R.K.D.F. UNIVERSITY, BHOPAL
B.E.(Electrical Engineering)
SECOND YEAR-Semester – III
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
B.E. EE	Environmental Engineering	BE- 3011	4L-0T-0P	4

Course Outcomes:

CO1 **Develop** critical thinking skills in relation to environmental affairs.

CO2 **Acquire** knowledge about natural resources and their effective management.

CO3 **Expand** awareness of self in a global society and effectively engage diverse perspectives, values, and cultures, ranging from local to global, in dealing with environmental and social issues.

CO4 **Formulate** an action plan for sustainable alternatives that integrate science, humanist, and social perspectives and **Interpret** and propose solutions to various environmental pollution.

Course Contents:

UNIT-I

Ecosystem – Principles of ecology, ecosystem concept: Biotic and biotic components of ecosystem, Segments of Environment: Atmosphere, hydrosphere, Lithosphere, biosphere. Biodiversity: Threats and conservation, Food Chain.

UNIT- II

Energy General idea about: Natural Resources , current status and types of resources Non Renewable Sources of energy, coal, oil, Gas, Hydrogen, nuclear sources

UNIT –III

Air Pollution & Sound Pollution - Air Pollution: Air pollutants, classification, (Primary &secondary Pollutants) Adverse effects of pollutants. Causes of Air pollution Environmental problems, (Global warming, ozone depletion and acid rain) General idea about forest ecosystem, grassland ecosystem, wetland ecosystems and aquatic Biogeochemical Cycling: Oxygen cycle,Carbon cycle, Nitrogen cycle, Sculpture cycle and water cycle.

UNIT –IV

Water Pollution– Water Pollution: Pollutants in water, adverse effects.Treatment of Domestic & Industrial water effluent.
Soil Pollution – Soil Profile, Pollutants in soil, their adverse effects, controlling measures.

UNIT- V

Society & Ethics – Impact of waste on society. Solid waste management (Nuclear, Thermal,

Plastic, medical, Agriculture, domestic and e-waste). Ethics and moral values, ethical situations, water preservation rain water collection. Environmental Impact Assessment.

Reference Books :

1. Harris, CE, Prichard MS, Rabin's MJ, "Engineering Ethics"; Cengage Pub.
2. RanaSVS ; "Essentials of Ecology and Environment"; PHI Pub.
3. Raynold, GW "Ethics in information Technology"; Cengage.
4. Svakumar; Energy Environment & Ethics in society; TMH
5. AK De "Environmental Chemistry"; New Age Int. Publ.
6. BK Sharma, "Environmental Chemistry" ;Goel Publ. House

R.K.D.F. UNIVERSITY, BHOPAL
B.E.(Electrical Engineering)
SECOND YEAR-Semester – III
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electromagnetic Fields	EE - 3021	3L-1T-0P	4

Course Outcomes:

CO1 **Explain** the concept of vector for different coordinate systems for **applying** various laws in the **analysis** of electromagnetic systems

CO2 **Define and Explain** physical basis for the functioning of circuit elements.

CO3 **Apply** Electromagnetic boundary conditions and be familiar with the four Maxwell's equations used **to study** time varying electromagnetic or dynamic fields.

CO4 **Illustrate** the concept of uniform plane-wave propagation and electromagnetic power density flow in lossless medium.

Course Contents:

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 solenoid 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.

Reference Books :

1. Mathew N.O Sadiku; Elements of Electromagnetic; Oxford.
2. P.V. Gupta; Electromagnetic Fields; DhanpatRai.
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.

R.K.D.F. UNIVERSITY, BHOPAL
B.E.(Electrical Engineering)
SECOND YEAR-Semester – III
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Semiconductor Devices and circuits	**EE - 3031**	**4L-0T-2P**	**6**

Course Outcomes:

CO1 **Explain** the properties of materials and application of semiconductor electronics.
CO2 **Understand** operating principles of basic electronic devices including pn junction, metal-semiconductor contact, bipolar junction transistors and field effect transistorsthe control application using semiconductor devices
CO3 **Describe** and classify semiconductor devices for special applications. Learn fundamental mechanisms of electrical conduction in semiconductors.
CO4 **Analyze** and evaluate the performance of basic electronic devices. Prepare for further analysis of electronic and photonic devices based on semiconductors.

Course Contents:

UNIT-I

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- II

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

UNIT –III

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. U.

UNIT –IV

Switching characteristics of diode and transistor, turn ON, OFF time, reverse recovery time , transistor as switch, Multivibrators, Bistable, Monostable, A stable multivibrators. Cllipers and clampers, Differential amplifier, calculation of differential, common mode gain and CMRR using hparameters, Darlingtonpair, Bootstrapping technique. Cascadeandcascade amplifier.

