

FPYC903: CLASSICAL ELECTRODYNAMICS

Marks-100

Unit-I

Electrostatics and magnetostatics, Boundary value problems and conservation laws. Maxwell's Equations:

Maxwells equations in free space; Magnetic charge; Maxwells equations inside matter; Displacement current; Vector and scalars potentials; Wave equation for potentials; Lorentz and Coulomb gauge conditions; Wave equation for Electric and Magnetic fields in absence of sources.

Covariant Formulation of Maxwells Equation:

Lorentz transformation; Scalars, vectors and Tensors; Maxwells equations and equations of continuity in terms of A and J ; Electromagnetic field tensor and its dual; Covariant form of Maxwells equations; Lagrangian for a charged particle in presence of external electromagnetic field and Maxwells equation as Euler-Lagrange equations. (15)

Unit-II

Plane Waves in Non-Conducting Media:

Plane waves in non-conducting media; velocity of wave propagation and energy flow; linear, circular and elliptic polarization; Reflection and refraction of electromagnetic waves at a plane interface between dielectrics; normal and oblique incidence; total internal reflection and polarization by reflection; waves in dispersive media, Kramer-Kronig relation.

Plane Waves in Conduction Media:

Plane waves in conduction media; Reflection and transmission at a conducting surface; Cylindrical cavities and wave guides; Modes in rectangular wave guide and resonant cavities. (15)

Diffraction:

Kirchoff 's formulation of diffraction by a circular aperture. (12)

Unit-III

Green's Function Solution for Retarded Potential

Green's function solution of potential form of Maxwell's equations, Retarded and advanced Green's Functions.

Multipole Radiation:

Potential, Fields and radiation due to an oscillating electric dipole; radiation due to a centre-fed linear antenna; angular distribution of power radiated; Rayleigh Scattering. Magnetic dipole and Electric Quadrupole radiation.

Radiation by Point Charge:

Lienard-Weichert potential, Field due to a point charge, Angular distribution of radiation and total power radiated by an accelerated charge, Larmor's formula, Thomson's scattering. (13)

Books:

1. Classical Electrodynamics - J. D. Jackson
2. Classical Theory of Fields - L. LandauLifshitz
3. Introduction to Electrodynamics - D. J. Griths.
4. Principles of Optics-M. Born and E. Wolf