors (AC & DC), techo generators, power amplifier, steeper motors

Unit-2

Time – domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, Steady state error & error constants Feedback control actions: Proportional, derivative and integral control. Solution of state equation: Eigen values & eigenvectors digitalization state transitive matrix, stability Routh-Hurwit stability analysis.

Unit-3

Characteristics equation of closed loop system root loci, construction of loci, Effect of adding, poles and Zeros on the loci, Stability by root loci.

Unit-4

Frequency, Domain analysis, Bode plots, Effect of adding, poles and Zeros, Polar plot, Nyquist stability analysis, Relative stability: Gain and phase margins.

Unit-5

Frequency- Domain compensation: lead lag, Lag-lead compensation, Design of compensating networks

List of Experiments

1. Time response of second order system.
2. Characteristics of Synchronous.
3. Effect of feedback on servomotors.
4. Determination of transfer function of A-C servomotor
5. Determination of transfer functions of D-C motor.
6. Formulation of PI & PD controller and study of closed loop responses of 1st and 2nd Order dynamic systems.
7. State space model for classical transfer function using MATLAB.
8. Simulation of transfer function using operational amplifier.
9. Design problem: Compensating Networks of lead and lag.
10. Temperature controller using PID.

11 Transfer function of a DC generator.
12 Characteristics of AC servomotor.
13 Use of MATLAB for root loci and Bode plots of type-1, type-2 systems.
14. Study of analog computer and simulation of 1st order and 2nd order dynamic equations.
15. Formulation of proportional control on 1st order and 2nd order dynamic systems.
16 Feed back control of 3rd order dynamic Systems
17 Study of lead and lag compensating networks.
18. Effect of adding poles & zeros on root loci and bode plots of type-1, type-2 systems through MATLAB.

References:

I.J. Nagrath and M. Gopal, "Control system Engineering", New Age International.
K. Ogata, Modern Control Engineering, PHI.
B.C. Kuo, Automatic Control systems, PHI
Gopal M., Control System: Principles & Design, TMH.
N.K. Sinha, Control Systems, New Age International
Stefani, Shahian, Savant, Hostetter – "Design of feedback control System's", Oxford.

EE603-ELECTRICAL DRIVES

Unit -1

Control of D.C. motors by converters: Introduction to Thyristor Controlled Drives, single phase semi and fully controlled converters and three semi and fully controlled converters connected to d.c. separately excited and d.c. series motors-continuous current operation, Output voltage and current waveforms, Speed and Torque expression, Speed-Torque Characteristics, Problems on converter fed d.c. motors.

Unit -2

Four quadrant operation of D.C. Drives: Introduction to Four quadrant operation, Motoring operations, Electric braking, Plugging, dynamic and regenerative braking operations. Four quadrant operation of D.C. motor by Dual converters-Closed loop operation of DC motor (Block diagram only) Control of D.C. Motors by Choppers:-Single quadrant, Two-quadrant and four quadrant chopper fed d.c. separately excited and series excited motors, Continuous current operation, Output voltage and current waveforms-Speed torques expressions-Speed torque characteristics, Problems on Chopper fed d.c. motors, Closed loop operation (Block diagram only)

Unit-3

Control of Induction Motors on stator side: Control of Induction Motor by AC Voltage controllers- Waveforms, Speed torque characteristics, Variable frequency control of induction motor by Voltage Source, Current Source inverters and cyclo-converters, PWM control Comparison of VSI & CSI operations, Speed- torque Characteristics, Numerical problems on induction motor drives, Closed loop operation of induction motor drives. (Block diagram only)

Unit-4

Control of Induction Motors from rotor side: Static rotor resistance control, slip power recovery static Scherbius Drive, Static Kramer Drive, Their performance and speed torque characteristics advantages- application-problems.

