SYLLABUS OF B.E. (ELECTRICAL) SEM. III & IV [C.B.C.S.]

3EE01/3 EP01/3EX01 ENGINEERING MATHEMATICS -III

Course Outcomes:
After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and partial differential equations, applied to electrical engineering systems.
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Apply Z Transform to solve of various Linear Difference equations with constant coefficients.
5. Apply the knowledge of vector calculusto solve physical problems.
6. Demonstrate the basic concepts of probability and statistics.

UNIT-I:
(a) **Statistics:**Introduction, Curve fitting by method of least square, change of scale, fitting of straight line and parabola, correlation, regression. Application of statistics to electrical engineering.

(b) **Probability**: Axioms, conditional probability, Bay'stheorem,mathematical expectations, probability distributions:Binomial, Poisson and Normal.Application of probability to electrical engineering.

UNIT-II:
(a)Partial differential equation (PDE)of first order and first degree of following type-

(i) f (p, q) = 0; (ii) f (p, q, z) =0; (iii) f (p, q, x, y) = 0; (iv) Pp + Qq =R (Lagrange's Form); (v) Clairaut form Z = px + qy + f(p, q) . Applications of PDE to electrical circuits.

(b)DifferenceEquation: -Solution of difference equations of first order, solution of difference equations of higher order with constant coefficient.Applications of difference equations to electrical engineering.

UNIT-III:
Laplace Transforms: Definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Laplace transform of Periodic Function, Impulse Function, Unit Step Function. Solution of linear differential equation using Laplace transform.

UNIT-IV:
Fourier Transforms- Definition, standard forms, properties of Fourier transform,inverse Fourier transform, Fourier Transform of some basic functions.Fourier transform of Periodic Function, Impulse Function, Unit Step Function.Fourier cosine transforms. Applications of Fourier Transforms in electrical engineering.

UNIT-V:
Z-transform: Definition, standard forms, Z-transform of impulse function, Unit step functions, Properties of Z-transforms (Linearity, shifting, multiplication by k, change of scale), initial and final values, inverse Z-transforms (by direct division and partial fraction), Solution of difference equation by Z-transforms.

UNIT-VI:
Vector Calculus: - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, Line Integral, Stokes and Divergence Theorem. Application of Vector calculus to electromagnetics.

Text Book: Elements of Applied Mathematics by P.N.Wartikar and J.N.Wartikar.

Reference Books:

1. Statistical Methods by S.G. Gupta
2. Advance Engineering Mathematics by B.S.Grewal
3. Integral Transforms by Goyal & Gupta.

3EE02/3 EP02/3EX02 ELECTRICAL CIRCUIT ANALYSIS

Course Outcomes:

After completing this course student twill be able to:

1. Analyze electric and magnetic circuits using basic circuital laws
2. Analyze the circuit using Network simplification theorems.
3. Solve circuit problems using concepts of electric network topology.
4. Evaluate transient response of different circuits using Laplace transform
5. Evaluate two-port network parameters and network functions

Unit I:

[a] Terminal Element Relationships: V-I relationship for Dependent &Independent , Voltage and Current Sources., Source Transformations. Source Functions: unit impulse, unit step, unit ramp and interrelationship, sinusoidal input, generalized exponential input.

Magnetic Circuits: concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, Analysis of series and parallel magnetic circuits.

[b] Basic Nodal and mesh Analysis: Introduction, Nodal analysis, super node analysis, mesh analysis, super mesh analysis.

Unit II:

Network Theorems: Superposition theorem, Thevenin'stheorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorem

Unit III :

Graph Theory and Network Equation:-Graph of a network, Trees and loops, Tie-set and cut set matrix of a network, Network equilibrium equations, duality-network transformation.

Unit IV:

a] **Transformation of a Circuit into s-domain:** LaplaceTransformed equivalent of inductance, capacitance and mutual inductance, Impedance and admittance in the transform domain, Node Analysis and Mesh Analysis of the transformed circuit. Complete Solution ofLinear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-for step Inputs. Natural Response, Transient Response, Determination of initial conditions.

Unit V :

Two Port Networks: Two port networks: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interrelationship between parameters, Interconnection of two port networks , Input impedance in terms of two port network parameters, Output impedance, Image impedance.

