R.K.D.F. UNIVERSITY, BHOPAL

B.E. (Electrical & Electronics Engineering)

SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
B.E. Common	**Engineering Mathematics-II**	**B.E.- 301**

Unit I

Second Order linear differential equation with variable coefficients: Methods one integral is known, removal of first derivative, changing of independent variable and variation of parameter, Solution by Series Method

Unit II

Vector Calculus: Differentiation of vectors, scalar and vector point function, geometrical meaning of Gradient, unit normal vector and directional derivative, physical interpretation of divergence and Curl. Line integral, surface integral and volume integral, Green's, Stoke's and Gauss divergence theorem

Unit III

Linear and Non Linear partial differential equation of first order: Formulation of partial differential equations, solution of equation by direct integration, Lagrange's Linear equation, charpit's method. Linear partial differential equation of second and higher order: Linear homogeneous and Non homogeneous partial diff. equation of nth order with constant coefficients. Separation of variable method for the solution of wave and heat equations

Unit IV

Fourier series: Introduction of Fourier series, Fourier series for Discontinuous functions, and Fourier series for even and odd function, Half range series Fourier Transform: Definition and properties of Fourier transform, Sine and Cosine transform.

Unit V

Laplace Transform: Introduction of Laplace Transform, Laplace Transform of elementary functions, properties of Laplace Transform, Change of scale property, second shifting property, Laplace transform of the derivative, Inverse Laplace transform & its properties, Convolution theorem, Applications of L.T. to solve the ordinary differential equations

References

(i) Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India
(ii) Higher Engineering Mathematics by BS Grewal, Khanna Publication
(iii) Advance Engineering Mathematics by D.G.Guffy
(iv) Mathematics for Engineers by S.Arumungam, SCITECH Publuication
(v) Engineering Mathematics by S S Sastri. P.H.I.

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B.E. (Electrical & Electronics Engineering)

SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Circuit Theory	EX- 302

UNIT I

Introduction to LLBP circuit elements R,L,C and their characteristics in terms of Linearity & time dependent nature, KCL and KVL analysis dual networks analysis of magnetically coupled circuits Dot convention, coupling co-efficient, Tuned circuits. Series & parallel resonance voltage & current sources, controlled sources.

UNIT II

Network topology, concept of Network graph, Tree, Tree branch & link, Incidence matrix, cut set and tie set matrices. Network Theorems – Thevenins & Norton's theorem, superposition, reciprocity, compensation, maximum power transfer and Millman's theorem, problems with controlled sources.

UNIT III

Transient analysis Transients in RL, RC & RLC Circuits initial conditions, time constants. Network driven by constant driving sources & their solutions. Steady state analysis - Concept of phasor & vector, impedance & admittance. Node & mesh analysis of RL,RC and RLC networks with sinusoidal and other driving sources.

UNIT IV

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. Concept of signal spectra, Fourier series co-efficient of a periodic waveform. Waveform symmetries. Trigonometric and Exponential form of Fourier series, steady state response to periodic signals.

UNIT V

Network function & Two port networks – concept of complex frequency, port. Network functions of one port & two ports, poles and zeros network of different kinds. Two port parameters – Z,Y, chain parameters relationship between parameters. Interconnection of two ports. Terminated two port network.

References:

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 (Expandable):

1. To Verify Thevenin Theorem.
2. To Verify Superposition Theorem.
3. To Verify Reciprocity Theorem.
4. To Verify Maximum Power Transfer Theorem.
5. To Verify Millman's Theorem.

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SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Instrumentation & Measurment	EX- 303

UNIT I

MEASUREMENT OF R,L,C

Functional elements of an instrument – static and dynamic characteristics – Errors in measurement. Measurement of R, L, C – Wheatstone, Kelvin's double, Maxwell, Anderson and Schering bridges. Measurement of high resistance – Megger – loss of charge method.

UNIT II

MEASURING INSTRUMENTS

Principle of operation and construction of PMMC, MI, Dynamometer, Induction, Thermal and Rectifier type instruments – Measurement of voltage and current – use of ammeter shunts and voltmeter multiplier – Use of CT and PT for extending instrument ranges.

UNIT III

MEASUREMENT OF POWER AND ENERGY

Dynamometer type wattmeter – induction type energymeter- 1 phase & 3 phase – errors and compensation – energymeter calibration by direct and phantom loading – Maximum demand indicator – Measurement of reactive power – Trivector meter.

UNIT IV

MEASUREMENT OF FREQUENCY,POWER FACTOR AND PHASE SEQUENCE

Frequency meters – Powerfactor meter - 1 phase & 3 phase – Synchroscope – Phase sequence indicator. Magnetic tape recorders – Stripchart recorder – X-Y recorder – Cathode Ray Oscilloscope – block diagram – CRT – Dual Trace oscilloscope.

UNIT V

ELECTRONIC INSTRUMENTS

Electronic voltmeters – Digital voltmeter – Multimeter – Signal generator – Function generator. Classification of transducers – resistive, capacitive and inductive – piezoelectric transducer – strain gauges – LVDT – thermoelectric – piezoelectric. Transducers for measurement of displacement – temperature – pressure – velocity.

TEXT BOOKS

1. Golding, EW. & Widdies, FW. *Measurements & Measuring instruments*, Sir Issar Pitman & sons (P)Ltd. 1998.
2. A.K. Sawhney; Electrical & Electronic Measurements & Instrument; Dhanpat Rai & Sons Pub.
3. Albert D Half ride & William D Cooper, *Modern Electronic instrumentation and measurement techniques*, Prentice Hall of India Pvt Ltd. 1998.

LIST OF EXPERIMENTS (EXPANDABLE):

1. Measurement of low resistance using Kelvin's Double bridge
2. Measurement of medium resistance using Wheatstone'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 method
7. Calibration of a dynamometer type of wattmeter with respect to a standard/Sub Standard wattmeter
8. Calibration of a induction type single phase energy meter
9. Calibration of a dynamometer type of wattmeter by Phantom Loading method.