Unit-5

Control of Synchronous Motors: Separate control & Self control of synchronous motors, Operation of self controlled synchronous motors by VSI, CSI and Cyclo-converters. Load commutated CSI fed Synchronous motor, Operation, Waveform, Speed torque Characteristics, Application, Advantage, Numerical problems, Closed loop operation Asynchronous motors drives. (Block diagram only)

References Books:

1. G.K. Dubey "Fundamentals of Electrical Drives"-. Narosa Publications.

2. Gopal K. Dubey "Power semiconductor Controlled Drives"- PHI.
3. S.B. Dewan, G.R. Slemon, A. Straughen "Power semiconductor Controlled drives.
4. B.K. Bose "Power Electronic control of AC Drives". PHI Learning.
5. Ned Mohan Electrical Drive Wiley India
6. V. Subramanyam "Thyristor control of Electric Drive" Tata Mc Graw Hill Pub.
7. N.K. De, P.K. Sen "Electric Drives" PHI.
8. S.K. Pillai, "A first course of Electrical Drive" New age International.
9. S.K. Pillai. "Analysis of Thyristor Power conditioned Motors" University Press (India) Ltd.
10. Longman P.V. Rao, "Power semiconductor Drives", BS Publications.
11. S.Shiva Nagaraju power semiconductor drives PHI learning.

EE604- SOFT COMPUTING TECHNIQUES

UNIT-1

Review of probability theory: Random variable, distribution functions, function of random variable. generation of random digit, and random variants from various distribution function, Monte Carlo simulation, sampling distributions station evolution using MCS, confidence interval, coefficient of variation.

UNIT-2

Evolution of ANN, Artificial neurons activation functions general network structure g - rule, and back propagation rule of training, RBF and FLN network.

UNIT-3

Drawback of classical optimization techniques, genetic algorithm; binary and real parameter GA, constraints handling in GA.

UNIT-4

Evolution strategies (ES), two members non-recombinative ES, multi member ES, recombinative ES. Optimization based on swarm intelligence particle, swarm optimization and its variants.

UNIT-5

Application of soft computing techniques to problem of electrical engg. E.g. economic dispatch, reliable optimization, ANN training using evolutionary algorithms.

References:

1. R.Y. Rubinstein Simulation and the Monte Carlo method, John Wiley & sons 1st Edition.
2. Paul. L. Mayer-Introducing probability and statical application,
Addition Wesley.
3. Rajasekaran and pai- Neural Network, Fuzzy logic & Genetic Algorithms. PHI Learing
4. LiMin. Fu, Neural Networks in Computer Intelligence, 9th Reprint TMH
5. Multi objective optimization using evolutionary algorithm- Kalyanmoy Deb John
Wiley Sons Ltd.
6. Probability and Random processes for Electrical Engineering, Alberto Leon
Garcia IInd Pearson.
7. Principles of soft computing- S N Shivanandan, S N Deepa Wiley India (P) Ltd, I
Edition 2007.
8. Hand book of genetic algorithm- Rajaserkharans, Vijay laxmi pai.
9. PSO Tutorial- Kennedy Ebuehart.
10. Sivanandam & Deepa- An Introduction to Neural Networks using Matlab 6.0 1st ed.,
TMH

EE605-ENERGY CONSERVATION AND MANAGEMENT

Unit-I

General energy problem: Energy use patterns and scope for conservation. Energy audit: Energy monitoring, Energy accounting and analysis, Auditing and targeting. Energy conservation policy, Energy management & audit, Energy audit, Types of energy audit, energy management (audit), qualities and function of energy managers, language of an energy manager, Questionnaire, Check list for top management, Loss of energy in material flow, energy performance, Maximizing system efficiency, Optimizing, input energy requirements, Energy auditing instruments, Material load energy balance diagram.

Unit-II

Thermodynamics of Energy Conservation. Basic principle. Irreversibility and second law efficiency analysis of systems. Primary energy sources, optimum use of prime-movers, energy efficient housekeeping, energy recovery in thermal systems, waste heat recovery techniques, thermal insulation. Thermal energy audit in heating, ventilation and air conditioning. Maintenance and Energy audit – friction, lubrication and tribo-logical innovations. Predictive and preventive maintenance.

Unit-III

Load curve analysis & load management DSM, Energy storage for power systems (Mechanical, Thermal, Electrical & Magnetic) Restructuring of electric tariff from energy conservation consideration, Economic analysis depreciation method, time value of money, Evaluation method of projects, replacement analysis, special problems inflation risk analysis. Payback period, Energy economics, Cost Benefit Risk analysis, Payback period.

