



.R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical & Electronics Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – III

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Environmental Engineering	EX- 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. Cunningham 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
EEE	Electromagnetic Fields	EX – 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's law, 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 AND CAPACITANCE

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

UNIT-III

STEADY MAGNETIC FIELDS

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

UNIT-IV

MAXWELLS EQUATIONS AND SCALAR, VECTOR PROPERTIES

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

UNIT-V

ELECTRO MAGNETIC WAVES

Uniform plane wave in time domain in free space, 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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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electrical Measurement and Measuring Instruments	EX- 3031	4L-0T-2P	6

Course Outcomes:

- CO1** Understand about different instruments that are used for measurement purpose.
- CO2** Analyze the Performance characteristics of each instrument.
- CO3** Understand how different physical parameters and there co-relation with measuring Instrument.
- CO4** Internal and general repairing of instruments and problem solving capacity.
- CO5** Acquire the Principle of operation and construction of PMMC, MI, Dynamometer.

Course Contents:

UNIT-I

MEASUREMENT OF R,L,C

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

UNIT-II

MEASURING INSTRUMENTS

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

UNIT-III

MEASUREMENT OF POWER AND ENERGY

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

UNIT-IV

MEASUREMENT OF FREQUENCY, POWER FACTOR AND PHASE SEQUENCE

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

UNIT-V

ELECTRONIC INSTRUMENTS

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

LIST OF EXPERIMENTS (EXPANDABLE):

1. Measurement of low resistance using Kelvin's Double bridge
2. Measurement of medium resistance using Wheatstone's bridge
3. Measurement of high resistance by loss of charge method
4. Measurement of Insulation resistance using Megger
5. Measurement of earth resistance by fall of potential method and verification by using earth tester
6. Measurement of power in a single phase ac circuit by 3 voltmeter/ 3 Ammeter method
7. Calibration of a dynamometer type of wattmeter with respect to a standard/Sub Standard wattmeter
8. Calibration of a induction type single phase energy meter
9. Calibration of a dynamometer type of wattmeter by Phantom Loading method

TEXT BOOKS

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



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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Network Analysis	EX – 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 Choudhary D; 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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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Value Education	EX - 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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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electrical Workshop	EX – 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
EEE	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 & Transcendental Equations (Regula Falsi, Newton-Raphson, Iterative, Secant Method), Solution of simultaneous linear equations by Gauss Elimination, Gauss Jordan, Crout's methods, Jacobi's and Gauss-Siedel Iterative methods.

UNIT –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
EEE	ELECTRICAL MACHINE-I	EX- 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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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Digital Electronics	EX - 4031	4L-0T-2P	6

Course Outcomes:

- CO1** Convert different type of codes and number systems which are used in digital communication and computer systems.
- CO2** Employ the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.
- CO3** Design various sequential circuits using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.
- CO4** Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.
- CO5** Design different types of with and without memory element digital electronic circuits for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints.

Course Contents:

UNIT-I

Number Systems and Codes: Digital number systems, base conversion, Binary, Decimal, octal, Hexadecimal, number system with radix r , Gray codes. Alphanumeric codes – ASCII code and EBCDIC codes, Hollerith code, concept of parity, complement's & $(r-1)$'s, subtraction with complements, signed Binary numbers, Error Detecting & Correcting codes. Basic Theorems & Properties of Boolean Algebra: AND, OR, NOT operators, laws of Boolean Algebra, Demorgan's theorem, Boolean expression & logic diagram. Negative logic, Alternate logic gate representation (concept of bubbled gates) canonical and standard Forms (Minterms & Maxterms), sum of minterms & product of maxterms, conversion between canonical forms. Truth table & maps, 2,3,4,5 and 6 variable maps, Solving digital problems using Maps, Don't care conditions, Tabular minimization. Sum of product & product of sum reduction, Exclusive OR & Exclusive NOR circuits, Parity generator & checkers.

UNIT- II

Combinational Circuits : Design procedure, Adders (half and Full), sub tractor (half and full) code convertors, Analysis of design, Universal building blocks, Implementation of any logic circuit with only NAND gates or with only NOR gates, Binary serial adder, parallel adder, serial/parallel adder, look ahead carry generator, BCD adder, Binary multiplier, Magnitude comparator, Decoder, Demultiplexer, Encoders, priority encoder, Multiplexers & implementation of combinational logic diagram, HDL for combinational circuit.

