

END OF SEMESTER EXAMINATIONS, APRIL / MAY - 2017
ELECTROMAGNETIC THEORY & ELECTRODYNAMICS
SUBJECT CODE : 16P3PH06

MAJOR : M.Sc. (PHYSICS)
TIME : 3 HOURS

SEMESTER : II
MAX. MARKS: 70

SECTION A - (10 X 1 = 10)

Answer ALL the Questions:

- The divergence of magnetic vector potential is
 a) 0 b) 1 c) 2 d) infinity
- Poynting vector $\vec{S} =$ _____
 a) $\vec{H} \cdot \vec{E}$ b) $\vec{E} \cdot \vec{D}$ c) $\vec{E} \times \vec{H}$ d) $\vec{H} \times \vec{E}$
- Electromagnetic waves are _____ in nature.
 a) Solenoidal b) Dielectric c) Transverse d) Negligible
- In retarded potentials, what factor of time delay is generally introduced in \vec{A} & \vec{V} equations?
 a) $R + c$ b) $R - c$ c) R / c d) $R \times c$
- The fourth component of the four force vector is
 a) real b) imaginary c) infinity d) zero
- What is an electric dipole?
- Explain displacement current?
- Define critical angle.
- Expression for Lienard-Wiechert potentials?
- What do you mean by a Tensor?

SECTION B - (5 X 4 = 20)

Answer ALL the Questions:

- a) Derive an expression for the potential at a point due to an electric dipole.
 [OR]
 b) State and prove Biot-Savart's law.
- a) Explain the formulation of Coulomb gauge.
 [OR]
 b) List Maxwell's equations and mention their significance.
- a) Highlight the boundary condition satisfied by electromagnetic fields at the interface.
 [OR]
 b) Write a short note on an electromagnetic waves propagation in anisotropic dielectric medium.
- a) Obtain an expression for retarded potentials.
 [OR]
 b) Briefly explain the power radiated by an oscillating electric dipole.
- a) Show that the electromagnetic field tensor is an antisymmetric and of rank 2 by using the electromagnetic field vectors \vec{E} and \vec{B} .
 [OR]
 b) Derive the covariant form of Lorentz force law.

SECTION C - (5 X 8 = 40)

Answer ALL the Questions:

- a) Explain gauss theorem in a dielectric and obtain an expression for electric displacement vector.
 [OR]
 b) Derive an expression for magnetic scalar potential and highlight its importance.
- a) Describe with the necessary derivations, the electromagnetic potentials A and ϕ .
 [OR]
 b) Explain the formulation of Lorentz gauge.
- a) Derive plane wave equation for electromagnetic waves in free space.
 [OR]
 b) Explain the transmission and reflection of electromagnetic waves at the interface of two transparent media.
- a) What are Lienard-Wiechert potentials? Calculate the electric and magnetic field vectors for a uniformly moving charged particle.
 [OR]
 b) Obtain an expression for electric and magnetic field due to an oscillating dipole.
- a) Obtain transformation laws for the current and charge densities. Prove that electric charge is invariant while charge density varies like mass under Lorentz transformation.
 [OR]
 b) Show that the Maxwell's field equations are covariant in four dimensions.
