R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – III

Course Content

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

Course Outcomes: After studying this course, students will be able to,

CO1-Convey a clear idea of use of renewable and non-renewable energy sources, its impact on environment. The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk and its effect on ecosystem.
CO2-Ability to understand environmental laws and regulations to develop guidelines, procedures and processes for health and safety issues due to air pollution and sound pollution.
CO3-Ability to understand environmental laws and regulations to develop guidelines, procedures and processes for health and safety issues due to water pollution
CO4-Understand what are professional ethics and how do ethics affect the outcomes of environmental laws and regulations.
CO5-Understanding the basic and causes of climate and weather change, global warming, climate variability

Unit –I

Energy- Sources of Energy : Renewable & Non Renewable, Fossil fuel, Biomass Geothermal, Hydrogen, Solar, Wind, hydal, nuclear sources.
Ecosystem – Segments of Environment: Atmosphere, hydrosphere, Lithosphere, biosphere. Cycles in Ecosystem – Water, Carbon, Nitrogen. Biodiversity: Threats and conservation,

Unit –II

Air Pollution & Sound Pollution - Air Pollution: Air pollutants, classification, (Primary & secondary Pollutants) Adverse effects of pollutants. Causes of Air pollution chemical, photochemical, Green house effect, ozone layer depletion, acid Rain. Sound Pollution: Causes, controlling measures, measurement of sound pollution (deciblage), Industrial and non – industrial.

Unit –III

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 –IV

Society, Ethics & Human values– Impact of waste on society. Solid waste management (Nuclear, Thermal, Plastic, medical, Agriculture, domestic and e-waste). Ethics and moral values, ethical situations, objectives of ethics and its study . Preliminary studies regarding Environmental Protection Acts , introduction to value education, self exploration, sanyam & swasthya.

Unit –V

Basics of climate and weather, global warming, climate variability;

Causes of climate change – natural and anthropogenic, greenhouse gases, carbon cycle;
Mitigation strategies – renewable energy, energy efficiency, afforestation and reforestation, carbon capture utilization and storage (CCUS), sustainable practices;
Adaptation strategies – climate-resilient infrastructure, agriculture adaptation, water management, disaster risk reduction;
Policies and global efforts – UNFCCC, IPCC, COP summits, Paris Agreement, Kyoto Protocol;
India's initiatives – National Action Plan on Climate Change (NAPCC), State Action Plans on Climate Change (SAPCC), green economy measures;
Sustainable Development Goals (SDGs) and climate action.

References:-

1. Harris, CE, Prichard MS, Rabin's MJ, "Engineering Ethics"; Cengage Pub.
2. Rana SVS ; "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.
7. Bala Krishnamoorthy; "Environmental management"; PHI
8. Gerard Kiely, "Environmental Engineering" ; TMH
9. Miller GT JR; living in the Environment Thomson/cengage
10. Cunninghan WP and MA; principles of Environment Sc; TMH
11. Pandey, S.N. & Mishra, S.P. Environment & Ecology, 2011, Ane Books , Pvt. Ltd, New Delhi
12. Joseph, B. Environmental Studies, 2009 Tata Mcgraw Hill, Edu India Ltd. New Delhi.
13. Gour R.R, Sangal, R &Bagaria, G.P. , Excel Books, A-45, Naraina Pilovepdf_merged.pdfPage 118hase-I ,New Delhi.- 110028

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Semester – III

Course Content

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

Course Outcomes:

CO1 Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields (Field intensity, Flux density etc.) in different media using the fundamental laws.

CO2 Solve Laplace‟s &Poisson‟s equations, solution of Laplace‟s equation.

CO3 Determine the electromagnetic force exerted on charged particles, current elements, working principle of various electric and electromagnetic energy conversion devices are based on this force.

CO4 Deduce and justify the concepts of electromagnetic waves, means of transporting energy or information, in the form of radio waves, TV signals, radar beams and light rays.

CO5 Explain Biot-Savart‟slaw, Faraday‟s Law

Course Contents:

UNIT-I

STATIC ELECTRIC FIELD

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 ANDCAPACITANCE

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‟slaw, 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, Sinusoidal 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 pointing 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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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 To introduce the fundamental concepts and working principle of JT, JFET, FET, MOSFET

CO2 To study the devices under low frequency for small signal.

CO3 To design amplifiers under different configurations and study their parameters.

CO4 To know the switching characteristics of components.

CO5 Describe and classify semiconductor devices for special applications. Learn fundamental mechanisms of electrical conduction in 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.

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.

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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 EXPERIMENTS (EXPANDABLE):

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

TEXT BOOKS

1. Nashelsky & Boysted; Electronic Devices and Circuits; PHI
2. Millman Halkias; Electronic Devices and Circuits; McGraw- Hill
3. Achuthan MA and Bhatt KN; Fundamentals of semiconductor devices; TMH
4. Neamen Donald; Semiconductor Physics and devices
5. Millman & Grabel; Micro Electronics; McGraw-Hill
6. Bogart; Electronic Devices and Circuits; Universal Book Stall, NDelhi
7. Millman & Halkias; Integrated Electronics; McGraw- Hill.

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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** Introduction to LLBP circuit elements R,L,C
- **CO2** Perform the experiments on Network Theorems – Thevenins & Norton‟s theorem, superposition, reciprocity, compensation, maximum power transfer and Millman‟s theorem
- **CO3** Concept of phasor & vector, impedance & admittance. Node & mesh analysis of RL,RC and RLC networks with sinusoidal and other driving sources
- **CO4** Analyze the response of Step, Ramp, Impulse, Sinusoidal, Co-sinusoidal, Exponential, and Gate signals. Solve the Laplace Transform and Inverse Laplace Transform.
- **CO5** Solve the two port network analysis.

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 Integra 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 experiments (Expandable):

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

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. Decarlolin; Linear circuit Analysis; Oxford
8. William D Stanley : Network Analysis with Applications, Pearson Education
9. Roy ChoudharyD; Network and systems; New Age Pub
10. Charles K. Alexander &Matthew N.O. Sadiku: Electrical Circuits: TMH
11. Chakraborti: Circuit theory: Dhanpa tRai
12. B.Chattopadhyay & P.C.Rakshit; Fundamental of Electrical circuit theory; S Chand
13. Nilson &Riedel , Electric circuits; Pearson

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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.
- **CO4** Understand the need for them as engineers and responsible citizens to use their professional knowledge and skills for the alleviation such problems
- **CO5** 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

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

Chapter6

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

Chapter7

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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Semester – III

Course Content

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

Course Outcomes:

CO1 To understand basic knowledge of machine tools and symbols.

CO2 To Learn about domestic wirings

CO3 To Learn about domestic equipment‟s

CO4 To Learn about circuit of SMPs and measuring instruments

CO5 To Learn about fuses MCBs and importance of earthling

LIST OF EXPERIMENTS

1. Introduction of Tools, Electrical Materials, Symbols And Abbreviations.
2. To Study Stair Case Wiring.
3. To Study House Wiring I.E, Batten, Cleat, Casing-Caping And Conduit Wirings.
4. To Study Fluorescent Tube Light.
5. To Study Circuit Of SMPs.
6. To Study Moving Iron, Moving Coil, Electrodynamics And Induction Type Meter.
7. To Study Circuit And Working Of Ups.
8. To Study Circuit And Working Of Home Inverter.
9. To Study Fuses MCBs And Importance of Earthling.

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Semester – IV

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Engineering Mathematics-III	BE- 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.

CO2 Expand the function in Fourier series and half range. Also Find Fourier transform and Fourier Integral and solve Integral equations.

CO3 Analyse solutions of partial differential equations and solve the initial value and boundary value problems. Extremis the functional and also solve Isoperimetric problems.

CO4 Identify, formulate and solve engineering problems.

CO5 Understand and apply the concept of probability distribution to engineering problems

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).

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 :

1) Higher Engineering Mathematics by BS Grewal, Khanna Publication
2) Advance Engineering Mathematics by D.G.Guffy
3) Mathematics for Engineers by S.Arumungam, SCITECH Publuication
4) Engineering Mathematics by S SSastri. P.H.I.
5) Numerical Methods for Scientific and Engg. Computation by MKJain, Iyengar and RK Jain, New Age International Publication
6) Mathematical Methods by KV SuryanarayanRao, SCITECH Publuication
7) Pobability and Statistics by Ravichandran, Wiley India
8) Mathematical Statistics by George R., Springer

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Semester – IV

Course Content

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

Course Outcomes:

CO1 Understand AC operation of magnetic circuits & losses. Field energy & mechanical force Single and Multiple excited systems. MMF , Generated voltage Torque.