UNIT –III

Sequential Logic Circuit : Latches, SR latch with NAND & NOR gates, D latch, edge triggered flip flop, J-K flip flop, T flip flop, Master slave flip flop, Analysis of clocked sequential circuit, state table, state diagram, state reduction state equations, state assignments, flip flop excitation table & characteristic equations, Design procedure for sequential circuits, Design with state reduction, Applications of flip flop.

UNIT –IV

Registers and Counters : Asynchronous and Synchronous counter, counters with MOD numbers, Down counter, UP/DOWN counter, propagation delay in ripple counter, programmable counter, Pre-settable counter, BCD counter, cascading, counter applications, Decoding in counted coding glitches, Ring Counter, Johnson counter, Rotate left & Rotate right counter, Registers – Buffer, Shift left, shift right, shift left/Right registers, parallel in parallel out, serial in serial out, parallel in serial out, serial in parallel out registers.

UNIT- V

Random Access Memory, Timing waveform, Memory Decoding, Internal Construction, Coincident decoding, Address multiplexing, Read only memory – Combinational circuit Implementation, Type of ROMs, combinational PLDs, Programmable Logic Array (PLA), Programmable Array Logic (PAL), sequential programmable device. Analog to digital conversion Ramp type, dual slope, integration, successive approximation, parallel conversion, parallel/ serial conversion, convertor specifications, Digital to Analog convertors – Binary weighted & R/2R D to A convertors.

List of Practical

1. Verification of all the logic gates.
2. Design of BCD to Excess-3 code converter.
3. Implementation of NAND & NOR as Universal gate.
4. Design of RS, JK, T& D Flip flop.
5. Multiplexer /Demultiplexer based Boolean function
6. Design of combinational circuit for the (i) Half adder (ii) Full adder (iii) Half subtractor (iv) Full subtractor
7. Design various A-D & D-A convertors.

Reference Books :

1. Mano; Digital design; Pearson Education Asia
2. Thomas Blakeslee; Digital Design with standard MSI and LSI; Wiley Interscience
3. Jain RP; Modern digital electronics; TMH
4. M.Mano; Digital logic & Computer Design; PHI
5. Tocci ; Digital Systems Principle & applications; Pearson Education Asia
6. Gothmann; Digital Electronics; PHI
7. R.H.Gour; Digital Electronics and Micro Computer - (DhanpatRai)



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Course Content

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

Course Outcomes:

- CO1** Learning how to draw the shapes, angles 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, commutator 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. To design transformer.
- 2 To design ac winding
3. Introduction to laboratory measuring instruments and their application
4. To Understand the Name plate Data of Electrical Machine

Reference Books:

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



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Semester – IV

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	POWER SYSTEM-I	EX-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; "Modern Power System Practice", Vol 1-8, PergamonOxfrd
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
EEE	JAVA PROGRAMMING	EX-4061	0L-0T-2P	2

Course Outcomes:

- CO1** Write, compile, and execute Java programs that may include basic data types and control flow constructs using J2SE or other Integrated Development Environments (IDEs) such as Eclipse, Net Beans, and Developer.
- CO2** Write, compile, and execute Java programs using arrays and recursion.
- CO3** Write, compile, and execute Java programs manipulating Strings and text documents.
- CO4** Write, compile, and execute Java programs that include GUIs and event driven programming.
- CO5** Write a final project that may be selected from among the following: applets for inclusion in web pages; applets to access enterprise data bases in robust, enterprise three level applications; secure communications over the internet; or an approved project chosen by the student.

List of Experiments

- 1:** Write a Java program to demonstrate String handling methods.
- 2:** Write a Java program for sorting a given list using inheritance concept.
- 3:** Write a Java program for creating one base class for student personal details and inherit those details into the sub class of student Educational details to display complete student information.
- 4:** Write a Java program to implement matrix operations using multidimensional arrays.



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Semester – V **Course Content**

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	ELECTRICAL MACHINE-II	EX- 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 X_d and X_q by slip test; SCR and its significance; regulation of salient pole alternator, power angle equation and characteristics; synchronizing of alternator with infinite busbar,; parallel operation and load sharing; synchronizing current, synchronizing power and 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, 3rd edition

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, Dhanpat Rai, New Delhi

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

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

A. E. Fitzgerald, 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 X_d and X_q 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
EEE	Switchgear And Protection	EX-5021	3L-1T-2P	6

Course Outcomes:

- CO1** Acquire the knowledge of various abnormal conditions that could occur in power system.
- CO2** Knowledge of various conventional relays, their design.
- CO3** Ability to design various protective devices in power system for protecting equipment and personnel.
- CO4** Knowledge of various types of existing circuit breakers, their design and constructional details.
- CO5** Knowledge of standards and specifications related to fuses.