Unit-IV

Energy efficient electric drives, Energy efficient motors V.S.D. power factor improvement in power system. Energy Conservation in transportation system especially in electric vehicle. Energy flow networks, Simulation & modeling, formulation & Objective & constraints, alternative option, Matrix chart.

Unit-V

Energy conservation task before industry, Energy conservation equipments, Co-Generation, Energy conservation process, Industry Sugar, Textiles, Cement Industry etc Electrical Energy Conservation in building, heating and lighting. Domestic gadgets

References:

1.Energy Management – W.R. Murphy & G. Mckey Butler worths.
2. Energy Management Head Book- W.C. Turner, John Wiley
3. Energy Management Principles- Craig B. Smith, Pergamon Press
4. Energy Conservation- Paul O Callaghan- Pergamon Press
5. Design & Management of energy conservation. Callaghan,
6. Elect, Energy Utilization & Conservation. Dr. Tripathi S.C.,

EE701 -ELECTRICAL MACHINE DESIGN

Unit-1

Introduction: Design problem-Mathematical programming methods, computer aided design-Mathematical formulation of the problem. Programming techniques (LP & NLP only), Methods of solution, Unconstrained optimization problems, constrained optimization problems.

Unit-2

Optimal design of DC machine: Design of armature, Windings and field systems, Selection of variables for optimal design, Formulation of design equations, Objective function, Constraint functions, Algorithms for optimal design.

Unit-3

Optimal design of power transformer: Design of magnetic circuit, Design of windings, Selection of variables for optimal design, Formulation of design equations, Objective function, Constraint functions, Algorithms for optimal design.

Unit-4

Optimal design for 3-phase alternator: Design of stator, windings, Design of Field systems for salient pole and non-salient pole machines, Selection of variables for optimal design.

Unit-5

Optimal design of 3-phase induction motor: Design of stator, Windings Design of squirrel cage rotor, Design of slip ring rotor, Selection of variables for optimal design, Formulation of design equations, Objective functions Constraint functions, Algorithms for optimal design.

References Books:

1. Design and Testing of Electrical Machines, MV Deshpandey PHI Learning
2. Computer- Aided Design of Electrical Equipment- by Dr. M. Ramamurthy-Affiliated East-West press Pvt. Ltd. New Delhi.
3. Electrical Machine Design- by A.K. Sawhney, Dhanpat Rai & Sons.
4. Principles of Electrical Machine Design with Computer Programmes by- S.K. Sen, Oxford & IBH Publishing Co.
5. Performance and Design of A.C. Machines-M.G. Say, Affiliated East West Press Pvt. Ltd., New Delhi.

EE702 -ADVANCE ELECTRICAL MACHINES

Unit-1

Induction Machine-characteristics, starting, Operation of induction motor on unbalanced supplies, Production of time and space harmonics. Their effect, harmonic torques, motor rating, speed control of 3 phase induction motors. Double cage and deep bar rotor motor.

Unit -2

Constructional features, operating principle, characteristics and application of special induction machine:

(i) Induction voltage regulator
(ii) Induction Generator
(iii) Synchronous induction motor
(iv) Linear induction motor
(v) Eddy current slip coupling

Testing of electrical machines, statutory testing procedures.

Unit-3

Single phase induction motor, construction, operation and methods of starting Double revolving field theory, Equivalent circuit. Performance evaluation and study of relevant BIS. Principle of working of stepper motors, various and construction techniques, control of stepper motor, static and dynamic characteristics.

Unit-4

Control of induction motor by emf injection in rotor circuit. Constructional features, operation characteristics and control of Schrage motor, Constructional features, analysis and operation of AC series motor, application of AC serious motor.

Unit-5

Construction and principle of switched reluctance motor and MBL d.c motor, Reluctance motor, Hysteresis motor, modeling of stepper motor, SRM, PMBL motor, AC series motor.

References Books:

1. Gernelized Theory of Machines- P S Bimbhra
2. Electric Machines- Dr.P.C Sen

EE7101 -EHV A.C. AND D.C. TRANSMISSION

Unit-1

Constitution of EHV a.c. and d.c. links, Kind of d.c. links, Limitations and Advantages of a.c. and d.c. transmission, Principal application of a.c. and d.c. transmission, Trends in EHV a.c. and d.c. transmission, Power handling capacity. Converter analysis garetz circuit, firing angle control, overlapping.