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SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Electromagnetic Theory	EX- 304

UNIT I

STATIC ELECTRIC FIELDS

Cartesian, cylindrical & spherical co-ordinate systems, scalar & vector fields, gradient, divergence & curl of a vector field, Divergence theorem & Stokes's theorem, concept of vectors. Coulomb's law – Electric field intensity – Field due to different types of charges – Stream lines and sketches of fields – Electric flux density – Gauss law and its application to symmetrical charge distributions – Gauss law applied to differential volume element – Concept of divergence – electric potential – Potential field due to different types of charges – Potential gradient – the dipole – field due to dipole – Energy density in electrostatic field.

UNIT II

CONDUCTORS, DIELECTRICS AND CAPACITANCE

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 III

STEADY MAGNETIC FIELDS

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 IV

MAXWELLS EQUATIONS AND SCALAR, VECTOR PROPERTIES

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. 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,

UNIT V

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.

References:

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.

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SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Value Education	EX- 305

Chapter 1

Value Education

Concepts of Values-Definition and Types of values –The need for Education in values-Challenges for Value adoption-Character development-Vision of a better world

Chapter 2

Inculcation of values

Classification of values- Personal Values-Family Values-Social Values-Spiritual values-Benefits of value adoption

Chapter3

Values for Professional excellence

Definition-Purpose-implementation-situations to adopt-reflection questions-quotable quotes of Active listening-Decision making-Determination-Perseverance-Discipline-Responsibility

Chapter 4

Business ethics

Ethics and Entrepreneurship- Professional Ethics –Ethical choices- Resolving Ethical Dilemmas-Leadership and Social Responsibility- Corporate Social Responsibility

Chapter 5

Quality of Life

Dealing with change-Trends, Organizations and the Individual-Self and the world-Quality from within-Relating to others-The dynamics of personal powers

Chapter 6

Exploring the self

True Identity-Anatomy of the self-The cyclic processes within the self-States of the awareness-Innate and Acquired qualities-Empowering the self

Chapter 7

Understanding Self-Esteem
Know self-esteem-Understanding the self-Components of self-esteem-**Association with self-esteem-Levels of self-esteem-Reflection exercises**

Chapter 8

Principles of living
Be introspective-Be an observer-Being optimistic-Appreciate differences-Don't compare yourself with others-Live at present

Chapter 9

Practical Meditation
Why meditate?-Soul consciousness-The supreme-Karma-Timeless dimension-The eight powers

Chapter 10

Exercises for Practice
Quiet reflection- Practice introversion-Being an observer-Stand back and observe -Self awareness (Soul consciousness)-Experiencing Body free stage-Reflect on original qualities-Visualize the Divine-Think attributes of the Supreme-Developing a living relationship-Surrender to God-Create Good wishes for all-Visualization in Meditation: Orbs of Light- The forest-The Balloon

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Every chapter will have 1.Objectives 2.Introduction 9. Summary 10. Glossary and 11. Suggested Reading apart from the CONTENT as referred above

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SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Self Study (Internal Assessment)	EX- 307

Objective of Self Study: is to induce the student to explore and read technical aspects of his area of interest / hobby or new topics suggested by faculty.

Evaluation will be done by assigned faculty based on report/seminar presentation and viva.

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SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Seminar / Group Discussion(Internal Assessment)	EX- 308

Objective of GD and seminar is to improve the MASS COMMUNICATION and CONVINCING/ Understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves.

Evaluation will be done by assigned faculty based on group discussion and power point Presentation.

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SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
B.E. Common	**Engineering Mathematics-III**	**B.E.- 401**

Unit I

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

Unit II

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

Unit III

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 IV

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 V

Concept of Probability: Probability: Binomial, Poisson's, Continuous Distribution: Normal 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 Engg. Computation by MKJain, 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) Pobability and Statistics by Ravichandran ,Wiley India
(vi) Mathematical Statistics by George R., Springer

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SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Power System-I	EX - 402

UNIT-I

Electrical Design of Lines:
Layout of different transmission and distribution systems, advantages of high voltage transmission, concept of short, medium and long lines, parameters of lines, performance of short lines (Regulation, efficiency, vector diagrams) corona formation and its effects on performance of lines.

UNIT-II

Transmission Systems:
Various system of transmission & their comparison, HVDC transmission Converter, inverter, filters & substation layout. Voltage and Reactive Power control. Types of supports, types of conductors, types of insulators, their properties, selection and testing, voltage distribution of string insulators, equalization of potential. Vibration dampers Various system of transmission & their comparison, HVDC transmission Converter, inverter, filters & substation layout. Voltage and Reactive Power control.

UNIT-III

Distribution System Distribution Systems: Primary and secondary distribution systems, concentrated & uniformly distributed loads on distributors fed at one and both ends, ring distribution, sub mains and tapered mains, voltage drop and power loss calculations, voltage regulators, Feeders Kelvin's law and modified Kelvin's law for feeder conductor size and its limitations.
Construction of Distribution Lines: Erection of pole, fixing of insulators on conductors, testing, operation and maintenance of lines.

UNIT IV

Overhead Transmission Lines: Types of Conductors, Line Parameters: calculation of inductance and capacitance of single and double circuit transmission lines, three phase lines with stranded and bundle conductors, Generalized ABCD constants and equivalent circuits of short, medium & long lines. Line Performance: circle diagram, regulation and efficiency of short, medium and long lines, Series and shunt compensation, FACTS.

UNIT V

Underground Cables Classification, Construction and characteristic of different types. Insulation resistance and capacitance, grading (capacitance and inter sheath), laying, jointing and splicing of cables. phenomenon of dielectric losses, dielectric stress and sheath loss in cables.

Carrier Communication: Prinicple of carrier communication over Power Lines, purposes, equipment, differences between radio transmission and carrier communication, block diagram.

References:

1. Nagrath IJ and Kothari DP; “Power System Engineering”, Tata McGraw Hill
2. John S. Grainger and W. D. Stevenson Jr.,” Power System Analysis”, McGraw Hill.
3. Deshpande MV; “Electric Power System Design”, TMH.
4. Central Electricity Generating Board; “Modem Power System Practice”, Vol 1-8, Pergamon Oxfd
5. James J. Burke,” Power Distribution Engineering: Fundamentals & Applications”; Marcel Dekker
6. Westinghouse Electric Corp; Electric Transmission & Distribution Reference Book; East Pittsbrg
7. Wadhwa CL; ” Electric Power Systems”; Wiley Eastern Limited.
8. Ashfaq Hussain; ”Electrical Power System
9. Gupta BR; ”Power System Analysis and Design”
10. Ray “ Electrical Power System:Concepts, Theory and practice”, PHI

List of Experiment Subject- Power System I

1. To study the Thermal Power Station.
2. To study the Hydro Power Station.
3. To study the Nuclear Power Station.
4. To study & draw Towers used in Transmission lines.
5. To study & draw the different types of insulator.
6. To study & design Electrical Power Transmission line.
7. Determination of Transmission Parameters of a transmission line.