Course Contents:

UNIT-I

FAULT ANALYSIS

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

UNIT-II

PROTECTIVE RELAYS

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

UNIT-III

PROTECTION OF GENERATOR, TRANSFORMER AND BUSBAR

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

UNIT-IV

CIRCUIT BREAKERS

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

UNIT-V

FUSES & MICROPROCESSOR BASED RELAYS

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

List of Experiments:

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

References:

1. B. Ravindran and M Chander, Power System protection and Switchgear, New Age International reprint 2006.
2. Badrirk, Power System protection and switchgear, TMH.
3. CL Wadhwa, Electrical Power systems, new age International.
4. Haddi Saadet, Power System Analysis, TMH
5. A.R. Bergen, Vijay Vittal, "Power System Analysis, Pearson Education, Asia. Switchgear & protection Sunil S. Rao. Khanna Publication



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Semester – V **Course Content**

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Energy Conservation Management	EX- 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
EEE	Wind & Solar energy	EX- 5031(B)	4L-0T-0P	4

Course Outcomes:

- CO1** Acquire the knowledge Fundamentals of Energy Science and Technology
- CO2** Demonstrate the functioning of various components involved in solar thermal systems for designing Commercial solar power plants.
- CO3** Summarize the control schemes, environmental aspects and classification of wind energy conversion Systems for reliable operation.
- CO4** Recall the power conversions involved in wind mills for production of electricity.
- CO5** Stand alone and Grid connected systems, Power Quality issues

Course Contents:

Unit-I

Fundamentals of Energy Science and Technology: Introduction, Energy, Economy and Social Development, Classification of Energy Sources, Importance of Non -conventional Energy Sources, Salient features of Non-conventional Energy Sources, World Energy Status, Energy Status in India. Energy Conservation and Efficiency: Introduction, Important Terms and Definitions, Important Aspects of Energy Conservation, Global Efforts, Achievements and Future Planning, Energy Conservation/Efficiency Scenario in India, Energy Audit, Energy Conservation Opportunities. Energy Storage: Introduction, Necessity of Energy Storage, Specifications of Energy Storage Devices. Solar Energy-Basic Concepts: Introduction, The Sun as Source of Energy, The Earth, Sun, Earth Radiation Spectrum, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, Depletion of Solar Radiation.

Unit-II

Solar Energy-Basic Concepts (continued): Measurement of Solar Radiation, Solar Radiation Data, Solar Time, Solar Radiation Geometry, Solar Day Length, Extraterrestrial Radiation on Horizontal Surface, Empirical Equations for Estimating Terrestrial Solar Radiation on Horizontal Surface, Solar Radiation on Inclined Plane Surface. Solar Thermal Systems: Introduction, Solar Collectors, Solar Water Heater, Solar Passive Space Heating and Cooling Systems, Solar Industrial Heating Systems, Solar Refrigeration and Air Conditioning Systems, Solar Cookers.

Unit-III

Wind Energy: Introduction, Basic Principles of Wind Energy Conversion, History of Wind Energy, Wind Energy Scenario-World and India. The Nature of the Wind, The Power in the Wind, Forces on the Blades, Wind Energy Conversion, Wind Data and Energy Estimation, Site Selection Considerations Wind energy systems: Environment and Economics Environmental benefits and problems of wind energy, Economics of wind energy, Factors influence the cost of energy generation, machine parameters, Life cycle cost analysis

Unit-IV

Basic Components of a Wind Energy Conversion(WEC) System: Classification of WEC systems, Advantages and Disadvantages of WECS, Types of Wind Machines (Wind Energy Collectors), Analysis of Aerodynamic Forces Acting on the Blade, Performance of Wind- machines, Generating Systems, Energy Storage, Applications of Wind Energy, Environmental Aspects.

Unit-V

Stand alone and Grid connected systems, Power Quality issues, Impact of power quality problems on DG, Mitigation of power quality problems, and Role of custom power devices in Distributed Generation

Reference Books:

1. Daniel, Hunt. V Wind Power, A Hand Book of WECS, Van Nostrend Co., Newyork, 2nd Edition,1998.
2. ArindamGhosh, Gerard Ledwich, “Power Quality Enhancement Using Custom Power Devices”,Springer,1stEdition,2002.
3. Roger C Dugan, Mark E Mc. Granaghan, Surya Santosoh and H. Wayne Beaty, “ElectricalPowerSystems Quality”, TATA McGraw Hill, 2nd Edition, 2010.
4. Mukund R Patel, “Wind and Solar Power Systems”, CRC Press, 1st Edition, 1999
5. Publications, 2nd Edition, 2001. G D Rai, “Non- Conventional Energy Resources”, KhannaPublishers,1st Edition, 2002.