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 of operation of DC motors, Back emf ,Torque equation, Torque characteristics, Starting. Different types of point starters.

CO4 Understand the principle, construction, connections, , operation and testing of single and 3-phase transformer, their cooling, maintenance & heat run tests

CO5 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 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 Langsdorf (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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Semester – IV

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Analog & Digital Communication	EE - 4031	4L-0T-2P	6

Course Outcomes:

CO1 Knowledge to analyze energy and power spectral density of the signal.

CO2 Analyse the various Analog and Digital Modulation and Transmission Techniques.

CO3 Describe data and pulse communication systems.

CO4 Demonstrate various digital communication techniques

CO5 Design and implement error control coding schemes.

Course Contents:

UNIT-I

Time domain and frequency domain representation of signal, Fourier Transform and its properties, Transform of Gate, Periodic gate, Impulse periodic impulse sine and cosine wave, Concept of energy density and power density (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 low pass filter, Correlation & Autocorrelation.

UNIT- II

Base band signal, need of modulation, Introduction of modulations techniques, Amplitude modulation, Equation and its frequency domain representation, Bandwidth, Power distribution. AM suppressed carrier waveform equation and frequency domain representation Generation (Balance/Chopper modulator) and synchronous detection technique, errors in synchronous detection, Introduction to SSB and VSB Transmission Angle modulation, 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, Digital signal, Quantization, Quantization error, Pulse code modulation, signal to noise ratio, Commanding, Data rate and Baud rate, Bit rate, multiplexed PCM signal, Differential PCM (DPCM), Delta Modulation (DM) and Adaptive 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 quadrature phase shift keying (QPSK), M-Ary PSK, Binary frequency Shift Keying(BFSK), M-Ary FSK Quadrature Amplitude modulation (QAM), MODEM, Introduction to probability of error.

UNIT- V

Information theory and coding- Information, entropies (Marginal and conditional), Model of a communication system, Mathematical representation of source, channel and receiver characteristics, Mutual information, channel capacity 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-BW trade off)Source encoding code properties; Shanon, Fano and Huffman coding methods and their efficiency error control coding, Minimum Hamming distance, Linear Block Code, Cyclic code and convolution codes. Line Encoding: 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.

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.7. R.H.Gour; Digital Electronics and Micro Computer - (DhanpatRai)

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Semester – IV

Course Content

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

Course Outcomes:

CO1 Learning how to draw the shapes, angels and lines and others which is essential for engineer.

CO2 The ability to read and understand information contained on drawings is essential to perform most engineering-related jobs

CO3 Engineering drawings are the industry‟s means of communicating detailed and accurate information on how to fabricate, assemble, troubleshoot, repair, and operate a piece of equipment or a system

CO4 Learning the main idea from assembly and detail drawing

CO5 Technical drawing is essential for communicating ideas in industry and engineering. To make the drawings easier to understand, people use familiar symbols, perspectives, units of measurement, notation systems, visual styles, and page layout. Technical drawings are understood to have one intended meaning.

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, commentator and its details.

UNIT-V

Sketches of transmission line structures, types of towers, insulating equipment‟s, single line diagram of power Sub-station.

List of Practical

1. Using basic AutoCAD drawing commands (line, circle, rectangle, etc.) and Editing commands (erase, copy, move, trim, extend, etc.).
2. Draw common electrical symbols like resistors, capacitors, inductors, switches, and lights.
3. Design conduit and cable routes for wiring systems.
4. Design for electric motors, types of transformer and their parts.
5. Design for single line diagram of power Sub-station.

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

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Semester – IV

Course Content

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

Course Outcomes:

CO1 Understand the concepts of power systems.

CO2 Understand the operation of conventional generating stations and renewable sources of electrical power.

CO3 Evaluate the power tariff methods.

CO4 Determine the electrical circuit parameters of transmission lines

CO5 Understand the layout of substation and underground cables and corona.

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 systems 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 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.

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

List of Experiment Subject-

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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Semester – IV

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	**Simulation Lab-I**	**EE-4061**	**0L-0T-2P**	**2**

Course Outcomes:

CO1 Analyze the generation Various Signals and Sequences in MATLAB, including the operations on Signals and Sequences.

CO2 Verification of Sampling Theorem, Linearity and Time Invariance Properties of a given Signals/ Systems.

CO3 Analyze the Fourier Transform of a given signal and plotting its magnitude and phase spectrum and also plot Pole-Zero Maps in Z-Plane.

CO4 Analyze and design various combinational using VHDL like Adder, Subtractor, Multiplexers, etc

CO5 Analyze and design various sequential circuits using VHDL like Flip flop, Counters, etc..

List of Experiments

1. Basic Operations on Matrices
2. Write a program for finding the even and odd parts of the signal / sequence and real and Imaginary parts of the signal.
3. Write a program to perform operations like addition, multiplication, scaling, shifting, and folding on signals and sequences and computation of energy and average power
4. Write a program to perform convolution between signals and sequences.
5. Write a program for verification of linearity and time invariance properties of a given continuous/discrete system
6. Write a program to find the Fourier transform of a given signal and plotting its magnitude and Phase spectrum.
7. Write a program for locating the zeros and poles and plotting the pole-zero maps in Z-plane for the given transfer function
8. Write a program for sampling theorem verification.

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Semester – V

Course Content

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

Course Outcomes:

CO1 Acquire knowledge about the constructional details and principle of operation of three phase and single phase induction motors.

CO2 Acquire knowledge about the starting and speed control of induction motors

CO3 Acquire knowledge about the constructional details and principle of operation of synchronous machines.

CO4 Acquire knowledge about testing and applications of Salient pole machines

CO5 Acquire knowledge about the working of synchronous machines as motors.

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; poly phase 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 synchronizing torque coefficient; synchroscopes and phase sequence indicator; effect of varying excitation and mechanical torque,.

UNIT-V

SYNCHRONOUS MACHINE-III

Synchronous motor operation, starting and stopping of synchronous motor, pull in torque, motor under load power and torque, reluctance torque, effect of excitation, effect of armature reaction, power factor adjustment, V curves, inverted V curves, synchronous motors as power factor correcting device, super synchronous and sub synchronous motors, hunting and damper winding efficiency and losses. Analysis of short circuit oscillogram, determination of various transient, sub transient and steady reactance 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.

Reference Books:

M.G. Say, Performance & design of AC machines, CBS publishers & distributors, Delhi, 3rdedition

A.E. Clayton & N.N. Nancock, The Performance & design of DC machines CBS publications & distributors, Delhi, 3rd edition

P.S. Bhimbra, Electrical Machinery, KhannaPub.

P.S. Bhimbra, Generalized theory of Electrical Machines, Khanna publishers,Delhi,

Ashfaq Husain, Electric Machines, DhanpatRai, NewDelhi

I.J. Nagrath& D.P. Kothari, Electric Machines, Tata McGraw Hill , NewDelhi,

Syed A. Nasar,Electric Machines & Power Systems, Volume I , Tata McGraw Hill, NewDelhi

A. E. Fitzerald, C. Kingsley & S.D. Umans , Electric Machinery Tata McGraw Hill ,New Delhi ,5th edition.

List of Experiments (Expandable)

To plot magnetization characteristic of a separately excited DC generator

To perform load test on DC generators.

To perform load test on DC series and shunt motor

To perform Swinburne‟s test on a DC machine and find out its efficiency under full load condition.

To conduct Hopkinson‟s test on a pair of DC shunt machine.

To perform OCC and SCC test on an alternator and determine its regulation.

To determine regulation of alternator using mmf and zpf methods.

To synchronise alternator with infinite busbar.

To plot V and inverted V curves for a synchronous motor

To find Xd and Xq of salient pole synchronous machine by slip test.

To determine negative sequence and zero sequence reactance of an alternator.

To determine sub transient direct axis and quadrature axis synchronous reactance of salient pole machine.

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Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	SIGNALS & SYSTEMS	EE-5021	3L-1T-2P	6

Course Outcomes:

CO1 Understand mathematical description and representation of continuous and discrete time signals and systems.