Unit VI :

Network functions: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function. Applications of network analysis in driving network functions, positive real functions, driving point and transfer impedance function.

Text Book: Network Analysis, M.E. Van Valkenburg, PHI, 2005.

Reference Books:

1. Circuits & Networks – Analysis, Design & Synthesis by M.S.Sukhija, T.K.Nagasarkar, OxfordUniversity Press, 2010.
2. Circuit and Network Analysis, SudhakarShyammohan, Tata Mc Graw Hill, 2005.
3. Network Analysis, P. Ramesh babu, SciTech Publications, Chennai, 2009.

3EE03/3 EP03/3EX03 ELECTRICAL MACHINES – I

Course Outcomes:

After Completing this course, students will be able to:

1. Explain the construction and working of DC Machines.
2. Illustrate the different Characteristics, types, their applications and parallel Operation of D.C. Generators.
3. Demonstrate the various characteristics, starting, speed control and braking operation on DC motors
4. Analyze the performance of DC machines by conducting the various tests on it.
5. Determine the parameters of equivalent circuits, performance parameters of single phase transformer and merits & demerits of autotransformer
6. Explain the construction, working, different connections, applications and testing of three phase transformer.

Unit I :
D.C. Machines: Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.

Unit II :
D.C. Generators: Types, Characteristics and Applications of D. C. Generators, Parallel Operation of D.C. Generators, Introduction to testing of D. C. Generators as per Indian standard.

Unit III :
D.C. Motors: Types, Characteristics & Modified Characteristics, Applications of D.C. Motors. Starting, Electric Braking, Speed Control of DC Motors. Losses, efficiency and testing of DC Motors.

Unit IV :
Single phase Transformer: Working Operation, EMF Equation, and separation of core losses in to its component. Equivalent Circuit, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on transformer as per Indian standard.

Single phase Autotransformer: - construction, working, merits, demerits and its application.

Unit V :
Three Phase Transformer: Construction, Working, Types, connections, vector group connections, open delta Connection, OC, SC, Heat run test, load test, magnetic balance, vector group test on three phase transformer.

Unit VI :
Three Phase Transformer: Three-winding transformer, On load & Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Waveforms of no load current & inrush current phenomenon.

Text Book: Electrical Machines by D P Kothari & I J Nagrath TMH. New Delhi.

Reference Books:

1) C. Dawes: Electrical Engineering, Vol.I: Direct current (IV Edition), (McGraw Hill Book Company)
2) H. Cotton: Advance Electrical Technology, (Wheeler publication)
3) Indian Standard Guide for testing DC Machine. IS: 9320-1979, (Indian Standards Institution, New Delhi.)
4) Indian Standard Specification for safety transformer. IS: 1416-1972, (Indian Standards Institution, New Delhi.)

3EE04/3 EP04 ENERGY RESOURCES AND GENERATION

Course Outcomes:
A student, on completion of this course, will be able to:

1. Explain the operation of Thermal, Hydro, Nuclear and Diesel power plants.
2. Summarize solar energy conversion, solar radiation measuring instruments, wind energy conversion and their applications.
3. Outline the principle and operation of fuel cells, ocean & tidal energy conversion, and other non-conventional energy resources.
4. Determine the various factorsand curves related to electrical load & generating plant.

Unit I :
Conventional and non conventional energy sources, Indian Energy Scenario.
Thermal and hydro power plant: Layout of Thermal power plant, Selection of site, working of various parts: Economizer, air preheater, condenser, cooling tower, ash &coal handling plant, advantages & disadvantages
Layout of Hydro power plant, classification of hydro power plant according to available head, nature of load, functions of different components and their working, mini and micro hydro-electric power generation, advantages & disadvantages.

Unit II :
Nuclear and Diesel power plant: nuclear fission and fusion, Layout of Nuclear power plant, Selection of site, Functions of different components of nuclear plant, types of nuclear reactors , advantages & disadvantages of different nuclear reactors, nuclear waste disposal., safety measures.
Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages.

Unit III :
Solar Energy and its measurement: Solar cell, array & module, Solar constants, solar radiation at earth's surface, Solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface, principle of solar energy conversion in to heat, types of solar collectors, energy balance equation and collector efficiency.