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Semester – V **Course Content**

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Renewable Power Generation	EX- 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. El-Wakil: Nuclear Power Engineering, McGraw Hill, 1962.
4. R.L. Murray: Introduction to Nuclear Engineering, Prentice 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
EEE	SWAYAM/NPTEL-MOOC-1	EX- 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 tutorial work submitted by the students.

7. All students would be motivated 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
EEE	Industrial Electronics	EX- 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 harmonics 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 protection, 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. inverters 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
EEE	Control System	EX- 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. Rudra Pratap, Getting Started with MATLAB, Oxford.
10. Dhanesh N. Manik, Control Systems, Cengage



R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical & Electronics Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – V

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electrical And Electronics Material	EX- 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



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Semester – V **Course Content**

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

Guideline

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

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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
EEE	Electrical Simulation Lab-I	EX- 5051	0L-0T-2P	2

Course Outcome:

- CO1** Ability to understand the concept of MATLAB programming in solving power systems problems
- CO2** Ability to understand power system planning and operational studies.
- CO3** Ability to find Symmetric and Unsymmetrical fault.
- CO4** Ability to acquire knowledge on power system analysis methods.
- CO5** Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- CO6** Ability to effectively employ different techniques to analyze different power system network conditions.

Course Contents:

UNIT- I

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

UNIT- II

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

UNIT- III

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

UNIT- IV

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

UNIT- V

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



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Semester – V **Course Content**

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

List of Experiments:

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



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Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Microprocessors and Microcontrollers	EX-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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New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Power System-II	EX-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 Runge-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. Nagarkar, M.S. Sukhiza, -“Power System Analysis”, Oxford University Press.
5. Elgerd O.I., “Electric Energy Systems Theory”, TMH, New Delhi, Second Edition 1983.
6. PrabhaKundur, “Power system stability and control”, Mc-Graw Hill Inc, New York, 1993.
7. Taylor C.W., “Power System Voltage Stability”, Mc-Graw Hill Inc, New York, 1993.
8. Nagrath IJ, Kothari D.P., “Power System Engineering”, Tata Mc-Graw Hills, New Delhi 1994.
9. Weedy B.M. “Electric Power System” John Wiley and Sons, 3rd edition.
10. P.S.R. Murthy, “Power System Operation and Control”, B S Publication
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 Raphson method.
4. Assessment of transient stability of a single machine system.
5. Effect of compensation on voltage profile of IEEE 6-bus system.
6. Study of any software tools (PSAT, EDSA, MY POWER, ETAP etc).



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B.Tech.(Electrical & Electronics Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Utilization Of Electrical Energy	EX – 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 characteristics, tractive effort, transmission requirement, vehicle performance and energy consumption.

References:

1. Open Shaw ,Taylor, .Utilization of electrical energy., Orient Longmans, 1962.
2. H. Pratap, Art and Science of Utilization of Electrical Energy.
3. Gupta, J.B., Utilization of Elect. Energy ,Katariya and sons, New Delhi.
4. Garg, G.C., Utilization of Elect. Power and Elect.Traction.
5. N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect.



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B.Tech.(Electrical & Electronics Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electromagnetic Waves	EX – 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 ∇ and divergence theorem, Numerical Problems.

Energy, Potential and Conductors: Energy expended or work done 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's 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 ($\gamma, \alpha, \beta, \eta$) 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 & Electronics Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Digital Signal Processing	EX – 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 Schaffer 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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Semester – VI **Course Content**

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

Guideline

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Semester – VI **Course Content**

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electronic Instrumentation	EX – 6041(A)	4L-0T-0P	4

Course Outcomes:

- CO1** Identify various types of electronic instrument suitable for specific measurement.
- CO2** Understand different types of bridges and their construction to find unknown values.
- CO3** Apply the complete knowledge of various electronics instruments/transducers to measure the physical quantities in the field of science, engineering and technology.
- CO4** Elaborate discussion about the importance of signal generators and analyzers in measurement
- CO5** develop an understanding of construction and working of different digital devices

Course Contents

UNIT-I

Introduction to CRO, Different parts of CRO, Its Block diagram, Electrostatic focusing, Electrostatic deflection, post deflection acceleration, Screen for CRTs, Gratitude, 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

A.C. Bridge Measurement:-

Sources and detectors, Use of Bridges for measurement of inductance, Capacitance & Q factor Maxwells bridge, Maxwells inductance capacitance bridge, Hays bridge, Andersons bridge, Owen's Bridge, De-sauty's Bridge, Schering Bridge, High Voltage Schering bridge, Measurement of relative permittivity, Heaviside cambell's bridge, Weins bridge, Universal bridge, Sources of errors in Bridge circuit, Wagner's Earthing device, Q meter and its applications and measurement methods.