CO2 Understand and resolve the signals in frequency domain using Fourier series.

CO3 Understand and resolve the signals in frequency domain using 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

CO5 Comprehend the effects of sampling on a continuous time signal.

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 Z Transform for 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, sampling of discrete-time signals.

References:

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.

1. Study the relationship between the Z-transform and Laplace transform.
2. Experiment with various sampling rates to understand the limitations imposed by sampling theorem.
3. Perform Fourier analysis of signals to analyze their frequency content.
4. Show how to obtain amplitude and phase information from the Fourier transform.

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Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Energy Conservation Management	EE- 5031(A)	4L-0T-0P	4

Course Outcomes:

CO1 Acquire the knowledge of basic principles of energy auditing, types and objectives, Instruments used.

CO2 To learn the Energy conservation measures and optimal operation methods for electric load

CO3 Analyze the economic aspects for energy conservation

CO4 To learn energy efficient control methods and schemes for improvement of starting efficiency in electrical motors

CO5 Acquire the knowledge of different types and schemes of cogeneration.

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 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 Butlerworths.
2. Energy Management Head Book- W.C. Turner, JohnWiley
3. Energy Management Principles- Craig B. Smith, PergamonPress
4. Energy Conservation- Paul O Callagan- PergamonPress
5. Design & Management of energy conservation.Callaghan,
6. Elect, Energy Utilization & Conservation. Dr. TripathiS.C.,

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Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Applied Instrumentation	EE- 5031(B)	4L-0T-0P	4

Course Outcomes:

CO1 Identify various types of electronic instrument suitable for specific measurement.

CO2 Elucidate the working and application of several AC bridges for inductance and capacitance

CO3 Comprehend different types of signal generators and analyzers, their construction and operation.

CO4 Exhibit the knowledge of working principle and applications of various electronic instruments

CO5 Identify various types of Signal generator

Course Contents:

UNIT-I

Introduction to measurement: Definition, application and types of measurement System Introduction to CRO, Different parts of CRO, Its Block diagram, Electrostatic focusing, Electrostatic deflection, post deflection acceleration, Screen for CRTs, Graticule, Vertical & Horizontal deflection system, Time base circuit, Oscilloscope probes and transducers, Attenuators, Application of CROs, Lissajous patterns, Special purpose CROs Multi input, Dual trace, Dual beam, Sampling, Storage (Analog & Digital) Oscilloscopes.

UNIT-II

R, L, C Measurement: Bridges: Measurement of resistance using Measurement of inductance and capacitance by A.C. bridges: Maxwell‟s bridge, Anderson bridge, Schering bridge, Hay‟sbridge, Wein‟s bridge, Shielding and grounding, Q meter.

UNIT-III

Non Electrical Quantities (Transducer): Classification of Transducers, Strain gauge, Displacement Transducer Linear Variable Differential Transformer (LVDT) and Rotary Variable Differential Transformer (RVDT), Temperature Transducer Resistance Temperature Detector (RTD), Thermistor, Thermocouple, Piezoelectric transducer, Photo emissive, Photo conductive, Photo voltaic, Photodiode, Photo Transistor, Nuclear Radiation Detector.

UNIT-IV

Digital instruments: Advantages of digital instruments, Over analog instruments, DA, AD conversion, Digital voltmeter, Ramp type DVM, Integrating DVM, successive approximation DVM, frequency meter. Display devices: Digital display system and indicators like CRT, LED, LCD, Nixies, Electro luminescent, Incandescent, Electrophoretic image display, Liquid vapour display dotmatrix display, Analog recorders, XY recorders. Instruments used in computer controlled instrumentation RS 232C and IEEE 488, GPIB electric interface.

UNIT-V

Signal generator: Function generator, sweep frequency generator, Pulse and square wave generator, Wave Analysers, Harmonic Distortion Analyser, Spectrum Analyser, frequency counter.

References Books:

1. John P. Bentley : Principles of measurement systems, Longman 1983
2. Johnson C.D: Process control instrumentation technology, 4/e, PHI, 1995
3. D.Patranabis : Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd. New Delhi, 1999
4. Sheingold D. H.: Transducer interfacing hand book – a guide to analog signal conditioning, analog devices Inc masschusetts, 1980.
5. Anderson N A : Instrumentation for process measurement and control :Chilton book company 1980.
6. H. S. Kalsi: Electronics Instrumentation, TMH.
7. K. Sawhney: Instrumentation and Measurements, Dhanpat Rai and Co.

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Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Renewable Power Generation	EE- 5031(C)	4L-0T-0P	4

Course Outcome:

CO1 The fundamental concepts of power generation and gain enough knowledge about the wind energy source.

CO2 The key aspects in the design and operation of photovoltaic power energy systems.

CO3 The construction, principle of operation of Hydro Power used in power generation

CO4 The construction, principle of operation of Nuclear Power used in power generation

CO5 The construction, principle of operation of Wind Energy Resource used in power generation

Course Contents:

UNIT-I

Solar Power: Introduction, Solar Photovoltaic, History and projection, Advantage & disadvantage of Photovoltaic Systems, Application of Photovoltaic Systems, Overview of SPV programme in India, Solar potential, solar mission of GoI, Role of MNRE, IREDA etc., Energy from Sun, Insolation available on earth; Global Radiation distribution on an inclined plane.

UNIT-II

Solar Photovoltaic: Basic principle of power generation in a PV cell; Band gap and efficiency of PV cells; Component of PV System, Solar Cells; Types; Working; I-V characteristics; losses. Solar PV panel; Balance of Systems; Fabrications of Modules; Economics of PV Systems; Future prospects; Applications of Photovoltaic: Domestic lighting Systems; Remote Applications; Hybrid; Grid linked PV Systems.

UNIT-III

Hydro Power: Potential, Hydropower Generation and Distribution, Mini and Microhydel Power (MHP) Generation: Classification of hydel plants, Concept of micro hydel, merits, MHP plants: Components, design and layout, Turbines - Classification and selection criteria, efficiency and performance characteristics, Status in India. Integrated Energy systems and their cost benefit analysis; case studies of hydro power plants

UNIT-IV

Nuclear Power:Introduction, General Components of Nuclear Reactor, General Problems of Reactor Operation, Different Types of Reactors, Pressurised Water Reactors (PWR), Boiling Water Reactors (BWR), Gas-cooled Reactors, Breeder Reactors, Reactor Containment Design, Location of Nuclear Power Plant, Nuclear Power Station in India, India‟s 3-stage Programme for Nuclear Power Development; Peaceful application of Nuclear Energy –Power Generation and Isotope application; case studies of Nuclear power plants.

UNIT-V

The Wind Energy Resource Nature of atmospheric winds; wind resource characteristics and assessment; anemometry; wind statistics; speed frequency distribution, effect of height, wind rose, Weibull distribution, atmospheric turbulence, gust wind speed, effect of topography

References:

1. Solar Energy fundamentals & applications; by H.P. Garg, J Prakash
2. Solar Energy Technologies; by Chetan Solanki, IIT, Bombay
3. M.M. E1-Wakil: Nuclear Power Engineering, McGraw Hill, 1962.
4. 8. R.L. Murray: Introduction to Nuclear Engineering, Prentics Hall, 1961.
5. Paul Gipe, wind Energy Comes of Age, John Wiley & Sons Inc.

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Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	SWAYAM/NPTEL-MOOC-1	EE- 5031(D)	4L-0T-0P	4

Guideline

SWAYAM/NPTEL-MOOC-I courses is a programme initiated by Government of India and designed to achieve the three cardinal principles of education via, access, equity and quality. The objective of this effort is to take the best teaching resources to all, including the most disadvantaged SWAYAM seeks to bridge divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

Courses delivered through SWAYAM/NPTEL-MOOC courses are available free of cost to the learners, however learns wanting SWAYAM/NPTEL-MOOC courses Certificate should register for the final proctoral exams that come at a fee and attend in-person at designated center on specified dates.

In perspective of the need to create synergist between the salient features of „anytime anywhere format of e-learning and traditional classrooms chalk and talk method to develop a unique content delivery mechanism which is responsive to learners‟ needs and ensuring seamless transfer of knowledge across geographical boundaries. RKDF University proposes to incorporate MOOC courses delivered by SWAYAM/NEPTEL portal. Student can opt any courses from SWAYAM/NPTEL-MOOC courses as an elective Base on following condition

1. He/She has consulted and inform to the departmental coordinator regarding courses selection and mark obtain to him. No Subjected should be repeat from courses which is offer and courses which are selected.