UNIT- V

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.

List of Practical

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.

Reference Books :

1. Nashelsky&Boysted; Electronic Devices and Circuits; PHI
2. MillmanHalkias; 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, NDelhi
7. Millman&Halkias; Integrated Electronics; McGraw- Hill.
8. Tobbey; 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
13. I.J. Nagrath; Electronics -Analog and Digital; PHI

SECOND YEAR-Semester – III
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Network Analysis	EE - 3041	3L-1T-2P	6

Course Outcomes:

CO1 **Understand** the basic knowledge of engineering, **identifying** and **analyze** the complex circuits using the concept of loop (mesh), concept of node and transformation of sources using concept of duality.

CO2 **Analyze** the simple and complex circuits using the concept of various network theorems for design of electric circuits.

CO3 **Evaluate** the complex electric circuits using Laplace transformation and their response and also **compute** initial and final conditions for current and voltage in first and second order circuits.

CO4 **Apply** simple basic mathematics in determining the poles and zeros, **analyzingand calculating** transfer functions of basic single & two port networks and also the complex two – port network parameters including the complex Three phase circuit.

Course Contents:

UNIT-I

Introduction to DC and AC circuits, Active and passive two terminal elements. Ohms law, Voltage-Current relations for resistor, inductor, capacitor 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.

List of Practical

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.

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

B.E.(Electrical Engineering)
SECOND YEAR-Semester – III
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Value Education	EE - 3051	4L-0T-2P	6

Course Outcomes:

CO1 **Understand** the importance of value based living.Learn about philosophy of Life and Individual qualities. To learn and practice social values and responsibilities.

CO2 **Analyze &** gain deeper understanding about the purpose of their life. understand and start applying the essential steps to become good leaders.

CO3 **Emerge** as responsible citizens with clear conviction to practice values and ethics in life.to make the students aware of the problems of modern society and to make them understand the need for them as engineers and responsible citizens to use their professional knowledge and skills for the alleviation such problems

CO4 **contribute** in building a healthy nation.Apply value based professionals.to instill in them the need to follow professional ethics and ethical practices in their profession

Course Contents:

Chapter-1

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.

Chapter –3

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.

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
B.E. EE	Electrical Workshop	E.E.- 3061	0L-0T-2P	2

List Of Experiments:

1. **INTRODUCTION OF TOOLS, ELECTRICAL MATERIALS, SYMBOLS AND ABBREVIATIONS.**
2. **TO STUDY STAIR CASE WIRING.**
3. **TO STUDY FLUORESCENT TUBE LIGHT**
4. **TO STUDY MOVING IRON, MOVING COIL, ELECTRODYNAMIC AND INDUCTION TYPE METER.**
5. **TO STUDY CIRCUIT AND WORKING OF HOME INVERTER**
6. **TO STUDY FUSES MCBS AND IMPORTANCE OF EARTHING.**

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
B.E. EE	Engineering Mathematics-III	E.E.- 4011	3L-1T-0P	4

Course Outcomes:

CO1 **Find** Laplace Transform of periodic functions, Dirac delta function and solve differential equations, integral equations and integro- differential equations and can analyze the solution. **Expand** the function in Fourier series and half range. Also Find Fourier transform and Fourier Integral and solve Integral equations.

CO2 **Analyse** solutions of partial differential equations and solve the initial value and boundary value problems. Extremis the functional and also solve Isoperimetric problems.

CO3 **Understand** Principle of operation and characteristics, biasing arrangements of Field effect transistors and MOSFETs and types of oscillator.

CO4 **Evaluate** conversion of numbers from one code to other code, logic gates and truth table of digital circuits.

Course Contents:

UNIT-I

Fourier series: Introduction of Fourier series, Fourier series for Discontinuous functions, and Fourier series for even and odd function. 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.

UNIT- II

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

UNIT –III

Errors & Approximations, Solution of Algebraic &Trancedental Equations (RegulaFalsi, 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 –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). **Society & Ethics –** Impact of waste on society. Solid waste management (Nuclear, Thermal, Plastic, medical, Agriculture, domestic and e-waste). Ethics and moral values, ethical situations, water preservation rain water collection. Environmental Impact

Assessment.