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SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Electronics Devices & Circuits -I	EX - 403

UNIT I

Semiconductor Diode & Rectifiers:
Semiconductor diodes, ideal & practical diode equivalent circuit & frequency response, graphical analysis of diode circuits, diode applications, clipping and clamping circuits, half wave & full wave rectifier circuits with & without filters. Type of diodes and their applications, Signal diodes, Power Diode, Zener diode, Varactor diode, Schottky diode, PIN diode, Tunnel diode, Photo diode. Direct tunneling equivalent circuit, Tunnel diode oscillator; Solar Cell, LED, LEDs specification & geometry of LEDs, Colors' of LEDs, LCD, Diffusion and Transition capacitance of P-N junction diode, Simple zener regulators.

UNIT II

Transistor Characteristics:
Construction, principle of operation, V-I characteristics, Symbols, equivalent circuit, parameter calculations, applications, limitations and specifications of BJT, FET,UJT and MOSFET'S (Different configurations of transistors are to be considered), Specifications of BJT, FET, UJT and MOSFET's.

UNIT III

Amplifiers: Biasing, DC Equivalent Model, criteria for fixing operating point and methods of
bias stabilization, thermal runaway and thermal stability, small signal low- frequency transistor Amplifier – circuits; h-parameters, representation of transistor, analysis of single stage transistor Amplifier using h-parameters, voltage gain current gain, input impedance output impedance, Comparison of BJT & FET. RC coupled amplifier – frequency response, cascaded amplifiers (all
Configurations of BJT and FET are to be considered). High frequency model of transistor and , Cut-off frequencies of a transistor, single stage and multi stage amplifiers, Calculation of bandwidth of single and multistage amplifiers, concept of gain bandwidth product. Specifications of amplifiers, effect of cascading on bandwidth, Darlington amplifier, boot strapping, stability and thermal consideration, Noise in BJT.

UNIT IV

Feedback Amplifiers and Oscillators:
Concept of feedback, negative & positive feedback gain & sensitivity, Bandwidth, classification of feedback amplifiers, general characteristics of negative feedback amplifier, effect of feedback on amplifiers characteristics, condition for oscillation,RC and LC type of oscillators, Crystal oscillators, frequency and amplitude stability of oscillations, Generalized analysis of LC oscillators, quartz, Hartley Clopitts, R-C Phase shift and Wein Bridge oscillators, UJT oscillator.

UNIT V

Power Amplifiers and Tuned Amplifiers & Regulator: Classification of power amplifiers,
Class A,B,AB and C power amplifiers, Push pull & complementary push pull amplifiers. Design of heat sinks, Power output, efficiency, cross – over distortion and harmonic distortion, Derating curve. Specifications of power amplifiers, single tunned and double tunned voltage amplifiers. Interstagedesign, Stability consideration, Class B and Class C tuned power amplifiers and specifications.

References:

1. Nashelsky & Boysted; Electronic Devices and Circuits; PHI
2. Millman Halkias; Electronic Devices and Circuits; McGraw- Hill
3. Millman & Grabel; Micro Electronics; McGraw-Hill
4. Salivahanan; Electronic Devices and Circuits; TMH
5. Cathey; Electronic devices and circuits (Shaum); TMH

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. Use of UJT as relaxation Oscillator.
6. Design & Analysis of JFET Amplifier.
7. Design & Analysis of MOSFET Amplifier.
8. To study and construct power amplifiers of various classes.
9. Study of various oscillators.

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SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Electrical Enginnering Drawing	EX - 404

UNIT-I

Introduction to general purpose graphics software, AutoCAD, plotting techniques, coordinate systems, line drawings, polygon and circle generation, drawing entity commands of computer drafting. Sectional and dimensional drawing using computer.

UNIT-II

Conventional Symbols and brief introduction to electrical equipments and electronic devices, measuring instruments, parts of MI and MC instruments.

UNIT-III

Sectional drawing of different types of Cables, overhead conductors, wiring systems, domestic, staircase and godown wiring, wiring installation in small residences.

UNIT-IV

Mounting and types of enclosures for electric motors , types of transformer and their parts, core construction, sectional view of 1-phase and 3-phase transformers, H.T and L.T windings. DC machine and its parts, construction of pole, yoke and field coils, commutator and its details.

UNIT-V

Sketches of transmission line structures, types of towers, insulating equipments, single line diagram of power substation.

Reference Books:

1. Electrical Drawing -K.L.Narang
2. Engineering Drawing - N.D.Bhatt
3. Engineering Drawing with AutoCAD - T.Jayapoorva
4. Electrical Engineering Drawing (Part I & II) - Surjit singh

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SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Electrical Machine- I	EX - 405

UNIT I

ELECTRO MAGNETIC INDUCTION & BASIC CONCEPTS IN ROTATING MACHINES

Introduction to magnetic circuits – Magnetically induced e.m.f and force – AC operation of magnetic circuits – Hysteresis and Eddy current losses. Energy in magnetic systems – Field energy & mechanical force – Single and Multiple excited systems. MMF of distributed windings – Magnetic fields in rotating machines – Generated voltages – Torque.

UNIT II

DC GENERATORS

Constructional features of DC machine – Principle of operation of DC generator – EMF equation – Types of excitation – No load and load characteristics of DC generators – commutation – armature reaction – Parallel operation of DC generators.

UNIT III

DC MOTORS

Principle of operation of DC motors-Back emf – Torque equation –Types of DC motors-Speed – Torque characteristics of DC motors – Starting of DC motors: 2 point starter, 3 point starter, 4 point starter – Speed control – Losses and efficiency –Applications

UNIT IV

TRANSFORMERS

Principle of operation – Constructional features of single phase and three phase transformers – EMF equation – Transformer on No load and Load –Phasor diagram --equivalent circuit – Regulation - three phase transformer connections-parallel operation of single phase and three phase transformer- Auto transformers

UNIT V

SINGLE PHASE INDUCTION MOTOR

Single phase induction motors – Double revolving field theory – Torque – Speed characteristics – Equivalent circuit – No load and Blocked rotor test - Performance analysis – Starting methods of Single phase motors – Special motors: shaded pole motor, reluctance motor, repulsion motor, linear induction motor.

