Electromagnetic Field Theory: 3130301

Course Objective:

- To provide the basic concepts of vectors and fields, electrostatics, electric current flow, magnetic fields, Maxwell's equations, and electromagnetic wave propagation and its practice in modern communications such as wireless, guided wave principles etc.

Unit I: Electrostatics – I: Sources and effects of electromagnetic fields – Coordinate Systems –Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss 's law and applications.

Unit II: Electrostatics – II: Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization- Dielectric strength- Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

Unit III: Magnetostatics: Lorentz force, magnetic field intensity (H) – Biot Savart's Law -Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.'

Unit IV: Electrodynamic Fields: Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

Unit V: Electromagnetic Waves: Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth – Pointing vector – Plane wave reflection and refraction – Standing Wave – Applications.

Recommended Books:

1. Electromagnetic Fields by P.V. Gupta, Dhanpat Rai.
2. Element of Engineering Electromagnetic by N.N. Rao, PHI.
3. Engineering Electromagnetic by William H. Hayt; TMH.
4. Electromagnetic by John D. Kraus, TMH.
5. Electromagnetic Field by S.P. Seth, Dhanpat Rai & Sons

Course Outcomes

At the end of the course, student will be able to:

CO1: **Apply** vector calculus to understand the behavior of static electric fields in engineering configurations
CO2: **Describe** Maxwell's equations in differential and integral forms and apply them to diverse engineering problems
CO3: **Formulate** engineering problems of Electromagnetic, Electrostatic and Magnetic to Static circuits using Basic relations.
CO4: **Explain** the nature of Electromagnetic wave propagation and wave polarization.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	1	1	1	3	3	-
CO2	3	3	3	3	2	1	1	1	1	1	1	3	3	-
CO3	3	3	3	3	2	2	1	1	1	1	1	3	3	-
CO4	3	3	2	3	3	1	2	1	1	1	1	3	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Electrical Machines-I: 3130302

Course Objective:

- To familiarize the students with the constructional details, working principles, practical applications, and operational issues of the transformer, induction motor, and DC machines.

Unit- I Single Phase Transformer: Phasor diagram, Efficiency, voltage regulation, efficiency, all day efficiency. Testing of Transformers-O.C. and S.C. tests, Sumpner's test, and Polarity test. Auto Transformer- Single-phase and three-phase autotransformers, Volt-amp relation, Efficiency, Merits & demerits and applications.

Unit- II D.C. Machines I: Construction of DC Machines, Armature winding, EMF and torque equations, Armature reaction, Commutation, Interpoles and compensating windings, Performance characteristics of DC generators.

Unit- III D.C. Machines II: Performance characteristics of DC motors, Starting of DC motors; 3point and 4-point starters, Speed control of DC motors; Field control, Armature control, and Voltage control (Ward Leonard method); Efficiency and Testing of D.C. machines (Hopkinson's and Swinburn's Test).

Unit- IV Induction Motor-I: Review of constructional details. Principle of operation, Slip. Production of torque, Steady state analysis. Phasor diagram, equivalent circuit. Power flow diagram and Torque speed characteristics. Starting methods.

Unit-V: Induction Motor II: Circle diagram and its experimental determination, cogging and Crawling Losses, Efficiency and Testing I.M, Double cage induction motor, Operation on unbalanced voltages, Speed control, Rotor resistance control, pole changing method, Frequency control, Induction generator, Introduction to Single-phase Induction motor.

Recommended Books:

1. Electric Machines by D.P. Kothari &I.J. Nagrath, Tata McGraw Hill
2. Electric Machines by Ashfaq Hussain, Dhanpat Rai & Company
3. Electric Machinery by A.E Fitzerald, Kingsley and S.D. Umans, McGraw Hill.
4. Electrical Machinery by P.S. Bimbhra, Khanna Publisher
5. Alternating Current Machines by M.G.Say, Pitman & Sons

Course Outcomes

At the end of the course, student will be able to:

CO 1. **Explain** the principles and construction of single phase transformer, dc machine and 3-phase induction motor.

CO 2. **Analyze** the fundamental control practices such as starting, reversing, braking, plugging etc. associated with DC machines and three-phase induction motors.

CO 3. **Evaluate** the performance of single phase transformers, DC machines and three-phase induction motors using equivalent circuits, losses, etc.

CO 4. **Describe** various tests conducted for evaluating the performance of AC and DC machines.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	2	1	1	1	1	1	1	3	3	-
CO2	3	3	3	1	2	1	1	1	1	1	1	3	3	-
CO3	3	3	3	2	2	1	1	1	1	1	1	3	3	-
CO4	3	3	2	2	3	1	1	1	1	1	1	3	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Power System –I: 3130303

Course Objectives

- To expose the students with Transmission and distribution system, line parameters, performance of transmission lines, power plant economics and different types of tariffs.

Unit-I: Energy Resources and Electrical Power Generation: Introduction to Conventional and non-conventional energy resources; National and International energy trends; Global warming and greenhouse effects. Generation of electrical power, overview of conventional power generation: Hydro, Thermal, Nuclear and Gas Power; Renewable energy generation.

