ELECTROMAGNETICS

EX 503

Lecture : 3 **Year : II**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To provide basic understanding of the fundamentals of Electromagnetics

1. Introduction **(3 hours)**

1.1 Co-ordinate system.
1.2 Scalar and vector fields.
1.3 Operations on scalar and vector fields.

2. Electric field **(12 hours)**

2.1 Coulomb's law.
2.2 Electric field intensity.
2.3 Electric flux density.
2.4 Gauss's law and applications.
2.5 Physical significance of divergence, Divergence theorem.
2.6 Electric potential, potential gradient.
2.7 Energy density in electrostatic field.
2.8 Electric properties of material medium.
2.9 Free and bound charges, polarization, relative permittivity, electric dipole.
2.10 Electric Boundary conditions.
2.11 Current, current density, conservation of charge, continuity equation, relaxation time.
2.12 Boundary value problems, Laplace and Poisson equations and their solutions, uniqueness theorem.
2.13 Graphical field plotting, numerical integration.

3. Magnetic field **(9 hours)**

3.1 Biot-Savart's law.
3.2 Magnetic field intensity.
3.3 Ampere's circuital law and its application.
3.4 Magnetic flux density.
3.5 Physical significance of curl, Stoke's theorem.
3.6 Scalar and magnetic vector potential.
3.7 Magnetic properties of material medium.
3.8 Magnetic force, magnetic torque, magnetic moment, magnetic dipole, magnetization.
3.9 Magnetic boundary condition.

4. Wave equation and wave propagation **(13 hours)**

4.1 Faraday's law, transformer emf, motional emf.
4.2 Displacement current.

4.3 Maxwell's equations in integral and point forms.
4.4 Wave propagation in lossless and lossy dielectric.
4.5 Plane waves in free space, lossless dielectric, good conductor.
4.6 Power and pointing vector.
4.7 Reflection of plane wave at normal incidence.

5. Transmission lines **(5 hours)**

5.1 Transmission line equations.
5.2 Input impedance, reflection coefficient, standing wave ratio.
5.3 Impadance matching, quarter wave transformer, single stub matching, double stub matching.

6. Wave guides **(2 hours)**

6.1 Rectangular wave guide.
6.2 Transverse electric mode, transverse magnetic mode.

7. Antennas **(1 hour)**

7.1 Introduction to antenna, antenna types and properties.

Practical:

1. Teledeltos (electro-conductive) paper mapping of electrostatic fields.
2. Determination of dielectric constant, display of a magnetic Hysteresis loop
3. Studies of wave propagation on a lumped parameter transmission line
4. Microwave sources, detectors, transmission lines
5. Standing wave patterns on transmission lines, reflections, power patterns on transmission lines, reflections, power measurement.
6. Magnetic field measurements in a static magnetic circuit, inductance, leakage flux.

References:

1. W. H. Hayt, "Engineering Electromagnetics", McGraw-Hill Book Company.
2. J. D. Kraus, "Electromagnetics", McGraw-Hill Book Company.
3. N. N. Rao, "Elements of Engineering Electromagnetics", Prentice Hall.
4. Devid K. Cheng, "Field and Wave Electromagnetics", Addison-Wesley.
5. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Press.