UNIT-III

Transducers

Transducers definition and classification, mechanical devices as primary detectors, Characteristic & choice of Transducers, Resistive inductive and capacitive transducers, strain gauge and gauge factor, Thermistor, Thermo couples, LVDT, RVDT, Synchros, Piezo-Electric transducers, Magnet elastic and magnetostrictive Hall effect transducers, Opto-electronic transducers such as photo voltaic, Photo conductive, photo diode and photo conductive cells, Photo transistors, Photo optic transducers. Introduction to analog & Digital data acquisition systems-Instrumentation systems used, Interfacing transducers to electronic control & measuring systems Multiplexing –

UNIT-IV

Signal Generators:-

Fixed & variable frequency AF oscillators, Sine wave generators, Standard signal generator, AF Sine and Square wave generator Function generator, Square and pulse generator, Random noise generator, Sweep generator, TV Sweep generator, Marker generator, Sweep- Marker generator, Wobbly scope, Video pattern generator Vectroscope, Beat frequency oscillator

Wave analyser Basic wave analyzer, Frequency selective wave analyzer, Heterodyne wave analyzer, Harmonic distortion, analyzer, spectrum analyzer digital Fourier analyzer.

UNIT-V

Digital Instruments:-

Advantages of Digital instruments over analog instruments, resolution and sensitivity of Digital meters., Digital Voltmeter - Ramp type, Dual slope integration type, Integrating type, Successive approximation type, Continuous balance DVM or Servo balancing potentiometer type VM. , comparison of Electronic & Digital Volt meter, Digital Millimeter, Digital frequency meter, Time period measurement, High frequency measurement, Electronic counter, Digital tachometer, Digital PH meter, Digital phase meter, Digital capacitance meter. Digital display system and indicators like CRT, LED, LCD, Nixies, Electro luminescent, Incandescent, electrophoretic image display, Liquid vapour display dot-matrix display, Analog recorders, X-Y recorders. Instruments used in computer-controlled instrumentation RS 232C and IEEE 488, GPIB electric interface.

.

References:

1. Albert. D. Helfrick, W.D. Cooper, Modern Electronic Instrumentation and measurement techniques, PHI.
2. Kalsi H.S., Electronic Instrumentation, TMH.
3. A.K. Sawhney, Electrical and Electronic measurements and Instrumentation, DhanpatRai and Co.
4. E.W. Golding, Electrical Measurement and Measuring Instruments Sir Isaac Pitman and Sons.



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Semester – VI **Course Content**

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Internet of Things (IOT)	EX – 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

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 Madiseti 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



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Semester – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Analog & Digital Communication	EX – 6041(C)	4L-0T-0P	4

Course Outcomes:

- CO1** Explain sampling, PCM, delta modulation, adaptive delta modulation and super heterodyne receiver.
- CO2** Demonstrate generation and detection of analog and digital modulation techniques.
- CO3** Compare the different analog and digital modulation techniques
- CO4** Distinguish various line coding schemes used for digital data transmission.
- CO5** Apply time division multiplexing concepts in different pulse modulation techniques

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.

References:

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.

List of Experiments (Expandable)

1. Study of sampling process and signal reconstruction and aliasing
2. Study of PAM PPM and PDM
3. Study of PCM transmitter and receiver.
4. Time division multiplexing (TDM) and De multiplexing
5. Study of ASK PSK and FSK transmitter and receiver.
6. Study of AM modulation and Demodulation techniques (Transmitter and Receiver) Calculate of parameters
7. Study of FM modulation and demodulation (Transmitter and Receiver) & Calculation of parameters
8. To construct and verify pre emphasis and de-emphasis and plot the wave forms.
9. Study of super heterodyne receiver and characteristics of ratio radio receiver.
10. To construct frequency multiplier circuit and to observe the waveform
11. Study of AVC and AFC.



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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	SWAYAM/NPTEL-MOOC-IV	EX- 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 learners 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 tutorial work submitted by the students.