Text Books:

1. Electrical Machines by Nagrath and Kothari (TMH).
2. A.C. Machines by Langs dorf (McGraw-Hill)
3. Electrical Machines by Dr.P.S.Bimbhra (Khanna).
4. 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 Sumpner'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.

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SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Self Study (Internal Assessment)	EX - 406

Objective of Self Study: is to induce the student to explore and read technical aspects of his area of interest / hobby or new topics suggested by faculty.

Evaluation will be done by assigned faculty based on report/seminar presentation and viva.

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SECOND YEAR

Semester – IV

Course Content & Grade

Branch	**Subject Title**	**Subject Code**
EEE	**Seminar / Group Discussion(Internal Assessment)**	**EX - 407**

Objective of GD and seminar is to improve the MASS COMMUNICATION and CONVINCING/ Understanding skills of students and it is to give student an opportunity to exercise their rights to Express themselves.

Evaluation will be done by assigned faculty based on group discussion and power point Presentation.

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THIRD YEAR

Semester – V

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Switchgear And Protection	EX - 501

UNIT I

FAULT ANALYSIS

Fault Analysis per unit, representation and its advantages, faults in power systems (Symmetrical & Unsymmetrical), Single line and equivalent impendence diagram representation of power system components. Symmetrical components and its application to power systems, fault analysis, Sequence networks and their interconnection for different types of faults, Effect of fault impedance, Current limiting reactors, its location and application, Short circuit calculation.

UNIT II

PROTECTIVE RELAYS

Introduction to protective relaying-classification of relays – over current relays - directional over current relays - differential relays-distance relays - frequency relays-negative sequence relays - Introduction to static relays - comparison of electromagnetic and static relays, Bucholz Relay.

UNIT III

PROTECTION OF GENERATOR,TRANSFORMER AND BUSBAR

Generator protection-differential protection, balanced earth fault protection, restricted earth fault protection, statorinter-turn protection. Transformer protection-percentage differential protection-station bus zone protection differential, Fault bus protection- protection of transmission lines-time graded, differential, distance protection.

UNIT IV

CIRCUIT BREAKERS

Theory of arcing and arc quenching-RRRV-current chopping-capacitive current breaking-DC circuit breaking switchgear- fault clearing and interruption of current-Breakers-classification of circuit breakers-construction and operation of circuit breakers-minimum oil circuit breaker-air-blast circuit breaker-vacuum circuit breaker-SF6 circuit breaker-circuit breaker rating-circuit breaker testing.

UNIT V

FUSES & MICROPROESSOR BASED RELAYS

Definitions-characteristics of fuses-types of fuses-low voltage fuses-HRC fuses-high voltage fuses Introduction to Microprocessor based over current relays, impedance relays, Directional and reactance relay.

List of Experiments:

1. Determination of drop out factor of an instantaneous over current relay.
2. Determination of operating characteristic of IDMT relay.
3. Determination of operating characteristic of differential relay.
4. Study and operation of gas actuated protective relay.
5. Study and operation of static over current relay.
6. Determination of transmission line parameters using MATLAB.
7. Analysis of power system faults (Symmetrical & Asymmetrical) using MATLAB.
8. Study of SF6 circuit breaker
9. Protectional simulation study of generator, Transformer, Feeder & Motor protection.

References:

1. B. Ravindran and M Chander, Power System protection and Switchgear, New Age International reprint 2006.

2. Badrirka, Power System protection and switchgear, TMH.

3. CL Wadhwa, Electrical Power systems, New age International.

4. Haddi Saadet, Power System Analysis, TMH

5. A.R. Bergen, Vijay Vittal, "Power System Analysis, Pearson Education, Asia. Switchgear & protection Sunil S. Rao. Khanna Publication.

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THIRD YEAR

Semester – V

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Power System -II	EX - 502

UNIT-I

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

UNIT-II

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-III

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-IV

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-V

Power System Stability - Steady state, dynamic and transients stability, Swing equation , equal area criterion, solution of swing equation using step by step method modified Eulers 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. Electrical Power Systems-by C.L. Wadhwa New Age International (P) Limited Publishers, 2nd edition 1998.
3. Reactive power Control in Electric Systems-by T.J.E. Miller, John Wiley & Sons.
4. T.K. Nagsarkar, M.S. Sukhiza, -“Power System Analysis”, Oxford University Press.
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 Publ-ication
11. Power Generation, Operation and Control by A.J. wood and B.F. Wollenberg John Wiley & Sons Inc.

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 Rap son 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 (PSAT, EDSA, MY POWER, ETAP etc).

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Semester – V

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Control Systems	EX - 503

UNIT-I

TRANSFER FUNCTION

Introduction and classification of control systems – linear, nonlinear, time varying, time in-variant, continuous, discrete, SISO and MIMO systems – definitions. Mathematical modeling of mechanical (translation and rotational) and electrical systems – mechanical – electrical analogies – Transfer function block diagram reduction technique and signal flow graphs using Mason's gain formula. Transfer function of armature controlled and field controlled dc motor. Servomotors – Taco-generators – gear train – A Brief introduction on P, PI, PD and PID controllers.

UNIT II

TRANSIENT AND STEADY STATE ANALYSIS

Transient and steady state response – definitions – mathematical expression for standard test signals – type and order of systems – step response of first order and second order under damped systems. - Time domain specifications of second order under damped systems – Step response of second order critically damped and over damped systems. – Responses of first order systems with P, PI, PID controllers – Steady state error analysis.

UNIT-III

FREQUENCY DOMAIN ANALYSIS

Frequency response analysis – frequency domain specifications of second order systems – minimum phase, no minimum phase and all pass transfer functions – polar plots, bode plots, constant M and N circles, Nichols plot, Nichols chart..