Unit IV :
a]Fuel cells: Chemistry applied to fuel cells, principle and operation ,classification and types of fuel cells, performance characteristics of fuel cells, classification of fuel cell system.

b]Wind energy :Basic principle of wind energy conversion, wind data and energy estimation, selection of site ,basic components of wind energy conversion system ,classification of WEC systems ,generating system, applications of wind energy.

Unit V :
Ocean, Tidal & Other non-conventional energy resources: Ocean energy resources, ocean energy routes, ocean thermal energy conversion, basic principle of tidal power, components of tidal power plants, operation methods of utilization of tidal energy, estimation of power and energy in single and double basin tidal system,. Operating principles of energy from biomass, energy from biogas, geothermal energy, MHD power generation, energy from urban and rural waste.

Unit VI :
Load-Generation factors: connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, load curve, chronological load curve, load duration curve, energy load curve, energy duration curve, load survey, base load and peak load station.

Text Book : Generation of Electrical Energy by B.R.Gupta, Eurasia Publishing House, New Delhi.

Reference Books:

1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Solar energy by S.P.Sukhatme Tata McGraw Hill Publication
3. Principles of Power System by V.K.Mehta, S.Chand publication.
4. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.

3EE05/3 EP05ELECTRONIC DEVICES AND CIRCUITS

Course Outcomes:

After successfully completing the course, the students will be able to :

1. Demonstrate the knowledge of semiconductor physics and PN Junction Diode
2. Analyze the rectifier and regulator circuits.
3. Analyze the operational parameters of BJT
4. Analyze various multistage amplifier circuits
5. Demonstrate the knowledge of JFET, MOSFET, UJT and their operational parameters

UNIT-I:
P-N Junction diode theory, Energy bands in intrinsic and extrinsic silicon, carrier transport, diffusion current , drift current, mobility and resistivity, generation and recombination of carriers, PN junction diode , zener diode, zener diode as voltage regulator, Numericals based on voltage regulator (line and load regulation, Numericals based on resistivity, conductivity, mass action law)

UNIT-II:
Half wave, full wave center tapped full wave and bridge rectifier. Filters-C, LC and their analysis, clipping and clamping, Numericals based on clipping and clamping

UNIT-III:
Theory and Analysis of Bipolar Junction transistor, 'H' Parameter, methods of biasing, their needs, 'Q' and stability factors, compensation techniques.

UNIT-IV :
Study of typical transistor amplifier circuits i) Emitter follower, ii) Darlington emitter follower. iii) Bootstrap emitter follower, iv) RC coupled amplifier, v) Transformer coupled amplifier, vi) Cascaded amplifier, vii) Direct coupled amplifier, viii) Cascade stage.

UNIT-V :
FETs (JFET & MOSFET): Types, Characteristics and parameters (u, gm &Rds), Applications of FET amplifiers, UJT: Characteristics, working, UJT as relaxation oscillator.

UNIT-VI :
Theory, construction and applications of Schottky diode, Tunnel diode, Varactor diode, Selenium diode, LED, Photo diode, PIN diode, photo-transistor.

Text Book :
Millman's Electronic Devices & Circuits by J.Millman, C.Halkias, Satyabrata Jit TMH 3rd ed, 2nd reprint 2011.

Reference Books:

1. Electronic Devices and Circuits 5/e – David Bell Oxford University Press
2. Microelectronic Circuits 5/3 – Sedranad Smith Oxford University Press
3. Boylestad R. and "Electronics Devices & Circuits", Prentice Hall of India Private Limited, New Delhi (Fifth Edition), 1993.

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3EE06/3 EP06/3EX06 ELECTRICAL CIRCUIT ANALYSIS - LAB

Minimum eight experiments based on the syllabus content of 3EE02/3 EP02/3EX02Electrical Circuit Analysis. The intensive list of experiment is given below :

1. Verification of output response of series R-C circuit for step input
2. Study of dot convention and determination of
   A) Mutual inductance
   B) Coupling coefficient of b transformer
3. Verification of Mesh and Node analysis.
4. Verification of Superposition theorem.
5. Verification of Thevenin's theorem.
6. Verification of Maximum Power Transfer theorem.
7. Verification of reciprocity theorem.
8. Study of Milliman's theorem& verification.
9. Verification of Norton's theorem.
10. Determination of ABCD parametersT-network &Π-network.
11. Study of Tie set and Cut set schedule for a given network.
12. MATLAB simulation for o/p verification of any theorem.
13. Determination of Z and Yparameter.
14. Determination of hybrid parameter.