7. All students would be motivated 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 – VI

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Simulation Lab-II	EX - 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.
- CO6** Ability to analyze the power flow using GS and NR method.



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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electronics Instrumentation Lab	EX - 6061	0L-0T-2P	2

List of Experiments:

1. Measurement of inductance of a coil using Anderson Bridge.
2. Measurement of capacitance of a capacitor using schering bridge.
3. LVDT and capacitance transducers characteristics and calibration.
4. Resistance strain gauge- Strain Measurement and calibration.
5. Measurement of R,L,C& Q using LCR-Q meter.
6. Study & measurement of frequency using Lissajous patterns.
7. Measurement of pressure using pressure sensor.
8. Study of Piezo-electric Transducer and Measurement of impact using Piezo-electric Transducer
9. Measurement of Displacement using LVDT.
10. Measurement of speed of a Motor using photoelectric transducer.
11. Study & Measurement using ph meter.
12. Temperature measurement & Control using thermo couple & using thermistor



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Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Power Electronics	EX - 7011	2L-1T-1P	4

Course Outcomes:

- 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 (120° , 180°) 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

APPLICATIONS 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.

Reference Books:

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

List of experiments:

1. R, RC & UJT Triggering circuits
2. Single phase & Full converter
3. Single phase AC voltage controller using Triac
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
EEE	Power System Analysis & Control	EX-7021(A)	3L-1T-1P	5

Course Outcome:

- CO1** An ability to design and conduct experiments, as well as to analyze and interpret data
- CO2** An understanding of professional and ethical responsibility
- CO3** An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, health and safety, manufacturability, and sustainability

Course Contents:

UNIT-I

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

UNIT-II

FREQUENCY CONTROL:- Plant and system level control-mathematical model of speed governing system-speed load characteristics regulation of two generators in parallel-concept of control area-LFC control of a single area system-static and dynamic response of uncontrolled and controlled system-LFC of two area system- static and dynamic response of uncontrolled system-tie line with frequency bias control of two area system.

UNIT-III

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

UNIT-IV

ECONOMIC DISPATCH AND UNIT COMMITMENT:- Incremental cost curve-co-ordination equations without loss-solution by Lambda iteration method- coordination equations with loss-solution of co-ordination equations using Bmn co-efficient (no derivation) –base point and participation factors. Unit commitment (UC) problem-constraints in UC-Solution methods-Priority list methods (Numerical problems) Economic dispatch controller added to load frequency control.

UNIT-V

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

Reference Books:

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



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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electrical Drive	EX-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 of synchronous motors drives. (Block diagram only)

References:

1. G.K. Dubey “Fundamentals of Electrical Drives”-. Narosa Publications
2. Gopal K. Dubey “Power semiconductor Controlled Drives”- PHI
3. S.B. Dewan, G.R. Slemon, A. Straughen “Power semiconductor Controlled Drives”
4. B.K. Bose “Power Electronic control of AC Drives”.
5. V. Subramanyam “Thyristor control of Electric Drive” Tata McGraw Hill Pub
6. N.K. De , P.K. Sen “Electric Drives” PHI
7. S.K. Pillai, “A first course of Electrical Drive” New age International.
8. S.K. Pillai. “Analysis of Thyristor Power conditioned Motors” University Press (India)Ltd. Longman
9. P.V. Rao, “Power semiconductor Drives”, BS Publications.



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Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Power System Planning & Reliability	EX-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** Be acquainted with the categories of electric energy consumers.
- CO4** Be able to perform generation and transmission planning

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 load approach. Reliability evaluation in two and more than two interconnected systems. Interconnection benefits.

Text Books/Reference Material:

1. Roy Billinton, "Power System Reliability Evaluation", Gordon & 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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Semester – VII

Course Content

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

Guideline

SWAYAM/NPTEL-MOOC-V 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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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.
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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.

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Semester – VII Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Power Plant Instrumentation	EX – 7031(A)	4L-0T-0P	4

Course Outcome:

- CO1** To provide an overview of different methods of power generation with a particular stress on thermal power generation.
- CO2** To bring out the various measurements involved in power generation plants.
- CO3** To provide knowledge about the different types of devices used for analysis.
- CO4** To impart knowledge about the different types of controls and control loops.
- CO5** To familiarize the student with the methods of monitoring different parameters like speed, vibration of turbines and their control

Course Contents:

UNIT-I

An Overview: Brief survey of methods of power generation. Hydro, thermal, nuclear, solar and wind etc. Dependence of instrumentation on the method of power generation-thermal power plants-general structures, pulverization and burners – fans, dampers and actuators – super heaters steam traps – Economizers Recirculators and regenerators, Cooling towers – feed water generators Turbine cooling systems, Radiation detectors

UNIT-II

Control loops and inter and Annunciation System: Combustion control – control of main header, pressure, air/fuel ratio control – furnace draft and excess control, drum level (three element control) main and re-heat systems temperature control, burner tilting up by pass damper super heater-spray and gas re-circulation controls, Hot well level control – interlock – MFT Turbine trip conditions – pulverizer control.

