

BE IV SEMESTER						
COURSE CONTENTS						
EE4301	Electromagnetic Fields & Materials	L	T	P	Max. Marks	Min. Marks
Duration in hrs.		3	1	0	70	22

Course Objective:

UNIT – I :

Review of rectangular, cylindrical, spherical co-ordinate systems, conversion of vector from one system to another, concept of incremental length, area and volume. Expression for gradient, divergence, curl & Laplacian in generalised co-ordinate system too. Electrostatics – Coulomb's law & Gauss's law for various charge distributions, method of images. Poisson's & Laplace's equation, boundary conditions.

UNIT – II :

Thermal, Mechanical and electrical properties of various types conductors, insulators and semiconductors. Equation of continuity. Dielectric material in electric field, polarization. Capacitance of different configuration energy stored in electrical field. Claussius Mossotti equation.

UNIT – III :

Static field & material- Biot Savarts law (Analysis with different current flow configuration), Ampere's circuital law & its application. Lorentz force, magnetic dipole, magnetic boundary condition. Diamagnetic, Paramagnetic & Ferromagnetic materials and its B-H curve. Hysterises loss, eddy current loss.

UNIT – IV :

Scalar magnetic potential & Vector magnetic potential, their properties & limitations with analysis of different simple configuration. Self & mutual inductance of various geometric configurations, Faraday's law, Maxwell's equation in various form.

UNIT – V :

Wave equation in free space conducting medium. Uniform plane wave and its general solution. Wave equation in phasor form. Wave propagation and its characteristics in loss less medium, free space and conducting medium. Polarisation of wave. Wave's normal and oblique incidence on perfect conductor and dielectric. Poynting vector and flow of power. Complex pointing vector.

References-

1. S.P. Seth , Electromagnetic field
2. William H. Hayt, Engineering Electromagnetic
3. G.S.N. Raju, Electromagnetic field theory & transmission line.
4. P.V. Gupta, Electromagnetic Fields.
5. John D. Kraus, Electromagnetic.
6. K.A. Gangadhar, Field Theory.
7. Jon Allison – Electrical Engineering materials & Devices.
8. A.K. Dekkar – Electrical Engineering materials.
9. Kortisky– Electrical Engineering materials & Devices.
10. B.M. Tareev – Materials for Electrical Engineering.

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EE 4301

COURSE OUTCOMES: At the end of the course student will be able to:

CO1	Apply basic concepts of different co-ordinate system in Electrical Engineering.
CO2	Explain basic concept of Electrostatics and Electromagnetics.
CO3	Illustrate Dielectric, Dielectric strength, its effects on capacitance.
CO4	Classify materials on the basis of electrical and magnetic properties.
CO5	Derive Maxwell Equations and electromagnetic wave transmission equations.

Mapping of Course outcomes (COs) with Program outcomes (POs):

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE-4002.1	CO1	2	1	1	—	—	1	—	—	1	—	—	2
EE-4002.2	CO2	2	2	1	2	—	1	—	—	1	—	—	2
EE-4002.3	CO3	2	2	1	1	—	1	—	—	1	1	—	1
EE-4002.4	CO4	2	1	—	1	—	—	—	—	1	—	—	2
EE-4002.5	CO5	2	2	2	—	—	—	—	—	1	—	—	1
	EE-4002 (Average)	2	1.6	1	0.8	0	0.6	0	0	1	0.2	0	1.6

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BE IV SEMESTER						
COURSE CONTENTS						
EE4301 EE4302	Electrical Machine-I	L	T	P	Max. Marks	Min. Marks
Duration in hrs.		3	1	2	70	22

UNIT – I : EME Conversion:

Principal of virtual work, Singly excited systems, Energy, force and torque calculation for such a system, reluctance, permeance, self and mutual inductances, Derivation of torque equation for single phase reluctance motor, generalization of this concept for multiple excited systems. Calculation of torque in electrical machine by (i) coupled circuit view – point and (ii) magnetic field view point. Relation between mechanical and electrical angle. Elementary ideas about motor and generator.

Introduction to the analysis of synchronous and induction machines based on principles of electro mechanical energy conversion. Self and mutual induction as functions of space angle. General equations of voltage and torque in different cases. Coupled circuit view point.

