2/4 B.Tech. FIRST SEMESTER

EE3T2 **ELECTROMAGNETIC FIELDS** **Credits: 4**

Lecture: 4 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

OBJECTIVE:

The objective of this course is to introduce the concepts of electric field and magnetic fields and their applications which will be utilized in the development of the theory for power transmission lines and electrical machines.

LEARNING OUTCOMES :

1. Student shall be able to formulate potential problems within electrostatics, magnetostatics abd stationary current distributions in linear, isotropic media and also solve such problems in simple geometrics using separation of variables and the method of images
2. Define and derive expressions for the energy both of the electrostatic and magnetostatic fields and derive poytings theorem from maxwells equations and interpret the terms in the theorem physically.
3. Describe simple models for electromagnetic interaction with media.
4. Solve problems analytically and numerically.

UNIT – I

Review of vector calculus, Cartesian, cylindrical and spherical co-ordinate systems.
Coulomb's law, Electric field due to different charge distributions, Electric flux and flux density, Gauss's Law, Applications of Gauss's Law, Divergence, Maxwell's first Law.

UNIT - II

Electrostatic Energy, Electric Potential, Potential Gradient, Calculation of Electric field through Electric Potential for given charge configuration, Laplace's and Poison's equations, Solution of Laplace's equation in one variable.

UNIT – III

Electric Dipole, Dipole Moment, Potential and Electric Field due to Dipole, Torque on a Electric Dipole in an Electric field, Energy stored and Energy density in static Electric Field, Capacitance, Capacitance of a parallel plate, Spherical, Co-axial capacitors with Composite dielectric.

UNIT – IV

Conductors, Behavior of conductors in an electric field, Electric field inside a dielectric material, concept of Polarization, Boundary conditions between dielectric and conductor, between two dielectrics.

UNIT V

Static magnetic fields – Biot-Savart's law – Oesterd's experiment - Magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current – Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – Maxwell's second Equation, div(B)=0.
Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament – Point form of Ampere's circuital law – Maxwell's third equation, Curl (H)=Jc, Field due to a circular loop, rectangular and square loops.

UNIT – VI

Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic field – Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying conductors – Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field

UNIT – VII

Self and Mutual inductance – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field.

NIT – VIII

Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms – Maxwell's fourth equation, Curl (E)=-∂B/∂t – Statically and Dynamically induced EMFs – Simple problems -Modification of Maxwell's equations for time varying fields – Displacement current – Poynting Theorem and Poynting vector.

TEXT BOOKS:

1. “Engineering Electromagnetic” by William H. Hayt & John. A. Buck Mc. Graw-Hill Companies, 7th Editon.2006.
2. “Electromagnetics” by J. D Kraus Mc Graw-Hill Inc. 4th edition 1992

REFERENCES :

1. “Introduction to Electro Dynamics” by D J Griffiths, Prentice-Hall of India Pvt.Ltd, 2nd Editon
2. “Electro magnetic Fields” by Sadiku, Oxford Publications
3. Electromagnetism-Theory and Applications by Ashutosh Pramanik, PHI, 2003