UNIT-IV

STABILITY ANALYSIS

Stability analysis-characteristic equation-location of roots in s-plane for stability – Routh's stability criterion – relative stability analysis – root locus technique – construction of root loci, stability analysis using bode plot, Nyquist stability criterion

UNIT-V

DESIGN OF COMPENSATORS

Design of lead, lag, lead-lag compensating networks using bode plot technique, feedback compensation, Design of PI, PD and PID using bode plot technique**.**

References:

1. I.J. Nagrath and M. Gopal, "Control system Engineering", New Age International.
2. Modern Control Systems by Roy Chaudhary. PHI
3. K. Ogata, Modern Control Engineering, PHI.
4. B.C. Kuo, Automatic Control systems, PHI
5. Gopal M., Control System : Principles & Design, TMH.
6. Stefani, Shahian, Savant, Hostetter, “Design of feed back control System’s”, Oxford.
7. Krishna. K. Singh & Gayatri Agnihotri, System Design through MATLAB control tool & Simulink,
8. Stringer Verlag, U.K.
9. Rudra Pratap, Getting Started with MATLAB, Oxford.
10. Dhanesh N.Manik, Control Systems, CENGAGE Lea

List of Experiments:

1. Time response of second order system.
2. Characteristics of Synchros.
3. Effect of feedback on servomotors.
4. Determination of transfer function of A-C servomotor
5. Determination of transfer function 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. Grading System w.e.f. 2012-13
12. Transfer function of a DC generator.
13. Characteristics of AC servomotor.
14. Use of MATLAB for root loci and Bode plots of type-1, type-2 systems.
15. Study of analog computer and simulation of 1st order and 2nd order dynamic equations.
16. Formulation of proportional control on 1st order and 2nd order dynamic systems.
17. Feed back control of 3rd order dynamic Systems
18. Study of lead and lag compensating networks.
19. Effect of adding poles & zeros on root loci and bode plots of type-1, type-2 systems through MATLAB.

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THIRD YEAR

Semester – V

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Utilisation Of Electrical Energy	EX - 504

UNIT-I

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-II

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-III

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-IV

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-V

INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES

Configuration and performance of electrical vehicles, traction motor haracteristics, 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 ,Katariya and sons, New Delhi.
4. Garg, G.C., Utilization of Elect. Power and Elect. Traction.
5. N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect.

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THIRD YEAR

Semester – V

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Energy Conservation & Management	EX - 505

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 Callagan- Pergamon Press
5. Design & Management of energy conservation. Callaghan,
6. Elect, Energy Utilization & Conservation. Dr. Tripathi S.C.,

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THIRD YEAR

Semester – V

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Electrical Engineering Simulation Lab-I	EX - 506

Unit- I

MATLAB Basics

Simulation Mechanism and Simulation Tools, Starting and Ending MATLAB, MATLAB Desktop, Help Browser, Types of Files, Command Input Assistance, Operators and Special Characters, Variables and Arrays, Handling Arrays, Useful Built-in Functions, Control Structures, Input/Output Commands, File Handling

Unit- II

Introduction to Plotting

The plot command, Formatting and Labeling a Plot, Multiple Plots, Adding Legend, Sub Plots,
Plotting Complex Data, 2-D and 3-D Plots, Plotting a Function, Plot Editor, Interactive Plotting usingPlotting Tool

Unit- III

Programming in MATLAB

MATLAB Editor, MATLAB Programming, Debugging MATLAB Programs, MATLAB Debugger, Functions and Function Files, Differential Equation Solver, Symbolic Mathematics, Programming Examples

Unit- IV

Basic Electrical and Networks Applications

Analysis of Electrical Networks – Experiments based on Solution of Series-Parallel Circuits, Solution of system with linear equations - Experiments based on mesh and nodal analysis, Experiments forValidation of Network Theorems, Solution of Network Problems, Solution of First Order DifferentialEquation – Experiments for the study of Transients, Experiments for AC Signal Waveform Analysis, Study of Resonance in AC Circuit, Study of Frequency Response
Waveform Analysis, Study of Resonance in AC Circuit, Study of Frequency Response

Unit- V

System Modeling using SIMULINK

Simulation Steps, Getting Simulink, Creating and Simulating a Simulink Model, Simulink Solution of Differential Equation, Assigning Variables, Observing Variables During Simulation, Storing/Saving Data, Linking M-file with Model file, Creating and Masking Sub-systems, Solution using LaplaceTransform Approach, Solution using Laplace Transform Approach, Study of dynamic response,Simulation of Non-Linear System, Examples such as Simulink model to generate sine, cosinewaveform and ramp signal

BOOKS

1. “MODELLING AND SIMULATION USING MATLAB-SIMULINK”,2011 DR SHAILENDRA JAIN, WILLEY INDIA.
2. “MATLAB PROGRAMMING”, RUDRAPRASAD.

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Semester – V

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Self Study (Internal Assessment)	EX - 507

Objective of Self Study: is to induce the student to explore and read technical aspects of his area of interest / hobby or new topics suggested by faculty.

Evaluation will be done by assigned faculty based on report/seminar presentation and viva.

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Semester – V

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Seminar / Group Discussion (Internal Assessment)	EX - 508

Objective of GD and seminar is to improve the MASS COMMUNICATION and CONVINCING/ Understanding skills of students and it is to give student an opportunity to exercise their rights toExpress themselves.

Evaluation will be done by assigned faculty based on group discussion and power point Presentation.

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THIRD YEAR

Semester – VI

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	ELECTRICAL MACHINE-II	EX - 601

UNIT-I

THREE PHASE INDUCTION MOTOR

Construction and principle of operation of three phase induction motor – Equivalent circuit – Torque & Power equations – Slip – Torque characteristics – No load & blocked rotor tests – Separation of core loss – circle diagram.

UNIT-II

STARTING AND SPEED CONTROL OF INDUCTION MOTOR

Starting methods of three phase induction motor – Cogging & Crawling – Speed control – Voltage control – Rotor resistance control – Pole changing – Frequency control – Slip – energy recovery scheme – Double cage rotor – Induction generator – Synchronous induction motor.

UNIT-III

SYNCHRONOUS MACHINE-I

Construction; types of prime movers; excitation system including brushless excitation; polyphase distributive winding, integral slot and fractional slot windings; 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 Xd and Xq 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 steadyreactances and time constants, expression of transient and sub transient reactances in terms ofself 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.