2. He/She can opt from only courses which are not available from University.

3. Only enrollments in the courses and learning from it is free as this is a project supported by MHRD GOI.

4. To get Certificate from SWAYAM-NPTEL. The learner has to separately register and appear for a proctored exam at a fee as decided by host institution/Mooc of Rs. 1000/-Which be bearded by Student only.

5. If student successful appear in exam and obtain certificated of courses of 12 week course to earn 3 credits(As recommended by NPTEL) to suffice for required credit for the award of his/her degree.

6. The NPTEL recommended that an additional 1 credit may be awarded given by University. This credited can be given based on attendances, assignment and tuitorial work submitted by the students.

7. All students would be motived to take courses online with SWAYAM/NPTEL every semester to better prepared for the future so that they can cultivate the habilt of self-study online. The University propose to implement MOOC courses under Department. The University also made provision if student unable to get certificate He/She still be able to appear in the department elective courses and complete there degree

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Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Industrial Electronics	EE- 5041(A)	4L-0T-0P	4

Course Outcomes

CO1 Learn about the latest electronic devices available in industry.

CO2 Be able to effectively provide detailed explanation to the structure and operation of common linear components.

CO3 Learn about the digital ICs and sensory electronic devices.

CO4 Apply critical thinking in solving industrial electronic problems.

CO5 Will gain some experience with operational amplifiers.

Course Contents:

UNIT-I

Semiconductor Switching Devices: Review of Thyristor, two transistor Model of SCR, classification and V-I characteristics, junction temperature, gate circuit ratings, triggering process, UJT and characteristics, UJT as a relaxation oscillator, turn off methods, fast recovery diodes, schottky diodes, Series and parallel connections of SCR, DIAC, TRIAC, Power MOSFETS.

UNIT-II

Power Rectification: Classification of rectifiers, half, full, three-phase rectifier, semi converters, full converters, freewheeling diodes, circuits using SCR, voltage multiplying rectifier circuits, transformer utility factor. Regulated Power Supplies Classification of voltage regulators, short period and long period accuracy of voltage regulator, D.C. voltage regulators, complete series voltage regulator circuit with ICs, SMPS basic principles, step up and step down circuits.

UNIT-III

Inverters: Introduction, simple Inverters and Power Inverter using SCR, output voltage control in inverter waveform control, PWM inverters, reduction of harmonies with the help of PWM inverters. Industrial Timing Circuits Constituents of industrial timers, classifications, thermal timers, Electronic timers, SCR delay timer, I.C. electronic timers.

UNIT-IV

Electronic Control of D.C. Motors: introduction, control of D.C. shunt motor, full wave D.C. shunt motor control overload projection, universal motor control, electronic control for reversing motor control using SCR, choppers, their classifications and applications.

UNIT-V

Electronic Control of A.C. Motors: Instability of D.C. motors, variable speed induction motor drives, T.N. characteristics of I.M. invertors for driving the motor, speed control of I.M. using various methods, cyclo-converters, their classifications and applications.

References:

1. Rashid M H, “Power electronics”, 2nd Ed., PHI, N.Delhi (1998).
2. Mithal G K, “Industrial electronics”, 18th Ed., Khanna Publishers, Delhi (1998).
3. Biswas S N, “Industrial electronics”, 3rd Ed., Dhanpat Rai and Company, Delhi (2000).
4. Bhimbra P S, “Power electronics”, 3rd Ed., Khanna Publishers, Delhi (2002).
5. Singh M D, Khanchandani K B, “Power electronics”, 6th reprint TMH, New Delhi (2001)

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Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Control System	EE- 5041(B)	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..

CO5 To design a Lead, lag and Lag-Lead compensator sand to obtain the characteristics by experiment and simulation using MATLAB

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 – 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

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**.**

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 feedback control System‟s”,Oxford.
7. Krishna. K. Singh & Gayatri Agnihotri, System Design through MATLAB control tool &Simulink,
8. Stringer Verlag,U.K.
9. RudraPratap, Getting Started with MATLAB, Oxford.
10. DhaneshN.Manik, Control Systems, Cengagelea

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Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electrical And Electronics Material	EE- 5041(C)	4L-0T-0P	4

Course Outcome:

CO1 To provide students with a moderate level understanding of the physics behind the electrical engineering materials.

CO2 Acquire knowledge of Dielectric Materials, Application of dielectric materials, Insulating materials, their properties

CO3 Acquire knowledge of Classification of semiconductors, semiconductor conductivity, temperature dependence, Trends in materials used in Electrical Equipment.

CO4 Apply concepts of Magnetization of matter, Magnetic Material Classification, Soft and Hard Magnetic Materials, Superconductivity and its origin.

CO5 Acquire knowledge of IC Fabrication, planar process, characteristic of IC components.

UNIT-I

Classes of Engineering Materials – Metals & alloys, ceramics, organic polymers and composite material. Classification of solids from electrical Engineering point of view. Conducting material – properties of conductors, characteristics of good conductor material, commonly used conducting materials, conductor materials for overhead lines, types of conductors, conductor for underground cables, conductor materials used for electrical machines winding, resistor materials, types of resistors, materials for bus bar. Thermal conductivity of matter, super conductivity. Materials of MHD generator, Fuel cells, Thermoelectric generators, Thermionic conductors

UNIT-II

Dielectric Materials: Dielectric strength, factors affecting dielectric strength, dielectric loss, dissipation factor, factors affecting dielectric loss, permittivity & polarization, charging and discharging of dielectric, conduction through dielectric. Application of dielectric, different types of capacitors and materials used for them. Insulating materials, their properties – thermal, chemical, mechanical & electrical. Insulating materials like ceramic, mica, glass, rubber, resins, wax varnishes, Class of Insulation. Transformer oils & their testing. Piezoelectricity & Ferro electricity.

UNIT-III

Applications of semiconductor materials: type of semiconductors, working and applications of semiconductors, Temperature sensitive elements, photoconductive cells, photo voltaic cells; Varistor, Hall effect generator, LCD, Light dependent registers, LEDs, piezo – electric materials, semiconductor laser and its characteristics, photo conductors – photo diodes, avalanche photo diode, photo transistors.

UNIT-IV

Classification of magnetic materials: Dia-magnetism, Para magnetism, Ferro- magnetism, magnetization curve, hysteresis loop, Magnetostriction, Factors affecting permeability and hysteresis, Anti – ferromagnetism, Ferrimagnetism, Magnetic resonance, B-H curve for different magnetic materials, loss of magnetism, impurities in ferromagnetic materials, soft and hard magnetic materials, ferrites. Fiber optic materials, lasers Special Purpose materials – Thermo couple, soldering, fuse, contact, refractory, fluorescent & phosphorescent, galvanizing and impregnation.

UNIT-V

IC Fabrication: planar process – Fabrication of BJT, FET, & CMOS devices, Monolithic diodes – Contacts – IC resistor & Capacitors - IC packaging – characteristic of IC components.

References:

1. TTTI Madras; Electrical Engineering Materials; TMH.
2. C. S. Indulkar and S. Thruvengadem; Electrical Engineering Materials; S. Chand.
3. A.J. Dekkor; Electrical Engineering Materials; PHI.
4. John Allison; Electrical Engineering Material s & Devices; TMH.
5. Kasap; Electronic Materials and devices; TMH
6. V. Raghvan; Material Science & Engineering; PHI.
7. Milman & Grabe; Micro Electronics; TMH
8. S.P. Seth & P.V. Gupta; Electrical Engineering Materials; Dhanpat Rai

R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	SWAYAM/NPTEL-MOOC-I1	EE- 5041(D)	4L-0T-0P	4

Guideline

SWAYAM/NPTEL-MOOC-II courses is a programme initiated by Government of India and designed to achieve the three cardinal principles of education via, access, equity and quality. The objective of this effort is to take the best teaching resources to all, including the most disadvantaged SWAYAM seeks to bridge divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

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In perspective of the need to create synergist between the salient features of „anytime anywhere format of e-learning and traditional classrooms chalk and talk method to develop a unique content delivery mechanism which is responsive to learners‟ needs and ensuring seamless transfer of knowledge across geographical boundaries. RKDF University proposes to incorporate MOOC courses delivered by SWAYAM/NEPTEL portal. Student can opt any courses from SWAYAM/NPTEL-MOOC courses as an elective Base on following condition

1. He/She has consulted and inform to the departmental coordinator regarding courses selection and mark obtain to him. No Subjected should be repeat from courses which is offer and courses which are selected.