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 Books :

(i) Higher Engineering Mathematics by BS Grewal, Khanna Publication
(ii) Advance Engineering Mathematics by D.G.Guffy
(iii) Mathematics for Engineers by S.Arumungam, SCITECH Publuication
(iv) Engineering Mathematics by S SSastri. P.H.I.
(v) Numerical Methods for Scientific and Engg. Computation by MKJain, Iyengar and RK Jain, New Age International Publication
(vi) Mathematical Methods by KV SuryanarayanRao, SCITECH Publuication
(vii) Pobability and Statistics by Ravichandran, Wiley India
(viii) Mathematical Statistics by George R., Springer

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electrical Machines - I	EE - 4021	3L-1T-2P	6

Course Outcomes:

CO1 **Understand** the principle, construction, connections, vector grouping, operation and testing of single and 3-phase transformer and conversion of 3-phase supply to 2-phase supply, their cooling, maintenance & heat run tests.

CO2 **Demonstrate** and Analyse principle, armature and field construction, types, operation characteristics, armature reaction, commutation, methods to improve commutation in dc machines.

CO3 **Demonstrate** principle, construction, Distinguish types, torque development, Analysis performance characteristics, tests to determine performance indices & parameters of equivalent circuit of 3-phase and double cage induction motors, methods of starting, speed control and braking of induction motors.

CO4 **Illustrate** Revolving and cross field theories, Explain operation, characteristics, types, equivalent circuit & tests of 1 ph IM.

Course Contents:

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 operations 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.

List of Experiments (expandable)

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.

Reference Books :

1. Electrical Machines by Nagrath and Kothari (TMH).
2. A.C. Machines by Langsdorf (McGraw-Hill)
3. Electrical Machines by Dr.P.S.Bimbhra (Khanna).
4. Electrical Machines by AshfaqHussain. (DhanpatRai).

R.K.D.F. UNIVERSITY, BHOPAL
B.E.(Electrical Engineering)
SECOND YEAR-Semester – IV
Course Content

Branch	Subject Title	Subject Code	Contact Hours	Total Credits

			per Week	
EE	**Analog & Digital Communication**	**EE - 4031**	**4L-0T-2P**	**6**

Course Outcomes:

CO1 **knowledge** of fundamental circuit analysis techniques and basic electronics backgrounds, including BJT, MOSFET and operational amplifier.

CO2 **Design** and characterize differential amplifiers using BJT Study different parameters and basic circuits of op-amps.

CO3 **Analyze** Realize basic ADC and DAC circuitsusing various mapping and mathematical methods, voltage regulators using IC`s.

CO4 **Design** signal generation and wave shaping circuits using op- Amp, Design active filters using Op-amp.

Course Contents:

UNIT-I

Time domain and frequency domain representation of signal, Fourier Transform and its properties, Transform ofGate, Periodic gate, Impulse periodic impulse sine and cosine wave, Concept of energy density and powerdensity (Parseval's theorem), Power density of periodic gate and impulse function, impulse response of a system,convolutions, convolution with impulse function, causal and non causal system impulse response of ideal lowpass filter, Correlation & Autocorrelation.

UNIT- II

Base band signal, need of modulation, Introduction of modulations techniques, Amplitude modulation, Equationand its frequency domain representation, Bandwidth, Power distribution. AM suppressed carrier waveformequation and frequency domain representation Generation (Balance/Chopper modulator) and synchronousdetection technique, errors in synchronous detection, Introduction to SSB and VSB Transmission Anglemodulation, Frequency and phase modulation equation and their relative phase and frequency deviations,modulation index frequency spectrum, NBFM and WBFM, Bandwidth comparison of modulation techniques.

UNIT –III

Sampling of signal, sampling theorem for low pass and Band pass signal, Pulse amplitude modulation (PAM),Time division, multiplexing (TDM). Channel Bandwidth for PAM-TDM signal Type of

sampling instantaneous,Natural and flat top, Aperture effect, Introduction to pulse position and pulse duration modulations, Digitalsignal, Quantization, Quantization error, Pulse code modulation, signal to noise ratio, Commanding, Data rateand Baud rate, Bit rate, multiplexed PCM signal, Differential PCM (DPCM), Delta Modulation (DM) andAdaptive Delta Modulation (ADM), comparison of various systems**.**

UNIT –IV

Digital modulations techniques, Generation, detection, equation and Bandwidth of amplitude shift keying (ASK)Binary Phase Shift keying (BPSK), Differential phase shift keying (DPSK), offset and non offset quadraturephase shift keying (QPSK), M-Ary PSK, Binary frequency Shift Keying(BFSK), M-Ary FSK QuadratureAmplitude modulation (QAM), MODEM, Introduction to probability of error.