Unit-2

FACTS devices, basic types of controller, series controller, static synchronous series compensator (SSSC), thyristor-controlled series capacitor (TCSC), thyristor controlled series reactor (TCSR), shunt controller (STATCOM), static VAR compensator (SVC), series-series controller, combined series-shunt controller, unified power flow controller (UPFC), thyristor controlled phase shifting transformer (TCPST).

Unit-3

Components of EHV D.C. system, converter circuits, rectifier and inverter valves, Reactive power requirements, harmonics generation, adverse effects, Classification, Remedial measures to suppress, filters, Ground return. Converter faults & protection harmonics misoperation, Commutation failure, Multiterminal D.C. lines.

Unit-4

Control of EHV D.C. system desired features of control, control characteristics, Constant current control, and Constant extinction angle control. Ignition Angle control. Parallel operation of HVAC & DC system. Problems & advantages.

Unit-5

Travelling waves on transmission systems, their shape, Attenuation and distortion, effect of junction and termination on propagation of traveling waves. Over voltages in transmission system. Lightning, switching and temporary over voltages: Control of lighting and switching over voltages

Reference:

1. S. Rao,- “EHV AC & DC Transmission” Khanna pub.
2. Kimbark,-” HVDC Transmission” john willy & sons pub.
3. Arrillaga,- “HVDC Transmission”2nd Edition ,IEE londan pub.
4. Padiyar, -“HVDC Transmission” 1st Edition, New age international pub.
5. T.K. Nagsarkar, M.S. Sukhiza, -“Power System Analysis”, Oxford University
6. Narain.G. Hingorani, l. Gyugyi-”Undustanding of FACTS concept and technology”, John

EE7102 -DIGITAL ELECTRONICS & LOGIC DESIGN-II

Unit-1

Specification of sequential systems:
Characteristics equation & definition of synchronous sequential machines. Realization of Floatable from verbal description, Mealy and Moore model machines state table and transition diagram. Minimization of the flow table of completely and incompletely specifies sequential machines

Unit-2

High level description and specification of standard combinational & sequential modules and introduction to VHDL Programming. Concept of iterative arrays.

Unit-3

Secondary state assignments in sequential machine; parallel & serial decomposition of sequential machines. Introduction to asynchronous sequential machine, races and hazards. Information loss-less machine.

Unit-4

Algorithmic state machine and fundamental concept of hardware / firmware algorithms. Controllers and data system designing.

Unit-5

Concept of PROM, PLE and FPLA. PALASM / XYLINGS software applications. Other PLD devices like EPLA, GAL, PHEEL, Mega PAL and Hard Array Logic.

Books:
1. Z. Kohavi “Switching & Finite Automata Theory” TMH.
2. S. C. See “Digital Circuits and Logic Design” PHI,
3. M.K. Ercegovac & T. Lang, “Digital Systems and Hardware/Firmware Algorithms” John Wiley.
4. Stefan Sjoholm & Lennart Lind “VHDL for Designers” Prentice-Hall.
5. P.J. Ashenden “The Designers Guide to VHDL” Harcourt Asia PTE Ltd. M. Ercegovac et.al “ Introduction to Digital Systems”
6. M. Mano “Digital Design” John Wiley & Sons, PHI.
7. P.K. Lala “Digital System Design using Programmable logic Devices” BS Publication
8. K.L.Short “Microprocessors and Programmed Logic” PHI.

EE7103 -FLEXIBLE AC TRANSMISSION SYSTEM

Unit-1

Basic Issues Involved in Bulk Power Transmission, Review of basics of power transmission networks-control of power flow in AC transmission line- Analysis of uncompensated AC Transmission line- Passive reactive power compensation, Principle of Transmission system compensation, Need for FACTS controllers- types of FACTS controllers and Benefits

Unit-2 - STATIC VAR COMPENSATOR (SVC) and Purpose

Voltage control by SVC – Advantages of slope in dynamic characteristics- Influence of SVC on system voltage, Design of SVC voltage regulator, Modeling of SVC for power flow and stability studies, Applications- Enhancement of transient stability, Steady state power transfer, Enhancement of Power system damping, Prevention of voltage instability

Unit-3 - THYRISTOR AND GTO THYRISTOR CONTROLLED SERIES CAPACITORS (TCSC and GCSC)

Concepts of Controlled Series Compensation –Analysis of TCSC-GCSC , Different modes of operation, Modeling of TCSC and GCSC for load flow studies- modeling TCSC and GCSC for stability studies- Applications of TCSC and GCSC, SSR mitigation.