2. He/She can opt from only courses which are not available from University.

3. Only enrollments in the courses and learning from it is free as this is a project supported by MHRD GOI.

4. To get Certificate from SWAYAM-NPTEL. The learner has to separately register and appear for a proctored exam at a fee as decided by host institution/Mooc of Rs. 1000/-Which be bearded by Student only.

5. If student successful appear in exam and obtain certificated of courses of 12 week course to earn 3 credits(As recommended by NPTEL) to suffice for required credit for the award of his/her degree.

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R.K.D.F. UNIVERSITY, BHOPAL

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New Scheme Based on AICTE Flexible Curricula

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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New Scheme Based on AICTE Flexible Curricula

Semester – V

Course Content

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

List of Experiments:

1. Time response of second order system.
2. Effect of feedback on servomotors.
3. Determination of transfer function of A-C servomotor
4. Determination of transfer functions of D-C motor.
5. Formulation of PI & PD controller and study of closed loop responses of 1st and 2nd order dynamic systems.
6. State space model for classical transfer function using MATLAB.
7. Simulation of transfer function using operational amplifier.

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B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

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

Course Outcomes:

- **CO1** Understand the internal architecture and organization of 8086
- **CO2** Understand the Assembly language program.
- **CO3** Discuss the input /output , memory interface and Bus Interface devices
- **CO4** Analyze the Assembly language programs of 8051
- **CO5** Analyze the internal architecture and real time control of 8051

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 of Salient features of 8086, 80286 and 80386.

UNIT-II

Microprocessor 8086 programming

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

UNIT-III

Input-Output interfacing:

Memory Mapped I/O and Peripherals I/O. PPI 8255 Architecture and modes of operation, Interfacing to 16-bit microprocessor and programming, DMA controller (8257) Architecture, Programmable interval timer 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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B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

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** Acquire knowledge about the Regulatory framework, ancillary services, power system economics and power management.
- **CO2** Analyze power flows with the help of numerical analysis techniques such as Gauss Seidel and Newton-Raphson Methods.
- **CO3** Analyze the effects of variations in frequency on power system and various mechanisms to effectively control the same.
- **CO4** Analyze the effects of variations in voltage on power system and various mechanisms to effectively control the same..
- **CO5** Evaluate the impact of disturbances on stability of power system.

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, Newton Raphson and FDLF methods, comparison of these methods, Economic operation of power system – economic dispatch, Emission dispatch, line loss, ITL, economic dispatch is 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 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.
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).

R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Utilization Of Electrical Energy	EE – 6031(A)	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.

R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electromagnetic Waves	EE – 6031(B)	4L-0T-0P	4

Course Outcomes:

- **CO1** Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
- **CO2** Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
- **CO3** Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
- **CO4** Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
- **CO5** Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

Course Contents:

Unit - I

Coulomb's Law, Electric Field Intensity and Flux density: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems.

Unit – II

Gauss's law and Divergence: Gauss law, Application of Gauss law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator V and divergence theorem, Numerical Problems.

Energy, Potential and Conductors: Energy expended or work dme in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems.

Unit – III

Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem. Examples of the solution of Laplace's equation, Numerical problems on Laplace equation

Steady Magnetic Field: Biot-Savart Law,Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems.

Unit – IV

Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems

Magnetic Materials: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems , Faraday' law of Electromagnetic Induction -Integral form and Point form, Numerical problems

Unit – V

Maxwell's equations Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems

Uniform Plane Wave: Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (γ,α, β,η) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems.

Reference Books:

1. Elements of Electromagnetics -Matthew N.O., Sadiku, Oxford university press, 4th Edn.
2. Electromagnetic Waves and Radiating systems- E. C. Jordan and K.G Balmain,PHI, 2nd Edn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. Fundamentals of Electromagnetics for Engineering -N. Narayana Rao, Pearson.

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B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Digital Signal Processing	EE – 6031(C)	4L-0T-0P	4

Course Outcomes:

CO1 Illustrate digital signals, systems and their significance

CO2 Analyse the digital signals using various digital transforms DFT, FFT etc.

CO3 Design and develop the basic digital system.

CO4 Interpret the finite word length effects on functioning of digital filters.

Course Contents:

UNIT- I

Basic elements of digital signal Processing: Concept of frequency in continuous time and discrete time signals –Sampling theorem – Discrete time signals. Discrete time systems –Analysis of Linear time invariant systems –Z transform –Convolution and correlation.

UNIT- II

Introduction to DFT: Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and correlation.

UNIT- III

Structure of IIR: System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain.

UNIT - IV

Symmetric & Anti-symmetric FIR filters: Linear phase filter – Windowing techniques – rectangular, triangular, Blackman and Kaiser windows – Frequency sampling techniques – Structure for FIR systems.

UNIT-V

Finite word length effects in FIR and IIR digital filters: Quantization, round off errors and overflow errors. Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators. Poly phase decompositions. Application of DSP – Model of Speech Wave Form – Vocoder.

Reference Books:

1. Oppenheim A V and Sehafer R W, “Discrete Time Signal Processing”, Prentice Hall (1989).
2. Proakis J G and Manolakis D G, “Digital Signal Processing”, Pearson Education India.
3. DeFatta D J, Lucas J G and Hodgkiss W S, “Digital Signal Processing”, J Wiley and Sons, Singapore, 1988
4. Sanjit K Mitra “Digital Signal Processing” TMH

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New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	SWAYAM/NPTEL-MOOC-III	EE- 6031(D)	4L-0T-0P	4

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B.Tech.(Electrical Engineering)

New Scheme Based On AICTE Flexible Curricula

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

CO3 List types, principles of operations, components and applications of steam turbines, steam generators, condensers, feed water and circulating water systems

CO4 Define terms and factors associated with power plant economics

CO5 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 these power stations

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

UNIT-IV

Economic aspects of power plant operations: -

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

UNIT-V

Economic Scheduling of Power Stations:

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

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References:

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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B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Internet of Things (IOT)	EE – 6041(B)	4L-0T-0P	4

Course Outcomes:

CO1 Able to understand the application areas of IOT

CO2 Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks

CO3 Able to understand building blocks of Internet of Things and characteristics

CO4 In some cases, students may also learn about the business models and economic considerations associated with IOT implementations.

CO5 Many IOT courses include hands-on projects where students build real-world IoT applications. These projects help students apply their knowledge and gain practical experience.

Course Contents:

UNIT-I

IOT & WEB TECHNOLOGY - The Internet of Things Today, Time for Convergence, Towards the IOT Universe, Internet of Things Vision, IOT Strategic Research and Innovation Directions, IOT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IOT Related Standardization, Recommendations on Research Topics.

UNIT-II

M2M to IOT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IOT Value Chains, An emerging industrial structure for IOT, The international driven global value chain and global information monopolies. M2M to IOT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IOT architecture outline, standards considerations.

UNIT-III

IOT ARCHITECTURE -STATE OF THE ART – Introduction, State of the art. Architecture Reference Model- Introduction, Reference Model and architecture, IOT reference Model, IOT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT-IV

IOT APPLICATIONS FOR VALUE CREATIONS-Introduction, IOT applications for industry: Future Factory Concepts, Brownfield IOT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IOT, Value Creation from Big Data and Serialization, IOT for Retailing Industry, IOT For Oil and Gas Industry, Opinions on IOT Application and Value for Industry, Home Management, eHealth.

UNIT-V

INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE-Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IOT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IOT in Smart Cities, Security

References Book

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition,VPT, 2014
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
3. Cuno Pfister, Getting Started with the Internet of Things, O Reilly Media, 2010

R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Energy Modeling, Economics and Project Management	EE – 6041(C)	4L-0T-0P	4

Course Outcomes:

- **CO1** Understand the role of government policies and regulations in the energy sector.
- **CO2** Understand the ethical considerations related to energy projects, including social responsibility and environmental ethics.
- **CO3** Acquire knowledge of economic principles and theories relevant to energy projects and policy decisions.
- **CO4** Learn about energy conversion processes, energy generation technologies, and energy distribution systems.
- **CO5** Develop project management skills, including project planning, scheduling, budgeting, and resource allocation.