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.

LIST OF EXPERIMENTS (EXPANDABLE)

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

i. To plot magnetisation characteristic of a separately excited DC generator
ii. To perform load test on DC generators.
iii. To perform load test on DC series and shunt motor
iv. To perform Swinburn’s test on a DC machine and find out its efficiency under full load condition.
v. To conduct Hopkinson’s test on a pair of DC shunt machine.
vi. To perform OCC and SCC test on an alternator and determine its regulation.
vii. To determine regulation of alternator using mmf and zpf methods.
viii. To synchronise alternator with infinite bus bar.
ix. To plot V and inverted V curves for a synchronous motor
x. To find Xd and Xq of salient pole synchronous machine by slip test.
xi. To Determine negative sequence and zero sequence reactance of an alternator.
xii. To determine subtransient direct axis and quadrature axis synchronous reactances of salient pole machine.

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THIRD YEAR

Semester – VI

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Microprocessors and Microcontrollers	EX - 602

UNIT I

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 ofSalient features of 8086, 80286 and 80386.

UNIT II

Microprocessor 8086 programming

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

UNIT III

Input-Output interfacing:

Memory Mapped I/O and Peripherals I/O. PPI 8255 Architecture andmodes 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 IV

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 V

8051 Interfacing, Applications and serial communication

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

List of Experiment

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

B. 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.

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. McKinlay, 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.

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THIRD YEAR

Semester – VI

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Minor Project	EX - 603

COURSE GUIDELINES

The Minor Project Work provides students an opportunity to do something on their own and under the supervision of a guide. Each student shall work on an approved project, which may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas. The project work involves sufficient work so that students get acquainted with different aspects of manufacture, design or analysis. The students also have to keep in mind that in final semester they would be required to implement whatever has been planned in the Major Project in this semester. It is possible that a work, which involves greater efforts and time may be taken up at this stage and finally completed in final semester, but partial completion report should be submitted in this semester and evaluated also at the end of the semester. At the end of semester, all students are required to submit a synopsis and be assessed by an external examiner.

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THIRD YEAR

Semester – VI

Elective - I

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	High Voltage Engineering	EX - 6101

UNIT-I

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-II

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-III

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-IV

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-V

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.
3. Rakosh Das Begamudre, Extra High voltage AC transmission engineering, Wiley Easternlimited, 1987.
4. Transmission and distribution reference book-Westing House.C.L.Wadhwa, High voltage engineering, New Age International Private limited, 1995.

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THIRD YEAR

Semester – VI

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	HVDC Transmission	EX - 6102

UNIT – I

BASIC CONCEPTS

Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

UNIT – II

ANALYSIS OF HVDC CONVERTERS

Choice of Converter configuration – analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star –star mode – their performance.

UNIT – III

CONVERTER & HVDC SYSTEM CONTROL

Principal of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

UNIT-IV

REACTIVE POWER CONTROL IN HVDC

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

UNIT –V

POWER FLOW ANALYSIS IN AC/DC SYSTEMS

Modelling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC loadflow – P.U. System for d.c. quantities-solution of AC-DC Power flow-Simultaneous method-Sequential method.

UNIT-VI

CONVERTER FAULT & PROTECTION

Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

UNIT – VII

HARMONICS

Generation of Harmonics –Characteristics harmonics,calculation of AC Harmonics,Non- Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics

UNIT-VIII

FILTERS

Types of AC filters,Design of Single tuned filters –Design of High pass filters.

REFERENCE BOOKS:

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao.
3. HVDC Transmission – J.Arrillaga.
4. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
5. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications.

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THIRD YEAR

Semester – VI

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Flexible Ac Transmission Systems	EX - 6103

UNIT I

INTRODUCTION TO FACTS

Electrical Transmission Network – Necessity – Power Flow in AC System – relative importance of controllable parameter – opportunities for FACTS – possible benefits for FACTS

UNIT II

STATIC VAR COMPENSATION

Need for compensation – introduction to shunt & series compensation – objectives of shunt & series compensation – configuration & operating characteristics – Thyristor Controlled Reactor (TCR) – Thyristor Switched Capacitor (TSC) –Comparison of TCR & TSC

UNIT III

SERIES COMPENSATION

Variable Impedance Type Series Compensation: Thyristor Switched Series Capacitor (TSSC) – Thyristor Controlled Series Capacitor (TCSC) – Basic operating control schemes for TSSC & TCSC

UNIT IV

STATIC VOLTAGE PHASE ANGLE REGULATOR

Objectives of voltage & phase angle regulators – approaches to Thyristor – Controlled Voltage & Phase Angle Regulator.

UNIT V

EMERGING FACTS CONTROLLER

STATCOM – Introduction to Unified Power Flow Controller (UPFC) & Interline Power Flow Controller (IPFC) basic operating principles UPFC – introduction to sub synchronous resonance.

TEXT BOOKS

1. Narain G. Hingorani & Laszlo Gyugyi, Understanding FACTS – Concepts & Technology of Flexible AC Transmission Systems, Standard Publishers, New Delhi, 2001.
2. Mohan Mathur, R. & Rajiv K. Varma, Thyristor Based FACTS Controller for Electrical Transmission Systems, Wiley Interscience Publications, 2002

REFERENCE BOOKS

1. Miller. T.J.E., Reactive Power Control in Electric System, John Wiley & Sons, 1997.
2. Dubey G.K., Thyristerized Power Controller, New Age international (P) Ltd., New Delhi 2001.
3. Narain G. Hingorani, Flexible AC Transmission, IEEE Spectrum, April 1993, pp 40 – 45.
4. Narain G. Hingorani, High Power Electronics in Flexible AC Transmission, IEEE Power Engineering Review, 1998.
5. Elinar V. Larsen, Juan J Sanchez – Gasca Joe H. Chow, Concepts for design of FACTS controllers to damp power swings, IEEE Transactions on Power Systems, Vol. 10, No. 2, May 1995.

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THIRD YEAR

Semester – VI

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Computer Applications To Power Systems	EX - 604

UNIT-I

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

UNIT-II

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-III

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-IV

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

UNIT-V

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. Power Generation, Operation and Control by A.J. wood and B.F. Wollenberg John Wiley & Sons Inc. 1984.
2. Computer methods in power systems analysis – by stage G.W. and E.L. Abiad A.H. Mc Graw Hill.
3. Computer Techniques in Power Systems Analysis- Pai M.A. Tata Mc Graw Hill.
4. Computer Modeling of Electrical Power Systems, Arrillaga J. Arnord C.P Harker B.J. John Wiley & Son
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.