UNIT-III

Turbine monitoring and control: Condenser vacuum control – gland steam exhaust pressure control-speed, vibration, shell temperature monitoring – lubricating oil temperature control-hydrogen generator cooling system.

UNIT-IV

Analysis in power plant: Thermal conductive type, paramagnetic type-Oxygen analyzer, hydrogen purity meter-chromatography-PH meter, fuel analyzer, pollution monitoring and control.

Computer in power plants: load dispatching .

References:-

1. 1 E. L. Wakil, M. M. Power Plant Technology, McGraw Hill, 10984
2. Richard Dolezal and Ludrik Varcop, Process dynamics Automatic Control of Steam Generation Plant, Elsevier Publishing Co. Amsterdam, 1972.
3. J. Balasubramonian & R. K. Jain, Modern Power Plant Engineering, Khanna Publishers, New Delhi, 1987.
4. Stephen Michael Elonka & Antony Lawrence Kohan, Standard Boiler Operations: Questions & Answers, TMH
5. Modern Power Station Practice Vol. 6: Instrumentation Control & Testing, Pergaman Press, Oxford, 1971.



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B.Tech.(Electrical & Electronics Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Semiconductor Devices	EX – 7031(B)	4L-0T-0P	4

Course Outcome:

- CO1** Demonstrate the characteristics of power semiconductor devices.
- CO2** Designing circuit .of Transistors
- CO3** Analyse the operation of oscillators
- CO4** Construct power semiconductor circuits for industrial applications
- CO5** Analyse power semiconductor circuits for domestic application

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, Multi vibrators, Bistable, Monostable, A stable multi vibrators. Cllippers and clampers, Differential amplifier, calculation of differential, common mode gain and CMRR using h parameters, Darlington pair, Boot strapping technique. Cascade and cascade amplifier.

UNIT-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.

References:

1. Nashelsky & Boysted; Electronic Devices and Circuits; PHI
2. Millman Halkias; Electronic Devices and Circuits; McGraw- Hill
3. Achuthan MA and Bhatt KN; Fundamentals of semiconductor devices; TMH
4. Neamen Donald; Semiconductor Physics and device



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Semester – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electrical Machines – III	EX – 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 X_d and X_q (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. Bimbhra, 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. Electromechanics-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
EEE	SWAYAM/NPTEL-MOOC-VI	EX- 7031(D)	4L-0T-0P	4

Guideline

SWAYAM/NPTEL-MOOC-VI 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 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 tutorial work submitted by the students.

7. All students would be motivated 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 – VII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electrical Drive-LAB	EX-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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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Power System Protection -LAB	EX - 7051	0L-0T-2P	2

List of Experiment

- 1.To perform symmetrical and asymmetrical fault analysis in a power system
- 2.Study and Testing of Over Current Relay Training System
- 3.Study and Testing Differential Relay Training System
- 4.Operational characteristic of SF6 circuit breakers
- 5.Operating mechanisms of MCB and HRC fuse
- 6.To perform alternator protection for faulty condition



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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Electric and Hybrid Vehicles	EX-8011	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 Electric 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:



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Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Computer Application To Power System	EX-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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Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	SCADA System & Application	EX-8021(B)	3L-1T-0P	4

Course Outcomes:

- CO1** Understand basics of SCADA systems and its various functions.
- CO2** Acquire knowledge regarding SCADA System Components and Programmable Logic Controller (PLC).
- CO3** Explore Various SCADA architectures, advantages and disadvantages
- CO4** Investigate various industrial communication technologies.
- CO5** Learn and apply the SCADA Applications in Transmission and Distribution sector operations and industries.

Course Contents

UNIT – I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

Operation and control of interconnected power system-Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, state estimation, SCADA applications Utility applications, transmission and distribution sector operation, monitoring analysis and improvement. Industries oil gas and water. Case studies, implementation, simulation exercises.