Unit-4 - VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS

Static synchronous compensator(STATCOM)- Static synchronous series compensator(SSSC)-Operation of STATCOM and SSSC-Power flow control with STATCOM and SSSC- Modeling of STATCOM and SSSC for power flow studies –operation of Unified and Interline power flow controllers(UPFC and IPFC).

Unit-5 - CONTROLLERS AND THEIR CO-ORDINATION

FACTS Controller interactions – SVC–SVC interaction - co-ordination of multiple controllers using linear control techniques – Quantitative treatment of control coordination.

References-

1. Mohan Mathur, R., Rajiv. K. Varma, Thyristor – Based FACTS Controllers for Electrical Transmission Systems, IEEE press and John Wiley & Sons, Inc, 2002.
2. K.R.Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International (P) Ltd., Publishers, New Delhi, Reprint, 2008.

EE7201- COMPUTER APPLICATION TO POWER SYSTEMS

Unit-1

Models of power system components, network model using graph theory, formation of Z bus, transmission line models, regulating transformer, line load ability, capability curves of alternator.

Unit-2

Control of load bus voltage using reactive power control variable, SVC & SVS, Regulated shunt Compensation, series and shunt compensation, Uniform series and shunt compensation and effect on load ability of transmission lines.

Unit-3

Sensitivity analysis- General sensitivity relations, generation shift distribution factors, line outage distribution factors, compensated shift factors, sensitivity associated with voltage-VAR, sensitivities relating load bus voltage changes in terms of PV bus voltage changes, sensitivity relating changes in reactive power generation for changes in PV Bus Voltage.

Unit-4

Power system security - Security functions, Security level, contingency analysis, security control, economic dispatch using LP formulation, pre-contingency and post- contingency, corrective rescheduling.

Unit-5

Voltage stability - Difference between voltage and angle stability, PV Curve for voltage stability Assessment, proximity and mechanism, modal analysis using reduced Jacobian, participation factor, effect of series and shunt compensation on voltage stability , effect of load models.

References:

1. Computer Modeling of Electrical Power Systems, Arrillaga J. Watson N R Wiley India
2. A Chakrawarti Power System Analysis: Operation and Control PHI Learning 3rd edition
3. Power Generation, Operation and Control by A.J. wood and B.F. Wollenberg John Wiley & Sons Inc. 1984.
4. Computer Techniques in Power Systems Analysis- Pai M.A. Tata Mc Graw Hill.
5. Computer Aided Power Systems Analysis Kusic G.L. 2nd Edition, CRC Press
6. Modern Power Systems Analysis Nagrath I.J. and Kothari D.P. Tata Mc Graw Hill.
7. Power System Analysis Grainger J.J. & Stevnson W.D. Mc Graw Hill.
8. Power System Stability and control -P Kundur, IEEE Press 1994.
9. Advance Power Systems Analysis and Dynamics Singh L.P. John Wiley.

EE7202 – ADVANCED ELECTRICAL DRIVES

Unit-1

Review of electric motors & Solid state converters: Speed control techniques of DC, Induction & synchronous motor, Converters, inverters, chopper and cyclo converter operation, Effects of power electronic equipments on load side & supply side.

Unit-2

Review of closed loop controllers, sensors & transducers: PI, PID, Variable structure. AC, DC & Pulse tacho- generators

Unit-3

DC Drives: Converter & chopper fed DC drive, Reversing, Starting, Regenerative breaking, Four quadrant operation, High power application.

Unit-4

AC Drive: Inverter & cyclo converter fed drive, Vector control, Sensor less operation, Linear Electrical motor concept, Synchronous motor Drive

Unit-5

Special Drives: Switched reluctance & permanent magnet brushless DC Operation, Converters, Characteristics &Control, PLC based drives.