UNIT- V

Information theory and coding- Information, entropies (Marginal and conditional), Model of a communicationsystem, Mathematical representation of source, channel and receiver characteristics, Mutual information, channelcapacity efficiency of noise free channel Binary symmetric channel(BSC) Binary erasure channel (BEC),Repetition of signal, NM symmetric Binary channel, Shannon theorem, Shannon-Hartley theorem (S/N-BWtrade off)Source encoding code properties; Shanon,Fano and Huffman coding methods and their efficiency errorcontrol coding, Minimum Hamming distance, Linear Block Code, Cyclic code and convolution codes. LineEncoding: Manchester coding,RZ, NRZ coding.

List of Practical

1. Study of sampling process and signal reconstruction and aliasing.
2. Study of PAM PPM and PDM
3. Study of PCM transmitter and receiver.
4. Time division multiplexing (TDM) and De multiplexing.
5. Study of ASK PSK and FSK transmitter and receiver.
6. Study of AM modulation and Demodulation techniques (Transmitter and Receiver) Calculate of Parameters.
7. Study of FM modulation and demodulation (Transmitter and Receiver) & Calculation of parameters.

8. To construct and verify pre emphasis and de-emphasis and plot the wave forms.
9. Study of super heterodyne receiver and characteristics of ratio radio receiver.
10. To construct frequency multiplier circuit and to observe the waveform
11. Study of AVC and AFC.s.

Reference Books :

1. Singh &Sapre, Communication System, TMH
2. Taub& shilling, Communication System, TMH
3. Hsu; Analog and digital communication(Schaum); TMH
4. B.P. Lathi, Modern Digital and analog communication system,
5. Simon Haykins, Communication System. John Willy
6. Wayne Tomasi, Electronic Communication system.

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	**Electrical Engineering Drawing**	**EE - 4041**	**4L-0T-2P**	**6**

ourse Outcomes:

CO1 **Model &explain** the system components used in power system.

CO2 **Understand** and **apply** the concept of per unit system.

CO3 **Understand and apply** the concept of designing transmission line parameter.

CO4 **Learn** the basic concept of load flow analysis and power sharing in power system.

Course Contents:

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 equipment's 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.

List of Practical

1. To design transformer.

2 To design ac winding
3. Introduction to laboratory measuring instruments and their application
4. To Understand the Name plate Data of Electrical Machine

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) - Surjitsingh

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Power System-I	EE - 4051	4L-0T-2P	6

Course Outcomes:

CO1 **Model &explain** the system components used in power system
CO2 **Understand** and **apply** the concept of per unit system
CO3 **Understand and apply** the concept of designing transmission line parameter
CO4 **Learn** the basic concept of load flow analysis and power sharing in power system

Course Contents:

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: Principle of carrier communication over Power Lines, purposes, Equipment, differences between radio transmission and carrier communication, block diagram.

List of Experiment

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.

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, PergamonOxfd
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. AshfaqHussain; "Electrical Power System
9. Gupta BR; "Power System Analysis and Design"
10. Ray " Electrical Power System:Concepts, Theory and practice", PHI

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
B.E. EE	Electrical Machine-II	EE – 5011	4L-0T-2P	6

Course Outcomes:

CO1 **Understand** basic principle, construction, laying of armature and field windings, types, generation of emf, steady state, transient behaviour and analysis performance characteristics of synchronous machine.

CO2 **Understand** synchronization and parallel operation of synchronous generators

CO3 **Describe** principle, construction, methods of starting of synchronous motor, its operation with variable load, operation with variable excitation, performance evaluation

Course Contents:

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, zpfand new A.S.A method.

UNIT –IV

SYNCHRONOUS MACHINE-II

Salient pole machines; two reaction theory equivalent circuit model and phasor diagram; determination of Xdand Xq by slip test; SCR and its significance; regulation of salient pole alternator, power angle equation and characteristics; synchronizing of alternator with infinite bus bar,; 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 subsynchronous 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 reactance 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)

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.

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, DhanpatRai, 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.

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Course Content

Branch	Subject Title	Subject Code	Contact Hours	Total Credits

			per Week	
EE	**Signals & Systems**	**EE - 5021**	**3L-1T-2P**	**6**

Course Outcomes:

CO1 **Understand** mathematical description and representation of continuous and discrete timesignals and systems.

CO2 **Develop** input output relationship for linear shift invariant system and understand theconvolution operator for continuous and discrete time system.

CO3 **Understand** and resolve the signals in frequency domain using Fourier series and Fourier transform

CO4 **Understand** the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain

Course Contents:

UNIT-I

Dynamic Representation of Systems:
Systems Attributes, Causality linearity, Stability, time invariance. Special Signals, Complex exponentials,Singularity functions (impulse and step Functions).. Linear Time-Invariant Systems: Differential equation representation convolution Integral. Discrete form of special functions.Discrete convolution and its properties.Realization of LTI system (differential and difference equations).