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FOURTH YEAR

Semester – VII

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Electrical Machines – III	EX - 701

UNIT – I

Construction and Principle of operation

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation.

UNIT-II

Synchronous Generator Characteristics

Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

UNIT – III

Regulation of Synchronous Generator

Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of Xd and Xq (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT – IV

Parallel Operation of Synchronous Generator

Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactances.

UNIT – V

Synchronous Motors – Principle of Operation

Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed .

UNIT-VI

Power Circles

Excitation and power circles – hunting and its suppression – Methods of starting – synchronous induction motor.

TEXT BOOKS

1. Electric Machines – by I.J.Nagrath & D.P.Kothari, Tata Mc Graw-Hill Publishers, 7th Edition 2005.
2. Electrical Machines – by P.S. Bimbra, Khanna Publishers.

REFERENCE BOOKS:

1. The Performance and Design of A.C.Machines – by M.G.Say, ELBS and Ptiman & Sons.
2. Electric Machinery – by A.E. Fitzgerald, C.Kingsley and S.Umans, Mc Graw-Hill Companies, 5th edition, 1990.
3. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw-Hill, 2nd edition.
4. Electromachanics-III (Synchronous and single phase machines), S.Kamakashiah, Right Publishers Reference Http://www.jntu.ac.in/

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FOURTH YEAR

Semester – VII

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Power Electronics	EX - 702

UNIT-I

POWER SEMICONDUCTOR DEVICES

Basic structure & switching characteristics of power diodes, Power transistor & SCR, Triggering methods of SCR, R, RC, and UJT firing circuits for SCR, series and parallel operation of SCR, need for snubber circuits, di/dt & dv/dt protection. Introduction to Triac, GTO, MOSFET, IGBT, FCT and MCT.

UNIT II

CONTROLLED RECTIFIERS

Operation of 1-phase half wave rectifiers with R load, 1-phase FWR with R, RL & RLE load (fully controlled & half controlled), operation and analysis of FWR using R & RL loads (RMS, average & PF), operation of 3-phase HWR & FWR with R & RL loads for continuous current mode, effect of source inductance in 1-phase FWR, Introduction to 1-phase dual converter operation.

UNIT III

CHOPPERS

DC Choppers: Classification & operation of choppers (A,B,C,D,E), control strategies, operation of voltage, current and load commutated choppers.AC Choppers: Operation of 1-phase voltage regulator with R, RL loads, 1-phase step up & step down cycloconverters.

UNIT IV

INVERTERS

Types of inverters, operation of 1-phase VSI and 3-phase VSI (120o , 180o) modes, Y with R load, operation 1-phase of CSI with ideal switches, 1-phases ASCSI operation, basic series inverter, Modified series Inverter, 1-phase parallel inverter operation (without feedback diode), 1-phase basic McMurray inverter, Introduction to harmonics and PWM inverters.

UNIT V

APPLICTIONS OF POWER ELECTRONICS CONVERTERS

Single phase (mid point & bridge configuration) and three phase cyclo convertor configuration and operating principles. Speed control of DC motor using rectifiers and choppers, SMPS, UPS (on line and off line), Introduction to FACTS – shunt and series compensators.

TEXT BOOKS

1. Bhimbra. Dr.P.S., Power Electronics Khanna Publishers, 2001.
2. Singh. M.D. & Khanchandani. K.B Power Electronics Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2000.
3. M.H. Rashid, Power Electronics Circuits, Devices and Applications, Pearson Education, Singapore, 1993.
4. Dubey, G.K. et al, Thyristorised Power Controllers, New Age International (P) Publishers Ltd., 2002.
5. Vedam Subramaniam, Power Electronics, New Age International (P) Publishers Ltd., 2000.

LIST OF EXPERIMENTS

1. R, RC & UJT Triggering circuits
2. Single phase& Full converter
3. Single phase AC voltage controller using Traic
4. Single phase series inverter (Basic & Proto type)
5. Single phase Parallel inverter
6. Single phase Mc Murray inverter
7. Commutation circuits
8. Speed control of DC shunt motor (using Rectifier & Chopper)
9. Speed control of Universal motor.
10. Speed control of TPIM using PWM inverter

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FOURTH YEAR

Semester – VIII

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Energy Modelling, Economics And Project Management	EX - 801

UNIT I

MODELS AND MODELING APPROACHES

Macroeconomic Concepts - Measurement of National Output - Investment Planning and Pricing - Economics of Energy Sources - Reserves and Cost Estimation.

UNIT II

INPUT OUTPUT ANALYSIS

Multiplier Analysis - Energy and Environmental Input / Output Analysis - Energy Aggregation –Econometric Energy Demand Modeling - Overview of Econometric Methods.

UNIT III

ENERGY DEMAND ANALYSIS AND FORECASTING

Methodology of Energy Demand Analysis - Methodology for Energy Technology Forecasting -Methodology for Energy Forecasting - Sectoral Energy Demand Forecasting.

UNIT IV

ECONOMICS OF STANDALONE POWER SUPPLY SYSTEMS

Solar Energy - Biomass Energy - Wind Energy and other Renewable Sources of Energy -Economics of Waste Heat Recovery and Cogeneration - Energy Conservation Economics.

UNIT V

PROJECT MANAGEMENT-FINANCIAL ACCOUNTING

Cost Analysis - Budgetary Control - Financial Management - Techniques for Project Evaluation.

References:

1. M.Munasinghe and P.Meier (1993): Energy Policy Analysis and Modeling, Cambridge University Press.
2. W.A.Donnelly (1987): The Econometrics of Energy Demand: A Survey of Applications, New York.
3. S.Pindyck and Daniel L.Rubinfeld (1990): Econometrics Models and Economic Forecasts, 3rd edition MC Graw -Hill, New York.
4. UN-ESCAP (1991): Sectoral Energy Demand Studies: Application of the END-USE Approach to Asian Countries, New York.
5. UN-ESCAP (1996): Guide Book on Energy -Environment Planning in Developing Countries: Methodological Guide on Economic Sustainability and Environmental Betterment Through Energy Savings and Fuel Switching in Developing Countries, New York.
6. S.Makridakis , Wiley(1983): Forecasting Methods and Applications.

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FOURTH YEAR

Semester – VIII

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Electrical Drives	EX - 802

UNIT-I

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-II

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-III

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 cycloconverters, PWM control Comparison of VSI & CSI operations, Speedtorque Characteristics, Numerical problems on induction motor drives, Closed loop operation of induction motor drives. (Block diagram only)

UNIT-IV

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 advantagesapplication-problems.

UNIT-V

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

References:

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”.
5. V. Subramanyam “Thyristor control of Electric Drive” Tata Mc Graw Hill Pub
6. N.K. De , P.K. Sen “Electric Drives” PHI
7. S.K. Pillai, “A first course of Electrical Drive” New age International.
8. S.K. Pillai. “Analysis of Thyristor Power conditioned Motors” University Press (India)Ltd. Longman
9. P.V. Rao, “Power semiconductor Drives”, BS Publications.

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FOURTH YEAR

Semester – VIII

Elective - II

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Renewable & Non Conventional Energy Systems	EX - 8201

UNIT – I

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 – II

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 stand alone systems. Use of electronic load controllers and self excited induction generators. Wave Energy System: System configuration: grid connected and hybrid systems.

UNIT – III

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.

BIOMASS ENERGY SYSTEM: 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-Wakil, 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 &
8. Year book 1994-95", Teri Tata Energy Research Institute, New Delhi,

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FOURTH YEAR

Semester – VIII

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	Power System Planning & Reliability	EX - 8202

UNIT-I

REVIEW OF PROBABILITY THEORY

Element of probability theory Probability Distribution, Random variable, Density and distribution functions. Mathematical expectation. Binominal distribution, Poisson distributions, Normal distribution, Exponential distribution, Weibull distribution.

UNIT-II

RELIABILITY OF ENGINEERING SYSTEMS

Component reliability, Hazard models, Reliability of systems wit non-repairable components, series, Parallel, Series-Parallel, Parallel-series configurations. Non-series-parallel configurations, minimal tie-set, minimal cut-set and decomposition methods. Repairable systems, MARKOV process, Long term reliability, Power System reliability.

UNIT-III

RELIABILITY OF ENGINEERING SYSTEMS

Reliability model of a generating unit, State space methods, Combing states, sequential addition method, Load modeling, Cumulative load model, merging of generation and load models, Loss of load probability, Percentage energy loss, Probability and frequency of failure, Operating reserve calculations.

UNIT-IV

POWER NETWORK RELIABILITY

Weather effect on transmission lines, Common mode failures, Switching after fauls, three, state components, Normally open paths, Distribution system reliability.

UNIT-V

COMPOSITE SYSTEM RELIABILITY

Bulk Power supply systems, Effect of varying load, Inter connected systems, correlated and uncorrelated load models, Cost and worth of reliability.

UNIT-VI

RELIABILITY IMPROVEMENT & TESTING

Proper Design simplicity, Component improvement Testing Plans, time censored & sequential reliability tests, accelerated life test, Environ mental test, Reliability estimations.

References:

1. J. Endreny, Reliability Modeling in Electric Power Systems, John Wiley & Sons.
2. Roy Billinton & Ronald, N allan, Reliability Evaluation of Power Systems, Plenum Press, New York.

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FOURTH YEAR

Semester – VIII

Course Content & Grade

Branch	Subject Title	Subject Code
EEE	VLSI	EX - 8203

UNIT-I

Overview of VLSI Design Methodology VLSI design process, Architectural design, Logical design, Physical design, Layout styles, Full custom & Semi custom approaches**.** Basic Electrical Properties of MOS and CMOS Circuits, NMOS, PMOS, Transistors, MOS device equations, Basic DC equations second order effects, MOS modules, Small signal AC characteristics, NMOS inverter, Steered input to an NMOS inverter, depletion mode & enhancement mode pull ups, CMOS inverter, DC characteristics, inverter delay, Pass transistor, transmission gate.

UNIT-II

VLSI Fabrication Techniques An overview of wafer fabrication, Wafer processing, Oxidation, Pattering, Diffusion, Ion implantation, Deposition, silicon gate NMOS process, CMOS processor, N well, P well, Twin tub, Silicon on insulator, CMOS process enhancements interconnect circuit elements latch up, latch up triggering & prevention techniques.

UNIT-III

MOS and CMOS Circuit Design Process-Layer representation, Stick diagrams, NMOS design style, CMOS design style, Design rules, Need for design rules, Mead Conway design rules for silicon gate NMOS process, CMOS n well/ p well based design rules simple layout examples, Sheet resistance estimation. Capacitance estimation, Area capacitance, Wiring capacitance, Driving large capacitive loads.

UNIT-IV

NMOS & CMOS Circuit and Logic Design, Switch logic, Pass transistor & Transmission gate, gate logic, inverter, two input NAND gate, NOR gate other form of CMOS logic, Dynamic CMOS logic Clocked CMOS logic, Precharged domino CMOS logic, Structured design, Simple combinational logic design examples, Parity generator, Multiplexers clocked sequential circuits, Two phase clocking, charge storage, Dynamic register element, NMOS and CMOS, Dynamic shift register, semi static register, J-K flip flop.

UNIT-V

Subsystem Design Process Design of a 4-bit shifter, general arrangement of 4 bit arithmetic processor, Design of a ALU system implementing ALU functions with an adder, carry look ahead adders, Multipliers, Serial parallel multipliers, Pipe lined multiplier array, Modified Booth's algorithm

References:

1. Douglas "A puchnel and Kamrah Eshraghian, Basic VLSI design, Prentice Hall of India.
2. Neil H.E. West and Kamrah Eshraghigm "Principle of CMOS VLSI design: A System perspective", Addison wisely.
3. Eugene D Fabricus " Introduction to VLSI design" McGraw Hill International.
4. Amar Mukherjee, "Introduction to NMOS & COMS VLSI design" Prentice Hall.
5. Wayne Wolf "Modern VLSI design- Systems on Silicon", Prentice Hall.
6. Carver Mead a Lynn Conway, "Introduction to VLSI Systems", Addison Wesley.