REFERENCE

1 Ned Mohan, T.M. Undeland, W.P. Robbins, Power Electronics-Converters, Applications and design", John Wiley
& Sons.
2 .J.M.D. Murphy, F.O. Turnbull, "Power Electronic Control of AC motors", Pergamon Press.
3. P.C. Sen, D.C. drive, Pergamon Press
4. B.K. Bose, Power Electronics & AC drive prentice Hall.
5. Dubey G.K. "Power semi Conductor controller drives, Prentice Hall.
6. Vedam Subramanyam, "Electrical Drives".
7. T.J.E. Miller, Switched Reluctance & P.M. B.L. DC motor, Pergamon Press
8. P.V. Rao, "Power semiconductor Drives", BS Publications.

EE7203 -ADVANCED CONTROL SYSTEM

Unit-1

Review of Linear Control System: Modeling through differential equations and difference equations, State space method of description and its solution, Discretization of continuous-time state space model, Laplace and z-domain analyses of control systems, Controllability, Observability & Stability, Bode & Nyquist analysis, Root Loci, Effect of load disturbance upon control actions.

Unit-2

Development of feedback control laws through state space technique, Modal control, Pole Placement problem.

Unit-3

Variable Structure Control and its applications. Examples on variable structure control.

Unit-4

Control of nonlinear dynamics: Lyapunov based control function, Phase plane technique, Lyapunov Stability analysis.

Unit-5

Optimal Control: Calculus of variation, Euler-Lagrange equations, Boundary conditions, Transversality condition, Bolza problem, Pontyagin's maximum principle.

Reference:

1. Automatic Control System – B.C. Kuo, PHI, New York, 1975.
2. Modern Control Engineering: K. Ogata, PHI. New Delhi, 1992.
3. Digital Control Systems – B. C. Kuo, Oxford Pub.
4. Discrete-Time Control Systems – K. Ogata. PHI. New Delhi
5. Advanced Control Systems N Sarkar PHI Learning
6. Control System Engineering S NISE Wiley India

EE7301- HIGH VOLTAGE ENGINEERING

Unit-1

Introduction:-
Introduction to HV technology, advantages of transmitting electrical power at high voltages, need for generating high voltages in laboratory. Important applications of high voltage.

Unit-2

Breakdown phenomena:-
Classification of HV insulating media, Properties of important HV insulating media. Gaseous dielectrics: Ionizations: primary and secondary ionization processes. Criteria for gaseous insulation breakdown based on Townsend's theory, Limitations of Townsend's theory. Streamer's theory breakdown in non uniform fields. Corona discharges. Paschen's law and its significance. Time lags of Breakdown. Breakdown in solid dielectrics: Intrinsic Breakdown, avalanche breakdown, thermal breakdown, and electro mechanic breakdown. Breakdown of liquids dielectric dielectrics: Suspended particle theory, electronic Breakdown, cavity breakdown (bubble's theory), electro convection breakdown.

Unit-3

Generation of HV AC DC and Impulse Voltage and current:-
HV AC-HV transformer; Need for cascade connection and working of transformers units connected in cascade, Series resonant circuit- principle of operation and advantages. Tesla coil. HV DC- voltage doubler circuit, cock croft- Walton type high voltage DC set, Introduction to standard lightning and switching impulse voltages. Analysis of single stage impulse generator-expression for Output impulse voltage, multistage impulse generator Components of multistage impulse generator. Triggering of impulse generator by three electrode gap arrangement. Triggering gap and oscillograph time sweep circuits. Generation of switching impulse voltage. Generation of high impulse Current.

Unit-4

Measurement of high voltages:-
Electrostatic voltmeter-principle, construction and limitation. Generating voltmeter- Principle, construction. Series resistance micro ammeter for HV DC measurements. Standard sphere gap measurements of HV AC, HV DC, and impulse voltages; Factors affecting the measurements. Potential dividers-resistance dividers capacitance dividers mixed RC potential dividers. Surge current measurement.

Unit-5

High voltage tests on electrical apparatus:-

Definitions of technologies, tests on isolators, circuit breakers, cables insulators and transformers.