Course Contents:

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.

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B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	SWAYAM/NPTEL-MOOC-IV	EE- 6041(D)	4L-0T-0P	4

Guideline

SWAYAM/NPTEL-MOOC-IV courses is a programme initiated by Government of India and designed to achieve the three cardinal principles of education via, access, equity and quality. The objective of this effort is to take the best teaching resources to all, including the most disadvantaged SWAYAM seeks to bridge divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

Courses delivered through SWAYAM/NPTEL-MOOC courses are available free of cost to the learners, however learns wanting SWAYAM/NPTEL-MOOC courses Certificate should register for the final proctoral exams that come at a fee and attend in-person at designated center on specified dates.

In perspective of the need to create synergist between the salient features of „anytime anywhere format of e-learning and traditional classrooms chalk and talk method to develop a unique content delivery mechanism which is responsive to learners" needs and ensuring seamless transfer of knowledge across geographical boundaries. RKDF University proposes to incorporate MOOC courses delivered by SWAYAM/NEPTEL portal. Student can opt any courses from SWAYAM/NPTEL-MOOC courses as an elective Base on following condition

1. He/She has consulted and inform to the departmental coordinator regarding courses selection and mark obtain to him. No Subjected should be repeat from courses which is offer and courses which are selected.

2. He/She can opt from only courses which are not available from University.

3. Only enrollement in the courses and learning from it is free as this is a project supported by MHRD GOI.

4. To get Certificate from SWAYAM-NPTEL. The learner has to separately register and appear for a proctored exam at a fee as decided by host institution/Mooc of Rs. 1000/-Which be bearded by Student only.

5. If student successful appear in exam and obtain certificated of courses of 12 week course to earn 3 credits(As recommended by NPTEL) to suffice for required credit for the award of his/her degree.

6. The NPTEL recommended that an additional 1 credit may be awarded given by University. This credited can be given based on attendances, assignment and tuitorial work submitted by the students.

7. All students would be motived to take courses online with SWAYAM/NPTEL every semester to better prepared for the future so that they can cultivate the habilt of self-study online. The University propose to implement MOOC courses under Department. The University also made provision if student unable to get certificate He/She still be able to appear in the department elective courses and complete there degree

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B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

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**

Course Outcomes:

- **CO1** Ability to understand the concept of MATLAB programming in solving power systems problems.
- **CO2** Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- **CO3** Ability to understand power system planning and operational studies.
- **CO4** Ability to acquire knowledge on power system analysis methods.
- **CO5** Ability to find Symmetric and Unsymmetrical fault.

List of Practical:

1. Study the basics of electromagnetic fields and how they interact with conductors and magnets.
2. Understand the properties of materials commonly used in electrical machines, such as iron, copper, and insulation materials
3. Learn about permanent magnets and how to select the appropriate magnet for your machine based on its performance requirements.
4. Practice winding coils and applying insulation to them to create the stator and rotor windings of electric machines.
5. Design and build cores for transformers and rotating machines using laminated iron cores.
6. Design and implement cooling systems to prevent overheating in machines, especially in high-power applications.

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New Scheme Based on AICTE Flexible Curricula

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 Experiments:

1. Study and working of various Equipment‟s used in Diesel power plant
2. Study and working of various Equipment‟s used in Nuclear power plant
3. Study of Substation layout and equipment‟s 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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New Scheme Based on AICTE Flexible Curricula

Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electric and Hybrid Vehicles	EE - 7011	2L-1T-1P	4

Course Outcomes:

- **CO1** Identify EV concepts, EV configurations and various EV parameters for better understanding of the EV technology
- **CO2** Analyse the EV propulsion system and electric motors for vehicular applications & power electronics converters required for their control.
- **CO3** Analyse DC motor & induction motor drives and discuss methods for controlling them.
- **CO4** Elaborate various hybrid electric vehicle configurations and explain the power flow control in all HEV configurations
- **CO5** Identify different energy sources used in EV and analyse the various methods used in charging these energy sources

Course Contents:

UNIT-I

INTRODUCTION TO EV & HEV:-

Introduction: Past, Present & Future of EV, Current Major Issues, Recent Development Trends, EV Concept, Key EV Technology, State-of-the Art EVs & HEVs, Comparison of EV Vs IC Engine.

EV System: EV Configuration: Fixed & variable gearing, single & multiple motor drive, In-wheel drives EV Parameters: Weight, size, force, energy & performance parameters.

UNIT-II

EV PROPULSION- ELECTRIC MOTOR:-

Choice of electric propulsion system, block diagram of EV propulsion system, concept of EV Motors, single motor and multi-motor configurations, fixed & variable geared transmission, In wheel motor configuration, classification of EV motors, Electric motors used in current vehicle applications, Recent EV Motors, Comparison of Electirc Motors for EV applications

REQUIRED POWER ELECTRONICS & CONTROL:

Comparison of EV power devices, introduction to power electronics converter, four quadrant DC chopper, three-phase full bridge voltage-fed inverter, soft-switching EV converters, comparison of hard-switching and soft-switching converter, three-phase voltage-fed resonance dc link inverter, Basics of Microcontroller & Control Strategies

UNIT-III

EV MOTOR DRIVES

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

HEV (HYBRID ELECTRIC VEHICLE):-

Configuration of HEV (Series, Parallel, Series-parallel &Complex), Power Flow control, Examples. Power flow control in all HEV configurations, Examples of HEV system performance

UNIT-V

ENERGY SOURCES & CHARGING:-

Different Batteries and Ultra-capacitors, Battery characteristics (Discharging &Charging) Battery Chargers: Conductive (Basic charger circuits, microprocessor based charger circuit. Arrangement of an off-board conductive charger, Standard power levels of conductive chargers, Inductive (Principle of inductive charging, Soft-switching power converter for inductive charging), Battery indication Methods Charging Infrastructure: Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and-charge zone.

Reference Books:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001
2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
4. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
5. Ms.Priyanka Maheshwari,Dr.Shewta Chourasiya Hybrid Electrical Vehicles Charging Infrastructure IIP Publication 2021.

List of experiments:

R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Calibration and Testing of Electrical Equipment's	EE-7021(A)	3L-1T-P	4

Course Outcome:

- **CO1** Understand about Indian electricity Acts and Rules
- **CO2** Understand about different instruments that are used for measurement purpose.
- **CO3** Calibration of equipment"s against appropriate physical standards using correct calibration tools
- **CO4** Analyze the Performance characteristics of each instrument.
- **CO5** Calibration of Different equipment"s as per standards specification.

Course Contents:

UNIT-I

Electricity Rules: Indian Electricity Rules, Indian Electricity Act, Electricity Supply Act.

UNIT-II

Standards: Study of Various Indian Standards codes for various important electrical equipment"s.

UNIT-III

Installation & Commissioning : Installation & Commissioning of out door Indoor electrical equipments like transformer, Motors, Switchgears, Panels, Relays, CT, PT, Earthing etc.

UNIT-IV

Testing: Testing of new & Old electrical installation as per IS of the following. Transformer, Cables, Insulating Oil, Protective relays, Circuit Breakers, CT, PT, Meters, Energy Meters, PVC insulated cables, High voltage Testing & Routing Test, Type test on above.

UNIT-V

Calibration : Calibration of meters, Energy meters, Relays, Circuit breakers, & other equipments as per IS specification.

Reference Books:

1. M. Subbarao, Installation Commissioning & testing of Electrical Engineering Equipments, Khanna Pub.
2. Jagdishlal, Hanbook of Electricity Laws, Delhi Law House.
3. I.S. Codes, Indian Standard codes, Indian Standard Institution, Nanak Bhavan, New Delhi.

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B.Tech.(Electrical Engineering)

New Scheme Based On AICTE Flexible Curricula

Semester – VII

Course Content

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

Course Outcomes:

- **CO1** Develop design knowledge on how to design the speed control and current control loops of a DC Motor drive.
- **CO2** To analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
- **CO3** To understand the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
- **CO4** To learn the principles of static rotor resistance control and various slip power recovery schemes.
- **CO5** To understand the speed control mechanism of synchronous motors

Course Contents:

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 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 current operation, 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 conservation in electric drives

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, 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.