UNIT – II : DC Machines:

Constructional details about essential features such as the field magnet, armature winding, commutator, brush gear etc. Simple armature windings, lap and wave armature winding as current sheet-interpretation of torque equations: Voltage generated in an electrical m/c voltage generated in a DC Machine. DC Machine magnetic fields-flux and mmf distribution. Position of brushes, armature Ampere turns – cross magnetizing and demagnetizing effect of armature reaction, effect of armature reaction on field form, brush shifting, reactance voltage, commutation, methods of improving commutation interpoles, High resistance brushes, compensating winding, analysis of DC machine from electric circuit and magnetic circuit view point. Characteristics of DC generators, effect of saturation magnetization characteristics, critical resistance, load and total characteristics of separately excited, series, shunt and compound machines, load sharing.

UNIT – III : The D.C. motor:

Principle of operation, back e.m.f, speed of D.C. motor, use of starter-3 point and 4 point, magnetic controller for D.C. motor, speed control of D.C. motor, characteristics of series, shunt and compound motors, losses in d.c. motors and efficiency, testing of d.c. machines-direct, indirect and regenerative test, separation of losses in d.c. machine, application of d.c. machine.

UNIT – IV : Transformers:

Elementary Principle of transformer ;constructional detail, classification of transformers according to its magnetic circuit, electric circuit, uses ,cooling system etc. Magnetic coupled circuit, introduction to transformer, self and leakage reactance, voltage and current ratios, vector diagram as on no load, development of equivalent circuit concept, equivalent resistances reactances, referred quantities performance calculation, regulation-kapp's regulation diagram, per unit and percentage regulation, efficiency, maximum efficiency, effect of saturation on exciting current, Inrush of magnetizing current, vector diagrams on load (lag and lead cases) Testing of transformers-o.c. and s.c. tests for calculation of equivalent circuit parameters of transformer. Auto transformer vector diagram, economy in copper in comparison to two winding transformer.

UNIT – V : Polyphase transformers:

Three winding transformer equivalent circuit, star equivalent, regulation and vector diagram. Polyphase transformers-transformer connections – merits and demerits, three – phase, two phase and single phase conversion – Scott, V, and T, method of obtaining 6, 9 and 12 phase supply from three phase supply. Effect of harmonics in different connections of transformers. Transformer banks, parallel operation of transformers and load sharing.

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References-

1. Alternating current machinery-by Fitzarld and kingslay
2. Alternating current machines-by Puchstein,Lioyed and Conord.
3. Performance and design of d.c. machine-by Clayton

COURSE OUTCOMES: At the end of the course student will be able to:

CO1	Understand energy conversion and development of torque in rotating machines.
CO2	Analyze the construction, principle of operation, Characteristics and application of various types of DC generators.
CO3	Understand principle of operation, starting, testing, speed control and application of various types of DC motors.
CO4	Understand construction working principle, conduction of various test on single phase transformer.
CO5	Impart the knowledge on 3-phase connections effect of harmonics and conversion of 3-phase to multiphase transformer.

Mapping of Course outcomes (COs) with Program outcomes(POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	—	—	—	—	—	—	—	—	—	—	—	3
CO2	2	—	—	—	—	—	—	—	—	—	—	2
CO3	3	—	—	2	2	—	—	—	—	—	—	3
CO4	2	—	—	—	—	—	—	—	—	—	—	3
CO5	3	—	2	—	—	—	—	—	—	—	—	3

List of Experiment

1. To perform open circuit and short circuit test on single phase transformers and evaluation of performance.
2. Perform Simpers test on 2 single phase transformers.
3. To perform the parallel of 2, single phase transformer and observe load sharing.
4. Swinburns test on DC motor and determine its efficiency.
5. To perform speed control of DC Motor by field control method.
6. To perform speed control of DC Motor by armature control method
7. To plot OCC on a separately excited DC generator.
8. Perform load test on DC generator.
9. Load test on single phase transformer and determination of voltage regulation and efficiency at different power factors.
10. Study of Scott connection of transformer.
11. Polarity test of transformer

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BE IV SEMESTER						
COURSE CONTENTS						
EE-4006 EE 4302	Power System-I	L	T	P	Max. Marks	Min. Marks
Duration in hrs.		3	1	2	70	22

Course Objective:

UNIT – I : Transmission Systems:

Various system of transmission & their comparison, HVDC transmission Converter, inverter, filters & substation layout. 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.

UNIT – II : Performance of Transmission Lines:

ABCD constants and equivalent circuits of short, medium & long lines. Line Performance: regulation and efficiency of short, medium and long lines, Series and shunt compensation, Power flow along a transmission line and circle diagram.