UNIT- II

Fourier Analysis of Continuous Time Signals and Systems :
Fourier Series, Fourier Transform and properties, Parseval's theorem, Frequency response of LTI systems.Sampling Theorem.

UNIT –III

Fourier Analysis of Discrete Time Signals &Systems :
Discrete-Time Fourier series, Discrete- Time Fourier Transform (including DFT) and properties.Frequency response of discrete time LTI systems.

UNIT –IV

Laplace Transform:
Laplace Transform and its inverse: Definition, existence conditions, Region of Convergence and properties,Application of Laplace transform for the analysis of continuous time LTI system (stability etc.) Significance of poles & zeros.

Z-Transform :
Z-Transform and its inverse: Definition, existence, Region of convergence and properties, Application of ZTransformfor the analysis of Discrete time LTI Systems, Significance of poles and zeros.

UNIT- V

Sampling:
The sampling theorem, reconstruction of signal from its samples, sampling in the frequency domain, samplingof discrete-time signals.

Reference Books

1. Alan V. Oppenheim, Alan S. Willsky and H. Nawab, Signals and Systems, Prentice Hall, 1997
2. Simon Haykin, Communication Systems, 3rd Edition, John Wiley, 1995.

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THIRD YEAR-Semester – V
Course Content

Branch	Subject Title	Subject Code	Contact Hours	Total Credits

			per Week	
EE	**Energy Conservation & Management**	**EE - 5031**	**4L-0T-0P**	**4**

Course Outcomes:

CO1 **Know** Present energy scenario with need of energy audit and energy conservation.
CO2 **Understand** various aspects of energy audit such as planning, monitoring and implementation

CO3 **Manage** electric and thermal energy in the industry

Course Contents:

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 recoveryin 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

Reference Books :

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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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits

EE	**Control System**	**EE - 5041**	**4L-0T-0P**	**4**

Course Outcomes:

CO1 **Design** the linear systems and **study** the control system components specifications through classical and understand concepts of state variable approach..

CO2 **Understand** the time response and time response specifications

CO3 **Analyze** the absolute stability and relative stability through root locus method

CO4 **Understand** the knowledge of Frequency response tools like bode plot and nyquist plot..

Course Contents:

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 – Tacho-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 domainspecifications 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

Modeling and mathematical description of dynamic systems in the time and frequency domain. DC motor Modeling using time and frequency domain 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.

Reference Books :

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 &GayatriAgnihotri, System Design through MATLAB control tool & Simulink,
8. Stringer Verlag, U.K.
9. RudraPratap, Getting Started with MATLAB, Oxford.
10. DhaneshN.Manik, Control Systems, CENGAGE Lea

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THIRD YEAR-Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Dot Net	EE - 5051	0L-0T-2P	2

List of Practical

1.Program to display the addition, subtraction, multiplication and division of two number using console application.

2.Program to display the first 10 natural numbers and their sum using console application.

3.Program to display the addition using the windows application.

4.Write a program to convert input string from lower to upper and upper to lower case.

5.Write a program to simple calculator using windows application.

6.Write a program working with Page using ASP.Net.

7.Write a program working with forms using ASP.NET.

8.Write a program to connectivity with Oracle database.

9.Write a program to access data source through ADO.NET.

10.Write a program to manage the session.

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Control System	EE - 5061	0L-0T-2P	2

List of Practical

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.

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THIRD YEAR-Semester – VI
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Microprocessors and	EE-6011	4L-0T-2P	6

	Microcontrollers			

Course Outcomes:

CO1 **Design** the VLSI circuit and**study** the Introduction of Intel 8085 architecture.

CO2 **Understand** the Assembly language program.

CO3 **Analyze** the Interrupts and methods of data transfer

CO4 **Understand** the External peripheral devices.

Course Contents

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 machinelanguageprogramming, 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 254, 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 setnilkumar, SaravamJeevanathan shah.

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits

EE	**Power system II**	**EE-6021**	**3L-1T-2P**	**6**

Course Outcomes:

CO1 **To comprehend** the different issues related to overhead lines and underground cables.

CO2 **To understand** power system concepts required to solve engineering problems.

CO3 **To provide** the knowledge about the system transients, sag and various issues related to cables and transmission lines.