R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Power System Planning & Reliability	EE-7021(C)	3L-1T-0P	4

Course Outcomes:

CO1 Understand the load forecasting methodology.

CO2 Be able to evaluate power system generation, transmission, distribution reliability.

CO3 Students should be able to analyze and forecast electrical load patterns, considering factors like seasonality and load growth..

CO4 Be able to perform generation and transmission planning

CO5 Extend the understanding of reliability assessment to systems with more than two interconnected subsystems.

Course Contents:

UNIT – I

Load forecasting: Classification and characteristics of loads. Approaches to load forecasting. Forecasting methodology. Energy forecasting.

UNIT – II

Basic Reliability Concepts: General reliability function, Markov Chains and processes and their applications, simple series and parallel system models

.

UNIT – III

Static Generating Capacity Reliability Evaluation: Outage definitions, loss of load probability methods, loss of energy probability method. Frequency and duration methods, load forecasting uncertainty.

UNIT – IV

Spinning Generating Capacity Reliability Evaluation: Spinning capacity evaluation, load forecast uncertainty

UNIT – V

Transmission System Reliability Evaluation: Average interruption rate method. The frequency and duration method. Stormy and normal weather effects.

UNIT - VI

Inter-connected Systems Generating Capacity Reliability Evaluation: Introduction, The loss of toad approach. Reliability evaluation in two and more than two interconnected systems. Interconnection benefits.

Text Books/Reference Material:

1. Roy Billinton, "Power System Reliability Evaluation", Gordan & Breach Scain Publishers, 1990.
2. J. Endrenyi, "Reliability modelling in Electric Power System", John Wiley, 1980.
3. David Elmakias, "New Computational Methods in Power System Reliability", Springer--Verlag, 2008.
4. Ali Chowdhury, Don Koval, "Power Distribution System Reliability: Practical Methods and Applications", Wiley--IEEE Press, 2009.
5. Richard E. Brown, "Electric Power Distribution Reliability", CRC Press, 2002.
6. R. L. Sullivan, "Power System Planning", Heber Hill, 1987

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B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	SWAYAM/NPTEL-MOOC-V	EE- 7021(D)	4L-0T-0P	4

Guideline

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R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Generalised Theory of Electrical Machines	EE – 7031(A)	4L-0T-0P	4

Course Outcome:

- **CO1** Perform analysis and design of direct current (DC) machines and understand their characteristics and applications.
- **CO2** Analyze and design single-phase and three-phase including induction. Understand their operating principles, performance characteristics, and applications.
- **CO3** Analyze and design three-phase synchronous machines. Understand their operating principles, performance characteristics.
- **CO4** Develop and use equivalent circuit models for electrical machines to simplify analysis and predict machine behavior.
- **CO5** Learn how to identify and analyze common electrical faults and problems in machines.

Course Contents:

UNIT-I

Review : Primitive machine, voltage and torque equation. Concept of transformation change of variables & m/c variables and transform variables. Application to D.C. machine for steady state and transient analysis, and equation of cross field commutator machine.

UNIT-II

Induction Machine: Voltage, torque equation for steady state operation, Equivalent circuit, Dynamic performance during sudden changes in load torque and three phase fault at the machine terminals. Voltage & torque equation for steady state operation of 1- ö induction motor & scharge motor.

UNIT-III

Synchronous Machine : Transformation equations for rotating three phase windings, Voltage and power equation for salient and non-salient alternator, their phasor diagrams, Simplified equations of a synchronous machine with two damper coils.

UNIT-IV

Operational Impedances and Time Constants of Synchronous Machines: Park's equations in operational form, operational impedances and G(P) for a synchronous machine with four Rotor Windings, Standard synchronous machine Reactances, time constants, Derived synchronous machine time constants, parameters from short circuit characteristics.

UNIT-IV

Approximate Methods for Generator & System Analysis : The problem of power system analysis, Equivalent circuit & vector diagrams for approximate calculations, Analysis of line to line short circuit, Application of approximate method to power system analysis.

References:-

1. J. L. Blackburn, “Protective Relaying: Principles and Applications”, Marcel Dekker, New York, 1987.
2. Y. G.Paithankar and S. R. Bhide, “Fundamentals of power system protection”, Prentice Hall, India, 2010.
3. A. G. Phadke and J. S. Thorp, “Computer Relaying for Power Systems”, John Wiley & Sons, 1988.
4. A. G. Phadke and J. S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer, 2008.
5. D. Reimert, “Protective Relaying for Power Generation Systems”, Taylor and Francis, 2006.

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New Scheme Based on AICTE Flexible Curricula

Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Power Electronics	EE – 7031(B)	4L-0T-0P	4

Course Outcome:

- **CO1** Understand the structure of power electronic devices such as diode, BJT, SCR, IGBT, MOSFET and advanced devices such as MCT, IGCT
- **CO2** Illustrate the functioning of rectifiers and firing circuits.
- **CO3** Design and Analyze power converter circuits and learn to select suitable power electronic devices by assessing the requirements of application fields**.**
- **CO4** Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors.
- **CO5** Distinguish the speed control of DC motor using converters.

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.

References:

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.

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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Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Electrical Machines – III	EE – 7031(C)	4L-0T-0P	4

Course outcome:

CO1 To introduce the concepts of Construction and Principle of operation of machines.

CO2 Understand the working and characteristics of synchronous Generator

CO3 Understand the Different methods of Regulation of Synchronous Generator and alternators.

CO4 To study of synchronous machine and its applications.

CO5 Construction and operation of synchronous machines and their application

Course Contents:

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

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Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	SWAYAM/NPTEL-MOOC-VI	EE- 7031(D)	4L-0T-0P	4

Guideline

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Semester – VII

Course Content

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

List of Experiment

1. Study of thyristors controlled DC Drive.
2. Study of Chopper fed DC Drive.
3. Study of AC Single phase motor-speed control using TRIAC.
4. PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software.
5. VSI / CSI fed Induction motor Drive analysis using MATLAB / SPICE / PSIM Software.
6. Study of V/f control operation of 3phase induction motor drive.
7. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software
8. Regenerative / Dynamic braking operation for DC Motor - Study uses software.
9. Regenerative / Dynamic braking operation of AC motor - study uses software.
10. PC/PLC based AC/DC motor control operation.

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Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Power Electronics -LAB	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. Commutation circuits
7. Speed control of DC shunt motor (using Rectifier & Chopper)
8. Speed control of Universal motor.
9. Speed control of TPIM using PWM inverter

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New Scheme Based on AICTE Flexible Curricula

Semester – VIII

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 and their design
- **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.

References:

1. J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, New York, 1987.
2. Y. G.Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010.
3. A. G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley & Sons, 1988.
4. A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 2008.
5. D. Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, 2006.

List of Practical

1. Analyze fault scenarios to identify potential fault locations, types, and magnitudes.
2. Select appropriate protective relays based on the system requirements and protection objectives.
3. Provide protection for motors, including thermal, overcurrent, and under/over-voltage protection.
4. Install protective relays for generators, including stator and rotor protection.
5. Set up protection for transmission and distribution lines, including pilot protection if needed.
6. Demonstration of different types of circuit breakers (air circuit breakers, vacuum circuit breakers, SF6 circuit breakers, etc.).

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Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Computer Application To Power System	EE-8021(A)	3L-1T-0P	4

Course Outcomes:

- **CO1** Recent techniques and computer application for modeling of practical and large interconnected power system networks using programming languages
- **CO2** Recent methodologies for simulation and analysis of power system networks like real and reactive power flows and optimal scheduling.
- **CO3** Effect of outage of any important component of power system on the operation and reliability of power systems.
- **CO4** Algorithm required finding out parameters for monitoring and control of power system in real time from actual measurement data.
- **CO5** Computer Algorithms used to solve algebra-differential pertaining to power system to assess the stability performance of power systems

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 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. McGraw Hill.
3. Computer Techniques in Power Systems Analysis- Pai M.A. Tata McGraw 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 McGraw Hill.
7. Power System Analysis Grainger J.J. &Stevnson W.D. McGraw 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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B.Tech.(Electrical Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Computer aided design of electrical machines	EE-8021(B)	3L-1T-0P	4

Course Outcomes:

CO1 Apply computer aided optimization techniques for design of electrical machines

CO2 Understand and implement CAD of DC Machine.

CO3 Understand and implement CAD of power transformer.

CO4 Understand and implement CAD of Three phase alternator.

