Course Name Field Theory

Course Code EE402

Course Credit 4

Contact Hour 4L

Prerequisite Basic Electrical Engineering, Mathematics

Course Objective

The objectives of this course are

1. To prepare students to analysis of any electromechanical system.
2. To teach principles of DC machine Induction Machine and Transformers and how they work.
3. To empower students to understand the working of electrical equipment used in everyday life.
4. To expose the students to the concepts of various types of electrical machines and applications of electrical machines.
5. To analyze power requirements, power capability, efficiency, operating characteristics, control requirements and electrical demands of these machines.

Course Outcome

On completion of the course students will be able to

1. Analyze and solve problems on orthogonal co-ordinates & their transformation.
2. Solve & analyse problems on vector calculus.
3. Solve Electrostatic and magnetostatic circuits using basic relation.
4. Solve electromagnetic relation using Maxwell's formulae.
5. Gain the knowledge about applications of EM waves in different domains.
6. Solve transmission line problems.

CO Mapping with departmental POs

H: High, M: Medium, L: Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	H	H										
CO 2	H											
CO 3	H		H	H								H
CO 4	H		H	H								H
CO 5	H		H	H								H
CO 6	H		H	H								H

Course Content

Module I: Introduction: 6L

Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems.

Module II: Introduction to Vector calculus: 5L

DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Strokes theorem, Laplacian of a scalar, Classification of vector fields, Helmholtz's theorem. Solution of problems.

Module III: Electrostatic field: 8L

Coulomb's law, field intensity, Gauss's law, Electric potential and potential gradient, Relation between E and V, an Electric dipole and flux lines. Energy density inelectrostatic field. Boundary conditions: Dielectric-dielectric, Conductor –dielectric, Conductor-free space. Poisson's and

Laplace's equation, General procedure for solving Poisson's and Laplace's equation. Solution of problems.

Module IV: Magneto static fields: 8L

Biot- savart law, Ampere's circuit law, Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments, Magnetization in material, Magnetic boundary condition, Inductor and Inductances, Magnetic energy, Force on magnetic material. Solution of problems.

Module V: Electromagnetic fields: 6L

Faraday's law, Transformer and motional emf, Displacement current, Maxwell's equations, Time varying Potential, Time harmonic fields. Solution of problems.

Module VI: Electromagnetic wave propagation: 7L

Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems.

Module VII: Transmission line: 6L

Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems.

Text Books:

1. Elements of Electromagnetic, Mathew N.O. Sadiku, 4h edition, Oxford university press.
2. Engineering Electromagnetic, W.H. Hyat & J.A. Buck, 7th Edition, TMH
3. Theory and problems of Electromagnetic, Edminister, 2ndEdition, TMH
4. Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University Press.
5. Elements of Electromagnetic Fields, S.P. Seth, Dhanpat Rai & Sons.

Reference Books:

1. Electromagnetic with application, Krause, 5th Edition, TMH.
2. Elements of Engineering Electromagnetic, N.N. Rao, 6th Edition, Pearson Educat