Course Contents

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, NewtonRaphson 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 anexcitation 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 McGraw – 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. PrabhaKundur, "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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Course Content

Branch	Subject Title	Subject Code	Contact Hours	Total Credits

			per Week	
EE	**Utilization Of Electrical Energy**	**EE – 6031(B)**	**4L-0T-0P**	**4**

Course Outcomes:

CO1 Illumination engineering is a field that spans many topics, including the development of sources, design of luminaires and light pipes, measurement of lighting conditions, and machine vision

CO2 To Learn the process of HEATING & WELDING and understand the process of ELECTROLYSIS.

CO3 To Understand the action of drawing a body, vehicle, train, or the like, along a surface, as a road, track, railroad, or waterway.

CO4 Understand starting, speed control and braking of electric system

CO5 Learn and analysis the working of drives & Hybrid system used in traction.

Course Contents

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 – VI
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electrical Power Generation	EE-6041(A)	4L-0T-0P	4

Course Outcomes:

CO1 Describe sources of energy and types of power plants. performance characteristics and components of such power plants.

CO2 Classify different types of coupled vapor cycles and list the advantages of combined cycles power plant. List types, principles of operations, components and applications of steam turbines, steam generators, condensers, feed water and circulating water systems

CO3 Estimate different efficiencies associated with such systems

CO4 Define terms and factors associated with power plant economics. Calculate present worth depreciation and cost of different types of power plants. Estimate the cost of producing power per kW.

Course Contents

UNIT I

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

1. MHD generation
2. Solar generation
3. Wind power station
4. 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 thesepower 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 factorimprovement.

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"

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THIRD YEAR-Semester – VI
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electrical Machine Design	EE - 6051	0L-0T-2P	2

List of Practical

1 Introduction to laboratory measuring instruments and their application

2 To Understand the Name plate Data of Electrical Machines

3 To demonstrate construction and working of DC Machines and their Functional Details

4 To demonstrate the constructional part and working principal of AC Motor

5 Earth leakage circuit breaker (ELCB)

6 Transformer oil insulation test

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THIRD YEAR-Semester – VI
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electrical Power generation	EE - 6061	0L-0T-2P	2

List of Practical

1 Study and working of various Equipments used in Diesel power plant

2 Study and working of various Equipments used in Nuclear power plant

3 Study of Substation layout and equipments used in substations

4 To study of gas power plant

5 To study about economics of power generation systems

6 To study of different types of steam turbines

7 To study about different types of condensers and cooling towers.

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Power System Analysis & Control	EE - 7011	2L-1T-1P	4

Course Outcomes:

CO1 **An understanding** of operational constraints (equipment and stability), control objectives and their implementation, under normal and abnormal states of a power system

CO2 **Create** computational models for analysis power systems and able to understand per unit system

CO3 **Perform** load flow computations and analyze the load flow results, power system operation and stability control.

CO4 **Analyse** a power system network under Symmetrical Conditions, Understand Positive Sequence, Negative & zero sequence systemand fault analysis

Course Contents

UNIT I

INTRODUCTION:-

Necessity for voltage and frequency regulation of power system-p-f and Q-v control loops-recent trends in real time control of power system-Introduction to load dispatching, load forecasting, unit commitment, Loadshedding and Islanding.

UNIT II

FREQUENCY CONTROL:-

Plant and system level control-mathematical model of speed governing system-speed load characteristics

regulation of two generators in parallel-concept of control area-LFC control of a single area system-static and dynamic response of uncontrolled and controlled system-LFC of two area system- static and dynamic response of uncontrolled system-tie line with frequency bias control of two area system.

UNIT III

VOLTAGE CONTROL

Types of Excitation system-Characteristics of excitation systems-block diagram of excitation system-Static and Dynamic analysis- Methods of voltage control: OLTC, synchronous condenser, SVC, Shunt capacitor- Power system level voltage control using tap changing transformer (simple problems)

UNIT IV

ECONOMIC DISPATCH AND UNIT COMMITMENT:-

Incremental cost curve-co-ordination equations without loss-solution by Lambda iteration method-coordination equations with loss-solution of co-ordination equations using Bmn co-efficient (no derivation) –base point and participation factors. Unit commitment(UC) problem-constraints in UC-

Solution methods-Priority list methods(Numerical problems) Economic dispatch controller added to load frequency control.

UNIT V

COMPUTER CONTROL OF POWER SYSTEM:-

Energy control center-various levels-national, regional and state level-SCADA system-computer configuration functions- monitoring, data acquisition and controls-EMS system-System operating states: Normal, Alert, Emergency, nextremis, Restorative-Control strategies.