Reference books:

1. E. Kuffel and W.S. Zaengl, "High voltage engineering fundamentals", 2nd edition, Elsevier, Press, 2005.
2. M.S.Naidu and Kamaraju, "High Voltage Engineering", 3rd edition, THM, 2007.
3. L. L. Alston, "High Voltage technology", BSB Publication, 2007..
4. Rakosh Das Begamudre, Extra High voltage AC transmission engineering, Wiley Eastern limited, 1987.
5. Transmission and distribution reference book-Westing House.C.L.Wadhwa, High voltage Engineering, New Age International Private limited, 1995.

EE7302 - ADVANCE POWER ELECTRONICS

Unit- 1

Introduction to various power electronics supplies. Performance parameters for power electronics supplies and their measurement. Device selection, Control circuits. Switch mode power supplies, Square wave switching, resonant mode operation of Power supplies, Ferro resonant, Linear and the switchers.

Unit- 2

DC to DC Converters: Analysis and design of buck, boost, buck-boost and cuk converters, two quadrant and full bridge converters. Isolated converters i.e., fly back, forward and bridge topology. Design of D.C. inductor. Concept of integrated magnetic, converter control, averaged model, state-space model.

Unit- 3

DC to Controlled AC: Controlled inversion, three phase full bridge inverters. 180 mode and 120 mode operation, harmonic analysis, PWM control of VSI, current mode control of PWM VSI, space vector modulation, three phase current sourced PWM CSI,

Unit- 4

AC Choppers: Modeling and analysis of AC choppers, harmonics control using symmetrical and Asymmetrical waveform pattern,

Unit- 5

Soft switching DC to DC converters, zero current switching topologies, zero voltage switching topologies, generalized switching cell, ZCT and ZVT DC converters,

Text Books:

1. “Power Electronics Circuits”, Issa Batarseh, John Wiley & Sons Inc., 2004.
2. “Power Electronics: ”, L.Umanad, Wiley India.
3. “Power Electronics: Converters, Applications, and Design”, Ned Mohan, John Wiley & Sons Inc.,2001.
4. “Power Electronics: Devices and Circuits”, Jagannathan, PHI Learning 2012

Reference Books:

1. “Power Electronic Systems Theory and Design”, Jai P Agrawal, Pearson Education Asia, 2001.
2. “Switching Power Supply Design”, A I Pressman, McGraw Hill Publication, 1991.
3. “Handbook of Power Electronics”, M H Rashid

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EE7303 -SCADA SYSTEM & APPLICATIONS

Unit-1

Introduction to SCADA and PLC:SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions. PLC: Block diagram, programming languages, Ladder diagram, Functional Block diagram, Applications, Interfacing of PLC with SCADA.

Unit -2

SCADA system components: Schemes, Remote Terminal Unit, Intelligent Electronic Devices, Communication Network, SCADA server.

Unit-3

SCADA Architecture-Various SCADA Architectures, advantages and disadvantages of each system, single unified standard architecture IEC 61850 SCADA / HMI Systems.

Unit-4

SCADA Communication-Various industrial communication technologies- wired and wireless methods and fiber optics, open standard communication protocols.

Unit-5

Operation and control of interconnected power system-Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, and state estimation.

Unit-6

SCADA applications Utility applications, transmission and distribution sector operation, monitoring analysis and improvement. Industries oil gas and water. Case studies, implementation, simulation exercises.

Reference Books:

1. Stuart A Boyer: SCADA supervisory control and data acquisition.
2. Gordan Clark, Deem Reynders, Practical Modem SCADA Protocols.
3. Sunil S. Rao, Switchgear and Protections, Khanna Publication.

EE801 -MAJOR PROJECT-II

COURSE GUIDELINES

The objectives of the course 'Major Project' are to provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses. To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems. To give students an opportunity to do something creative and to assimilate real life work situation in institution. To adapt students for latest developments and to handle independently new situations. To develop good expressions power and presentation abilities in students. The focus of the Major Project is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write-up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis, market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration. The faculty and student should work according to following schedule: i) Each student undertakes substantial project in an approved area of the subject and supervised by a member of staff. ii) The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty. iii) At all the steps of the project, students must submit a written report of the same.