RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electrical & Electronics Engineering, V-Semester

Open Elective EX- 504 (B) Electromagnetic Theory

Unit I

Cartesian, cylindrical & spherical co-ordinate systems, scalar & vector fields, gradient, divergence & curl of a vector field, Divergence theorem & Stokes's theorem, concept of vectors.

Electrostatic Fields – Coulomb's law, electric field intensity due to different charge distribution viz. line charge, sheet charge, Field due to continuous volume – electric potential, properties of potential function, potential gradient equipotential surfaces, line of force, Gauss law, applications of Gauss law, Gauss law in point form, method of images.

Unit II

Laplace's & Poisson's equations, solution of Laplace's equation, Electric dipole, dipole moment, potential & electric field intensity due to dipole, Behavior of conductors in an electric field. Conductor & insulator, electric field inside a dielectric, polarization, Boundary value conditions for electric Field, Capacitance & Capacitances of various types of capacitors, Energy stored and energy density in static electric field, Current density, conduction & convection current density ohms law in point form, equation of continuity.

Unit III

Static Magnetic Field, Biot-Savart's law, Magnetic Field intensity due to straight current carrying filament, circular, square and solenoidal current carrying wire, Relationship between magnetic flux, flux density & magnetic Field intensity; Ampere's circuital law and its applications, magnetic Field intensity due to infinite sheet and various other configurations, Ampere's circuital law in point form, Magnetic force, moving charge in a magnetic field, Lorentz Force on straight and long current carrying conductors in magnetic field, force between two long & parallel current carrying conductors. Magnetic dipole & dipole moment, a differential current loop as dipole, torque on a current carrying loop in magnetic field, Magnetic Boundary conditions.

Unit IV

Scalar magnetic potential and its limitations, Vector magnetic potential and its properties, vector magnetic potential due to different simple configurations; Self and Mutual inductances, determination of self & mutual inductances, self inductance of solenoid, toroid

coils, mutual inductance between a straight long wire & a square loop. Energy stored in magnetic Field & energy density, Faraday's Law, transformer & motional EMFs, Displacement current, Maxwell's equations as Generalization of circuit equations, Maxwell's equation in free space, Maxwell's equation for harmonically varying Field, static and steady fields, Maxwell's equations in differential & integral form.

Unit V

Electro Magnetic Waves : Uniform plane wave in time domain in free space, Sinusoidally time varying uniform plane wave in free space, Wave equation and solution for material medium, Uniform plane wave in dielectrics and conductors, Pointing Vector theorem, instantaneous, average and complex poynting vector, power loss in a plane conductor, energy storage, Polarization of waves, Reflection by conductors and dielectric – Normal & Oblique incidence, Reflection at surface of a conducting medium, surface impedance, transmission line analogy.

References:

1. Mathew N.O Sadiku; Elements of Electromagnetic; Oxford.

2. P.V. Gupta; Electromagnetic Fields; Dhanpat Rai.

3. N.N. Rao; Element of Engineering Electromagnetic; PHI.

4. William H. Hayt; Engineering Electromagnetic; TMH.

5. John D. Kraus; Electromagnetic; TMH.

6. Jordan Balmian; Electromagnetic wave & Radiating System; PHI.

7. David K. Cheng; Fields and Wave Electromagnetic; Addison Wesley.

8. S.P. Seth; Electromagnetic Field ;Dhanpat Rai & Sons

Note: Field plotting of electromagnetic systems on a PC using standard softwares. Application for low and high frequency devices. Suggested softwares, GEMINI(Infolytica), ANSYS, ANSOFT, NISA.