TEXT BOOKS:

1. Olle.I.Elgerd, Electric energy systems theory-An introduction, Tata McGraw Hill publishing company,New Delhi, 2003.
2. Allen J.Wood, Bruce F. Woollenberg, Power generation operation and control, John Wiley and sons,2003.
3. Kundur.P., Power system stability and control, McGraw Hill publishing company, 1994.
4. Mahalanabis A.K., Kothari.D.P., and Ahson.S.I., Computer aided power system analysis and control,Tata
McGraw Hill publishing company, New Delhi, 1999.
5. Nagrath I.J and Kothari D. P. Power System Engineering, Tata McGraw Hill Publishing Company,New
Delhi, 1994.

List of Experiments:

1. MATLAB PROGRAM TO FIND OPTIMUM LOADING OF GENERATORS WITH PENALTY FACTORS
2. SIMULINK MODEL OF SINGLE AREA LOAD FREQUENCY CONTROL WITH AND WITHOUT PI CONTROLLER AND WITHOUT PI CONTROLLER IN SIMULINK
3. SIMULINK MODEL FOR TWO AREA LOAD FREQUENCY CONTROL
4. SIMULINK MODEL FOR EVALUATING TRANSIENT STABILITY OF SINGLE MACHINE CONNECTED TO INFINITE BUS

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electrical drives	EE - 7021	3L-1T-0P	4

Course Outcomes:

CO1 Acquire detailed knowledge of DC Shunt and Series motor operation using Generalised machine theory

CO2 Develop capability to arrive at different analytical models –large signal and small signal models – for a motor-drive combination and to develop capability to use the models to arrive at time-domain and frequency-domain responses

CO3 Acquire detailed knowledge on AC-DC Converters and DC-DC Converters and their modeling for steady-sate and transient

CO4 Develop design knowledge on how to design the speed control and current control loops of a DC Motor drive

Course Contents

UNIT-I

Control of D.C. motors by converters:-

Introduction to Thruster 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 currentoperation, Output voltage and current waveforms, Speed and Torque expression, Speed-Torque characteristics, Problems on converter fed d.c. motors. Losses in electrical drive system, Energy conservationin electric drives.

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 loopoperation of DC motor (Block diagram only)Control of D.C. Motors by Choppers:-Single quadrant, Twoquadrant 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, Variablefrequency control of induction motor by Voltage Source, Current Source inverters and cycloconverters, 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-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 advantages application- 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 McGraw 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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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Power Electronics	EX - 7031	4L-0T-P	4

Course Outcomes:

CO1 Learn basic operation of various power semiconductor devices & understand basic principle of switching circuits.

CO2 Analyze and design an AC/DC rectifier circuit & DC/DC converter circuits

CO3 Analyze DC/AC inverter circuit

CO4 Understand the role power electronics in the improvement of energy usage efficiency and demonstrate the development of renewable energy technologies.

Course Contents

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. VedamSubramaniam, Power Electronics, New Age International (P) Publishers Ltd., 2000.

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electrical Drives	EE - 7041	0L-0T-2P	2

List of Practical

1 Study of thyristors controlled DC Drive

2 Study of Chopper fed DC Drive

3 PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software.

4 VSI / CSI fed Induction motor Drive analysis using MATLAB / SPICE / PSIM Software

5 Study of V/f control operation of 3phase induction motor drive.

6 Regenerative / Dynamic braking operation for DC Motor - Study uses software.

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Power electronics	EE - 7051	0L-0T-2P	2

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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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Power System Protection	EE - 8011	2L-1T-1P	4

Course Outcomes:

CO1 Acquire the knowledge of various abnormal conditions that could occur in power system

CO2 Ability to design various protective devices in power system for protecting equipment and personnel.

CO3 Knowledge of various types of existing circuit breakers, their design and constructional details.Knowledge of various conventional relays, their design and latest developments.

CO4 To Learn standards and specifications related to switchgear and protection

Course Contents

UNIT-I

Fault Analysis:-

Faults in power systems, single line diagram, equivalent impedance diagram, per unit reactances. Analysis (using matrices) of power systems by symmetrical components under:
(a) Three phase short circuit.
(b) Line to line fault.
(c) Line to ground fault.
(d) Double line to ground fault.
Sequence networks and their inter connections for different types of faults, effects of fault impedance. Current Limiting Reactors: Applications, types, construction and location of current limiting reactors, short circuit calculation using reactors.

UNIT-II

Relays :-

General considerations, sensing of faults, construction of electro-magnetic attraction and induction types relays, Buchholz and negative sequence relay, concept of reset, pick up, inverse time and definite time characteristics, over current , over voltage, directional, differential and distance relays on R-X diagram. Static Relays: Introduction, advantage and limitation of static relays, static over current, directional, distance and differential relays.