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.
Computer Techniques in Power Systems Analysis- Pai M.A. Tata McGraw Hill.
3. Computer Modeling of Electrical Power Systems, Arrillaga J. Arnord C.P Harker B.J. John Wiley &Son
4. Computer Aided Power Systems Analysis Kusic G.L.- 2nd Edition, CRC Press
5. Modern Power Systems Analysis Nagrath I.J. and Kothari D.P. Tata McGraw Hill
6. Power System Analysis Grainger J.J. &Stevnson W.D. McGraw Hill
7. Power System Stability and control -P Kundur ,IEEE Press 1994.●
8. Advance Power Systems Analysis and Dynamics Singh L.P. JohnWiley.
9. Chakrabarti –Power System Analysis operation & Control – PHI Learning



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Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Digital Image Processing	EX-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.
- CO6** Review the fundamental concepts of a digital image processing coding system

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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Course Content

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

Guideline

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Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	High Voltage Engineering	EX-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 and 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, Cockcroft-Walton type high voltage DC set, Introduction to standard lightning and switching impulse voltages. Analysis of single stage impulse generator-expression for Output impulse voltage, Multistage impulse generator Components of multistage impulse generator. Triggering of impulse generator by three electrode gap arrangement. Triggering gap and oscillograph time sweep circuits. Generation of switching impulse voltage. Generation of high impulse current.

UNIT-IV

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

UNIT-V

HIGH VOLTAGE TESTS ON ELECTRICAL APPARATUS:- Definitions of technologies, tests on isolators, circuit breakers, cables insulators and transformers.

Reference books:

1. E.Kuffel and W.S.Zaengl, "High voltage engineering fundamentals", 2nd edition, Elsevier, press, 2005.
2. M.S.Naidu and Kamaraju, "High Voltage Engineering", 3rd edition, THM, 2007.
3. L. L.Alston, High Voltage technology", BSB Publication, 2007. 3. Rakosh Das Begamudre, Extra High voltage AC transmission engineering, Wiley Eastern limited, 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	EX-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 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

Competitions 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 toft. (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
EEE	Advanced Communication Systems	EX-8031(C)	3L-0T-0P	3

Course Outcomes:

- CO1** Appreciate the importance of microwave signal and learn spectrum modulation
- CO2** Describe the working principle of different RADAR systems and their applications.
- CO3** Understand the Satellite fundamentals and types of satellite.
- CO4** Explain the working of a Satellite communication system and its other subsystems
- CO5** Know the applications of Satellites in different areas.

Course Contents

UNIT-I

Introduction to spread spectrum modulation, Direct sequence (DS) spread spectrum, Spread spectrum with code division multiple access (CDMA), Ranging, Frequency hopping (FH) spread spectrum, PN sequence generation, Acquisition and tracking of FH signal and DS signals.

UNIT -II

Satellite communication: Introduction to satellite communication, Frequency allocation active/passive synchronous ,Non synchronous systems, Orbits satellite attitude, Transmission path, Path loss, noise consideration link analysis, Satellite systems effective isotropic radiated power, Multiple access methods, Earth stations, Tracking and servo system, Up-down converters, Example of satellite systems.

Unit-III

Digital switching systems: Introduction to electronics and digital exchanges, Hierarchy of switching offices, Common control push button dialing systems, Switching matrix multiple stage switching time division multiplexing time slot interchanging (TSI), Comparison of TSI with space switching, Space array for digital signals, Combined space and time switching. Principles of FAX.

Unit-IV

Mobile communication: Introduction to cellular mobile communication element of the cellular systems, Cell design, hand off techniques, Frequency Management.

Unit-V

Local access networks: Improvement in convention cables: XDSL, ADSL, Wireless local loop, Fiber in local loop, radio Trunking. ISDN: Architecture, Services and Protocols, ATM networks

References:

1. Radio Callins, Microwave communication.
2. Gagldardi, Satellite communication.
3. Thyggajan Vishwanathan, Tele Communication switching systems – PHI Learning
4. Lee, Cellular and mobile communication
5. Karmilo Fehar, Wireless digital communication. - PHI Learning



R.K.D.F. UNIVERSITY, BHOPAL

B.Tech.(Electrical & Electronics Engineering)

New Scheme Based on AICTE Flexible Curricula

Semester – VIII

Course Content

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

Guideline

SWAYAM/NPTEL-MOOC-VIII 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 learners 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 tutorial 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 & Electronics Engineering)

New Scheme Based On AICTE Flexible Curricula

Semester – VIII

Course Content

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
EEE	Computer Application To Power System-Lab	EX-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.