CO5 Understand and implement CAD of Three phase Induction Motor.

Course Contents

UNIT – I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

Optimal design for 3-phase alternator:-Design of stator, windings, Design of Field systems for salient pole and non-salient pole machines, Selection of variables for optimal design, Formulation of design equations, Objective function, Constraint functions, Algorithms for optimal design.

UNIT – V

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

References:

1. Computer- Aided Design of Electrical Equipment- by Dr. M. Ramamoorthy-Affiliated East-West press Pvt. Ltd. New Delhi.
2. Electrical Machine Design- by A.K. Sawhney, DhanpatRai& Sons.
3. Principles of Electrical Machine Design with Computer Programmes by- S.K. Sen, Oxford & IBH Publishing Co.
4. Performance and Design of A.C. Machines-M.G. Say, Affiliated East West Press Pvt. Ltd., New Delhi.
5. Performance and Design of D.C. Machines- Clayton & Hancock.

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New Scheme Based on AICTE Flexible Curricula

Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Digital Image Processing	EE-8021(C)	3L-1T-0P	4

Course Outcomes:

CO1 Analyze images in the frequency domain using various transforms.

CO2 Evaluate the techniques for image enhancement and image restoration.

CO3 Categorize various filter techniques.

CO4 To Analyse Discrete Fourier Transform, various theorems

CO5 Interpret image segmentation and representation techniques.

Course Contents

UNIT – I

Digital Image Processing (DIP) Introduction, examples of fields that use DIP, fundamental steps in DIP, components of an image processing system. Digital Image Fundamentals: elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixel

UNIT – II

Image Transforms Two-dimensional (2D) impulse and its shifting properties, 2D continuous Fourier Transform pair, 2D sampling and sampling theorem, 2D Discrete Fourier Transform (DFT), properties of 2D DFT. Other transforms and their properties: Cosine transform, Sine transform, Walsh transform, Hadamard transform, Haar transform, Slant transform, KL transform.

UNIT – III

Image Enhancement Spatial domain methods: basic intensity transformation functions, fundamentals of spatial filtering, smoothing spatial filters (linear and non-linear), sharpening spatial filters (unsharp masking and high boost filters), combined spatial enhancement method. Frequency domain methods: basics of filtering in frequency domain, image smoothing filters (Butterworth and Gaussian low pass filters), image sharpening filters (Butterworth and Gaussian high pass filters), selective filtering.

UNIT – IV

Image Restoration Image degradation/restoration, noise models, restoration by spatial filtering, noise reduction by frequency domain filtering, linear position invariant degradations, estimation of degradation function, inverse filtering, Wiener filtering, image reconstruction from projection

UNIT – V

Image Compression Fundamentals of data compression: basic compression methods: Huffman coding, Golomb coding, LZW coding, Run-Length coding, Symbol based coding. Digital image watermarking, representation and description- minimum perimeter polygons algorithm (MPP).

References:

1. Jain Anil K., "Fundamentals of Digital Image Processing", PHI Learning
2. Rafael, C. Gonzlez., and Paul, Wintz, "Digital Image Processing", AddisonWesley Publishing Company.
3. Sosenfeld, and Kak, A.C., "Digital Image Processing", Academic Press.
4. William K. Pratt., "Digital Image Processing", John Wiley and Sons.
5. Tamal Bose Digital signal processing wiley india

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New Scheme Based on AICTE Flexible Curricula

Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	SWAYAM/NPTEL-MOOC-VII	EE- 8021(D)	4L-0T-0P	4

Guideline

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Semester – VIII

Course Content

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

Course Outcomes:

CO1 Demonstrate knowledge and understanding of extra and ultra-high voltage

CO2 Evaluate the breakdown voltage for different insulating material.

CO3 Understand fundamental concepts of high voltage AC and DC generation.

CO4 Learn the techniques employed in high voltage measurements.

CO5 Demonstrate knowledge of the different types of insulators and high voltage cables and their applications.

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

BREAKDOWNPHENOMENA:- Breakdown in Gases: Elementary ideas on ionization by electron collision, Townsend mechanism, Townsend first and second ionization coefficients, Paschen law, breakdown in non-uniform field sand corona discharges, vacuum breakdown mechanisms,

Breakdown in liquid: fundamentals of insulating oils, conduction and breakdown in pure and commercial liquids.

Breakdown in Solids: Fundamentals of solid insulating materials intrinsic, electromechanical and thermal breakdown, breakdown in simple and composite dielectrics, types of insulating materials, temperature classification, factor affecting dielectric strength, insulation design of 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

MEASUREMENTOF 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-WestingHouse.C.L.Wadhwa, High voltage engineering, New Age International Private limited, 1995.

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Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Power System Economics	EE-8031(B)	3L-0T-0P	3

Course Outcomes:

CO1 Students will be exposed to the concepts and models related to Power Economics.

CO2 Students will understand basic Economics theories required for power sector understanding and issues of power sector.

CO3 Students will be able to demonstrate clear understanding of concepts Power economics.

CO4 Students should be able to analyze and calculate electricity prices in different market scenarios, taking into account factors

CO5 Students will exhibit the ability to integrate technical, economic, social and regulatory frameworks for power sector planning and resource management.

Course Contents

UNIT – I

Power System Fundamentals Regulation and Deregulation, condition for deregulation, problems with regulation, risk management, congestion management, ATC, screening curve.

UNIT – II

Competetions In Power Market What is competition, efficiency of perfect competition, marginal cost in power market, role of marginal cost, working with marginal cost, results of marginal cost.

UNIT – III

Market Power And Structure Define market power, price quality outcomes, three stages of market power, using price quality outcomes to show power, monopoly in power auction, market power on demand side

UNIT – IV

Restructure Fundamental restructure system, transmission pricing, restructure models, OASIS, structure of OASIS, transfer capability of OASIS.

UNIT – V

Designing And Testing Market Rules Design for competitive prices, testing of market design, designing to reduce market power.

References:

1- Power system economics-designing for electricity-steven stoft. (IEEE press & WILEY-INTERSCIENCE).

2- Electric Power Systems weedy, cory, wily india 2nd edition

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Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	**Process Control**	**EE-8031(C)**	**3L-0T-0P**	**3**

Course Outcomes:

CO1 Specify the required instrumentation and final elements to ensure that well-tuned control is achieved

CO2 Understand the basic principles & importance of process control in process plants;

CO3 To make the students understand basic ideas, challenges, techniques, and applications of process control for controlling various processes.

CO4 Knowledge of various types of existing circuit breakers, their design and constructional details.

CO5 Knowledge of various conventional relays, their design and latest developments.

Course Contents

UNIT-I

Special characteristics of process systems large time constants, interaction, multi staging, pure lag; control loops for simple systems and their Dynamics & stability.

UNIT -II

Generation of control action in electronic and pneumatic controllers. Control valves, valve positioners, relief and safety valves, relays, volume boosters, pneumatic transmitters for process variable. Tuning of controllers - Zeigler Nichols and other techniques.

Unit-III

Different control techniques and interaction of process parameters e.g. feed forward, cascade, ratio, over-ride controls Batch continuous process controls. Feed forward Control schemes.

Unit-IV

Various process schemes / unit operations and their control schemes e.g. distillation columns, absorbers, heat exchangers, furnaces, reactors, mineral processing industries, etc. Use of control schemes for process optimization.

Unit-V

Advanced control strategies with case studies. Use of DDC and PLC. Introduction to supervisory control. Conversion of existing control schemes in operating plants, data loggers.

References:

- Dale Patrick, Stephen Fardo, "Industrial Process Control System".
- Shinskey F.G., "Process Control System", III Ed., McGraw Hill.
- Smith C.A. & A.B. Corripio, "Principle & Practiced Automatic Process Control",
- J. Willey. Rao M & S.Qiv, "Process Control Engg.", Gorden & Breach.

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Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	SWAYAM/NPTEL-MOOC-VIII	EE- 8031(D)	4L-0T-0P	4

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EE	Computer Application To Power System-Lab	EE-8041	0L-0T-2P	2

List of Experiments (Extendable): MATLAB based:

1. Formation of bus admittance matrix using mat lab.
2. Z bus building algorithm using mat lab.
3. NEWTON RAPSON load flow analysis.
4. Fast de coupled load flow analysis.
5. Study of PV Curve for voltage stability.