UNIT-III

Protection:-

Types & detection of faults and their effects, alternator protection scheme (stator, rotor, reverse power protection etc.). Power transformer protection (external and internal faults protection), generator-transformer unit protection scheme, bus bar protection. Transmission line protection (current/time grading, distance), Pilot relaying schemes, power line carrier protection.

UNIT-IV

Switchgear:-

Theory of current interruption- energy balance and recovery rate theory, arc quenching, recovery and restricting voltages. Types of circuit breakers.bulk oil and minimum oil, air break and air blast, sculpture hexafluride (SF6) and vacuum circuit breakers. Rating selection and testing of circuit breakers/operating mechanisms. LT switchgear, HRC fuses, types construction and applications.

List of Experiments

1 STUDY OF CHARACTERISTICS OF IMDT OVER CURRENT RELAY

2 To learn code of making Y-bus matrix in MATLAB

3 STUDY AND TESTING OF UNDER VOLTAGE RELAY

4 STUDY AND TESTING OF OVER VOLTAGE RELAY

5 RELAY COORDINATION IN RADIAL FEEDER PROTECTION SCHEME

6 RELAY COORDINATION IN PARALLEL FEEDER PROTECTION SCHEME

7 To perform symmetrical and asymmetrical fault analysis in a power system

8 DIFFERENTIAL PROTECTION OF GENERATOR USING ELECTROSTATIC RELAY

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Computer application to power system	EE-8021	3L-1T-0P	4

Course Outcomes:

CO1 After undergoing this subject, the students shall be able to model, analyze the power system in the study state

CO2 The students can also apply the contingencies arising in the system under different conditions

CO3 The state estimation from line measurements can also be done by the students..

CO4 To understand the basic power system instrumentation technologies and principles

Course Contents

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 loadability of transmission lines.

UNIT – III

Sensitivity analysis- General sensitivity relations, generation shift distribution factors, line outage distribution factors, compensated shift factors, sensitivity associated with voltageVAR, 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 postcontingency, 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. Computer Techniques in Power Systems Analysis- Pai M.A. Tata Mc Graw Hill.
3. Computer Modeling of Electrical Power Systems, Arrillaga J. Arnord C.P Harker B.J. John Wiley &Son
4. Computer Aided Power Systems Analysis Kusic G.L.- 2nd Edition, CRC Press
5. Modern Power Systems Analysis Nagrath I.J. and Kothari D.P. Tata Mc Graw Hill
6. Power System Analysis Grainger J.J. & Stevnson W.D. Mc Graw Hill
7. Power System Stability and control -P Kundur ,IEEE Press 1994.•
8. Advance Power Systems Analysis and Dynamics Singh L.P. JohnWiley.
9. Chakrabarti –Power System Analysis operation & Control – PHI Learning

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FOURTH YEAR-Semester – VIII
Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	High voltage Engineering	EE-8031	3L-0T-0P	3

Course Outcomes:

CO1 Design and development of high voltage equipments and utility establishment.

CO2 Analyze and measure the magnitude of HVDC, HVAC (power frequency & high frequency) and impulse by different measurement schemes.

CO3 Conduct high voltage test of materials and apparatus

CO4 Evaluate the form of discharges in Gaseous, Liquid and Solid dielectrics.

Course Contents

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:-

Breakdownin Gases: Elementary ideasonionizationby electron collision, Townsend mechanism, Townsend firstand second ionization coefficients, Paschen law, breakdownin non-uniform fieldsand corona discharges, vacuum breakdown mechanisms,

Breakdownin liquid:,fundamentalsof insulating oils, conductionandbreakdownin pureand commercial liquids.

Breakdownin Solids: Fundamentalsof solid insulating materials intrinsic, electromechanicaland thermal breakdown, breakdowninsimpleand composite dielectrics, typesof insulating materials, temperature classification, factor affecting dielectric strength, insulation designof rotating machines, transformers, transmission lines, Switch gear, etc.

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.

References:

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 Easternlimited, 1987
5. Transmission and distribution reference book-Westing House.C.L.Wadhwa, High voltage engineering, New Age International Private limited, 1995.

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Computer application to power system	EE - 8041	0L-0T-3P	3

LIST OF EXPERIMENTS

1.Fault analysis and verify the results using MATLAB or any available software for thecases: (i) LG Fault (ii) LLG Fault (iii) LL Fault and (iv) 3 -Phase Fault.

2.Load flow analysis for a given system (for 3 to 6 bus) using (i) Gauss Seidal (ii) Newton Raphson (iii) Fast Decoupled Method and verify results using MATLAB or any available software.

3. Study of voltage security analysis.

4. Study of economic load dispatch problem with different methods.

5. Study of transient stability analysis using MATLAB/ETAP Software.