3EE07/3 EP07/3EX07 ELECTRICAL MACHINES - I LAB

Minimum eight experiments based on the syllabus content of 3EE03/3 EP03/3EX03Electrical Machines – I.

The indicative list of experiments is given below.

1. Plot the OCC of DC generator and find its critical resistance and critical speed.
2. To study the build-up of DC shunt generator, calculate critical resistance at different speeds.
3. Plot/Compare: External, Internal Characteristics of DC Shunt/series/compound generator.
4. Calculate the efficiency and voltage regulation of DC generator by the direct load test.
5. Speed Control of DC Shunt motor by armature control & Field Control method.

6. Perform the direct load test on DC series/shunt/compound motor to plot its performance characteristics, and determine its efficiency and speed regulation.
7. Conduct the Swinburn's test on DC machine to estimate its performance at any desired load condition.
8. Conduct the Hopkinson's test on DC Machine to analyze its performance.
9. Perform Electric Braking Operation on DC shunt Motor.
10. Conduct the Polarity test and Ratio test on transformer
11. Calculate the Equivalent circuit parameters of single-phase transformer by performing OC & SC test on itand determine its efficiency and voltage regulation.
12. Perform the direct load test on single phase/three phase transformer and determine its efficiency and voltage regulation.
13. Conduct back to back test (Sumpner's test)on two single phase transformers and determine the temperature rise.
14. Conduct the magnetic balance test on three phase transformer.
15. Conduct the vector group test on three phase transformer.
16. Conversion of three phase to two phase supply system using Scott Connection
17. Capture the waveform of inrush current of single phase/three phase transformer using DSO.

. **Reference:** S.G.Tarnekar, P.K.Kharbanda, S.B.Bodkhe, S.D.Naik and D.J.Dahigaonkar"Laboratory Courses in Electrical Engineering", S. Chand & Co. New Delhi, 2013.

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3EE08/3 EP08/3EX08 ELECTRONIC DEVICES & CIRCUITS - LAB

Minimum eight experiments based on the syllabus content of 3EE05/3 EP05/3EX04Electronic Devices & Circuits. The intensive list of experiment is given below :

1. To study and verify V-I characteristics of semiconductor diode
2. To study and verify V-I characteristics of Zener diode.
3. To verify the performance of half wave rectifier circuit with and without filter.
4. To verify the performance of full wave bridge rectifier circuit and determination of load regulation.
5. To verify the performance of Zener voltage regulator.
6. To verify characteristics of bipolar junction transistor
7. To study and perform C-E amplifier gain with variation of load resistance.
8. To study and verify the characteristics of FET
9. To study UJT as a relaxation oscillator
10. To study phase shift oscillator & determine frequency of oscillation
11. To study characteristics of MOSFT
12. To study clipper circuits using diodes
13. To study clamper circuits using diodes
14. To study and verify operation of cascade amplifiers
15. To verify operation of transistor as a switch

3EE09/3 EP09/3EX09 ELECTRICAL TECHNOLOGY - LAB

Perform **minimum Eight** practicals /demonstrations from the following list and prepare the report as a term work for this laboratory.

1. Introduction to standard symbols used in wiring diagrams
2. Introduction to different wiring accessories.
3. Demonstration of different types of wirings eg. Domestic wiring, commercial wiring, Industrial wiring.
4. Connection of Staircase wiring, Godown wiring, fluorescent lamp. Ceiling fan, air cooler etc
5. Domestic wiring diagrams
6. Connections of switch board, MCB and energy meter
7. Testing and electrical Maintenance of domestic appliances like lamps, electric iron, heater, geyser, air cooler, fan, microwave-oven, induction heater, etc.
8. Insulation resistance and earth resistance measurement
9. Conduct the load survey for domestic/commercial /Industrial consumers
10. Illumination system Design (selection of type and number of lamps required for any location)
11. Calculation of Energy bill for LT & HT consumers.
12. Safety precautions while working with electrical system
13. Demonstration of first aid treatment after getting electric shock.
14. Study of various components of solar power plant.
15. Design calculation of small capacity roof top solar power plant

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