UNIT – III : 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.

UNIT – IV : Insulators and Corona:

Types, string efficiency, grading ring. Corona-losses, critical disruptive voltage, disadvantages of corona, potential distribution over a string of suspension insulator.

UNIT – V : Mechanical Design and Cables:

Mechanical Design of Transmission Lines, preventive maintenance. Different types of tower, sag-tension calculations, sag-template, string charts, vibration dampers, line supports, spacing of conductors and grounds. Classification, Construction and characteristic of different types. Insulation resistance of cables, capacitance of single and three core cables, grading (capacitance and inter sheath), laying dielectric stress and sheath loss in cables.

References-

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

EE4303

COURSE OUTCOMES: At the end of the course student will be able to:

CO1	Understand Transmission system and calculate the line parameters of transmission lines.
CO2	Analyze the performance of transmission lines.
CO3	Understand and analyze the performance of distribution systems.
CO4	Learn the concept of Insulators & Corona and solve the string efficiency of insulator string.
CO5	Understand the mechanical design of transmission lines.
CO6	Understand the concept of cables & solve the numericals on cable capacitances.

Mapping of Course outcomes (COs) with Program outcomes(POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	—	—	—	—	—	2	—	—	—	—	1
CO2	3	3	—	—	—	—	—	—	—	—	—	2
CO3	3	3	—	—	—	—	—	—	—	—	—	1
CO4	3	3	—	—	—	—	2	—	—	—	—	1
CO5	3	3	—	—	—	—	2	—	—	—	—	1

List of Experiment

- 1 Radial distribution fed at one end.
- 2 Radial distribution fed at both ends.
- 3 Analysis of short transmission line.
- 4 Analysis of medium transmission line using T-equivalent network.
- 5 Analysis of medium transmission line using π -equivalent network.
- 6 String efficiency without shielding.
- 7 String efficiency with shielding.
- 8 Design of transmission line.

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BE IV SEMESTER						
COURSE CONTENTS						
EE4304	Electrical Instrumentation	L	T	P	Max. Marks	Min. Marks
Duration in hrs.		3	1	2	70	22

UNIT – I : CRO:

Introduction to CRO, Different parts of CRO, Its Block diagram, Electrostatic focusing, Electrostatic deflection, post deflection acceleration, Vertical & Horizontal deflection system, Time base circuit, deflection sensitivity of CRT, Lissajous patterns, Extension of frequency range, various types of Oscilloscope. Application of CROs,

UNIT – II : 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, magnetostrictive transducers, Hall effect transducers, Opto-electronic transducers such as photo voltaic, Photo conductive, photo diode and photo conductive cells, Photo transistors, Photo optic transducers.

UNIT – III : 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, Wobblyscope, Video pattern generator Vectroscope, Beat frequency oscillator

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

UNIT – IV : Display Devices:

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 Voltmeter, Digital Multimeter, 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.

UNIT – V : Electronic Recording Devices:

Recorders: Analog recorders, Graphic Recorder, Strip chart Recorder, Galvanometer Recorder, Null balance recorder, X-Y recorder, Circular chart recorder, , Oscillo-graphic recorder, Frequency modulation (FM) recording, PDM recording.

References-

1. Albert. D. Helfrick, W.D. Cooper, PHI - Modern Electronic Instrumentation and measurement techniques.
2. Kalsi H.S., TMH - Electronic Instrumentation.
3. A.K. Sawhney, Dhanpat Rai and Co - Electrical and Electronic measurements and Instrumentation.
4. E.W. Golding, Sir Isaac Pitman and Sons, Ltd. London 1940-Electrical Measurement and Measuring Instruments
5. C.S. Rangan, G.R. Sarma, V.S.V. Mani, Tata McGraw-Hill Publishing Company Ltd. - Instrumentation Devices and Systems

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COURSE OUTCOMES: At the end of the course student will be able to:

EE 4304

EE-4007 Electrical Instrumentation

Course Outcomes

At the end of the course the students will be able to,

CO1	Explain the basic principle of operation of CROs and their applications
CO2	Apply the knowledge of various transducers and select the most appropriate transducer for measuring various physical quantities
CO3	Choose different signal generators and wave analyzers as per the requirement
CO4	Compare various digital display devices used in measuring different physical quantities, based on their working principles
CO5	Explain the working principles of different electronic recorders

Course Articulation Matrix:

Course	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE-4007.1	CO1	1	1	—	1	1	—	—	—	—	1	—	1
EE-4007.2	CO2	2	1	2	—	2	—	—	—	—	1	—	1
EE-4007.3	CO3	1	1	1	1	1	—	—	—	—	1	—	1
EE-4007.4	CO4	1	—	—	1	1	—	—	—	—	1	—	1
EE-4007.5	CO5	1	—	—	1	1	—	—	—	—	1	—	1
Average		1.2	0.6	0.6	0.8	1.2	—	—	—	—	1	—	1

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BE IV SEMESTER						
COURSE CONTENTS						
EE-4305 Digital Electronics & Logic Design	L	T	P	Max. Marks	Min. Marks	
Duration in hrs.	3	1	2	70	22	

UNIT – I : (A) Number system:

Various number systems – decimal, Binary, Hex, and Octal with mutual conversion, binary arithmetic in computers, addition, subtraction, multiplication and division.

(B) Binary codes: Weighted, non – weighted codes, Error detecting correcting codes, alpha numeric codes, ASCII codes.

UNIT – II : Boolean Algebra & Logic Hardware:

(A) Boolean algebra; AND, OR, NOT, NAND, NOR, EXOR Operation and gates, Law of Boolean algebra, reduction of Boolean expression, logic diagram, Universal building blocks, Negative logic.

(B) Logic Hardware: Diode as switch, Bipolar transistor as switch FET as switch, MOSFET (Depletion and enhancement mode) IC technology, MSI, LSI, VLSI, Logic specification, Logic families (DTL, TTL, ECL, MOS, CMOS)

UNIT – III : Conventional Circuits and System:

(A) Combinational logic: Minterms and Maxterm, True table and Karnaugh mapping, reduction of Boolean expression with SOP, POS and Mixed terms, Incompletely Specified functions multiple output minimization, variable mapping, minimization by tabular/Quine Mc Cluskey method.

(B) Encoders, Decoders, multiplexers, Demultiplexers, Code converters, Binary address Digital comparator, Parity checker/generator, Programming logic Array (PLA)

UNIT – IV : Sequential Circuits:

(A) State tables and diagrams, flip flop and its various types – JK, RS, TD, Pulse and edge triggered flip flops transition and excitation tables, timing diagram.

(B) Shift registers: Series and parallel data transfer, ripple counters, Synchronous counters, modulo N counter design, up down counters, ring.

UNIT – V : Memory and A/D Conversion

(A) Semi Conductor ROM, Bipolar and MOS RAM, organization of RAM Memory sub system, timing circuit, clock circuit and IC timer.

(B) Analog/Digital Converters: D/A Conversion, dual slope integration successive approximation, parallel and parallel/ series conversion, converter specification.

References-

1. An introduction to digital computer design by V Rajaraman and T Radhakrishnan, 3rd Edn. PHI.
2. Digital principles and application by A P Malvino and B P Leach, 4th Edn. McGraw Hill.
3. Digital computer fundamentals by T C Bratee, 6th Edn. McGraw Hill.
4. Pulse, digital and switching circuits – Millman.
5. Digital electronics by W H Gothmann, 2nd Edn. PHI

COURSE OUTCOMES: At the end of the course student will be able to:

CO1	Describe various number systems along with their operations, different types of digital codes and their advantage/disadvantages.
CO2	Design and implement decision making circuits using combinational and sequential circuits.
CO3	Analyse and design various sequential circuits.
CO4	Demonstrate working of A/D and D/A converters.

Mapping of Course outcomes (COs) with Program outcomes(POs):

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
EE-4003.1	CO1	2	—	—	—	—	—	—	—	—	1	—	2
EE-4003.2	CO2	2	2	2	1	2	—	—	—	2	1	1	1
EE-4003.3	CO3	2	2	1	1	2	—	—	—	2	1	1	1
EE-4003.4	CO4	2	1	—	—	2	—	—	—	1	—	—	1
	EE-4003 (Average)	2	1.25	0.75	0.5	1.5	0	0	0	1.25	0.75	0.5	1.25

List of Experiment

1. Verification of truth table of AND, OR, NOT gates.
2. Verification of truth table of NAND, NOR gates.
3. Verification of truth table of half adder.
4. Verification of truth table of full adder.
5. Verification of truth table of R-S flip flop.
6. Verification of truth table of J-K flip flop.
7. Study of shift register.
8. Study of counter.
9. Study of code converter.
10. Study of comparator.