Unit-II: Transmission and Distribution Systems: Introduction, electrical supply system, comparison of AC and DC systems : conductor volume etc., overhead versus underground systems, choice of working voltages for transmission and distribution, transmission and distribution systems, Overhead line insulators, types of insulators pin, suspension and strain insulators, insulator materials, insulator string; Calculation of voltage distribution and string efficiency, methods of equalizing voltages, use of guard rings. Corona.

Unit-III: Line Parameters: Types of conductor, Inductance of a conductor due to internal flux, Inductance of a single phase & three phase transmission line, Self & mutual G.M.D., Inductance of three phase symmetrical and unsymmetrical spaced lines, transposed lines. Bundle conductors, skin effect, capacitance of single & three phase transmission line, effect of earth and charging current, transmission line communication and line interference.

Unit-IV: Performance of Overhead Transmission Line: Single line diagram of power system, ABCD constant and equivalent circuits of short, medium and long transmission line, regulation and efficiency of short, medium, transmission line, Ferranti effect, surge impedance loading. Long transmission line, Generalized circuit equation relation between generalized circuit constant for simple network

Unit-V Power Plants Economics and Tariff: Size and number of generating units. Effect of load factor on cost of generation, Load curves, Maximum demand, Load factor, diversity factor, Plant capacity and plant use factor, type of tariffs, and economics of power factor improvements.

Recommended Books:

1. Electric Power Generation, Transmission and Distribution by S.N. Singh, Prentice Hall of India, 2nd Edition.
2. Power system Analysis by A. Husain A, CBS Pub & Distributor.
3. Power System Analysis by B.R. Gupta B.R, S Chand & Co.
4. Electrical Power by S.L. Uppal, Khanna Publishers Limited, New Delhi.
5. Electrical Power Systems by C.L.Wadhwa, New Age International Publishers Ltd., New Delhi

Course Outcomes

After the completion of this course, students will be able to:

CO 1. **Describe** the general structure and supply systems used in power systems
CO 2. **Explain** the operation of conventional generating stations and renewable sources of electrical power.
CO 3. **Determine** the parameters of transmission line and corona losses
CO 4. **Analyze** the performance of overhead transmission line
CO 5. **Analyze** types of tariffs and power factor economics

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	3	1	1	1	1	3	3	2
CO2	3	3	3	2	2	2	3	1	1	1	1	3	3	2
CO3	3	3	3	2	2	2	2	1	1	1	1	3	3	2
CO4	3	3	3	2	2	2	2	2	1	1	1	3	3	2
CO5	3	3	3	2	2	2	3	3	1	1	1	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Analog & Digital Electronics: 3130304

Course Objectives:

- The course intends to provide an understanding of the principles, operation and application of the analog building blocks like diodes, BJT, FET etc. for performing various functions. Furthermore, the course is likely to impart knowledge of various techniques of digital electronics like K-map for simplified analysis, understanding of combinational & sequential circuits.

Unit- I: Diodes and Transistors Diodes, their characteristics & applications, clipper, clamper circuits, BJT, transistor biasing, CE, CB, CC configurations, input output characteristics, DC load line, small signal analysis.

Unit-II: Amplifiers & FETs BJT usage as switch & amplifier, Darlington pair, differential amplifier using BJT, Operational Amplifiers their types & applications, JFET, V-I characteristics, MOSFET& its types, ADC & DAC converters, Multivibrators, 555 timer.

Unit-III: Digital Circuits Digital (binary) operations of a system, OR gate, AND gate, NOT, EXCLUSIVE OR gate, De Morgan Laws, NAND and NOR DTL gates, Comparison of logic families, properties of Boolean Algebra

Unit-IV: Combinational Logic Circuits K-Map: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications. Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices

Unit-V: Sequential Logic Circuits Sequential Circuits, Storage Elements: Latches and flip flops, FLIP-FLOP Timing, SR, JK Master-slave, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Shift Registers, Asynchronous, Ripple& Ring Counters, Synchronous Counters, Random-Access Memory, Read-Only Memory.

Recommended Books:

1. Electronic Principles by A.P. Malvino, Tata Mcgraw Hill Publications
2. Digital Principles and Applications by Malvino & Leach, Eight Edition, McGraw-Hill Education.
3. Op-Amps and Linear Integrated Circuits by Ramakant Gayakwad, Pearson
4. Digital Logic and Computer Design by Morris Mano, Pearson
5. Digital Electronics by William Kleitz, Prentice Hall International Inc.

Course Outcomes:

After the completion of this course students will be able to:

CO1. **Explain** working principles & applications of electronic devices e.g. Diode, Transistor, Amplifier, FET, BJT, MOSFET, Op-Amp etc.
CO2. **Implement** combinational logic circuits using Programmable logic devices
CO3. **Identify** the applications of various digital electronics circuits like multiplexer, coder circuits, shift registers & counters
CO4. **Illustrate** reduction of logical expressions using Boolean algebra, k-map and tabulation method
CO5. **Analyze** synchronous and asynchronous sequential circuits using flipflops

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1				1	1	1	1	2	-	-
CO2	2	2	3	2	1			1	1	1	1	2	-	-
CO3	2	3	3	2				1	1	1	1	2	-	-
CO4	3	2	3	2	2			1	1	1	1	2	-	-
CO5	2	2	3	2	1			1	1	1	1	2	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially