 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - PHYSICS

FIRST SEMESTER – APRIL 2012

# PH 1812 - ELECTRODYNAMICS

Date : 25-04-2012 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

**PART A**

**Answer all questions (10 x 2 = 20 )**

1. Explain why electrostatic energy does not obey superposition principle?
2. What is a non polar dielectric? Give an example
3. Mention any two differences between para and ferro magnets
4. How are the bound and the free charges related to each other in linear media?
5. What is motional e.m.f.?
6. Give the expressions for Maxwells stress tensor
7. Define skin depth
8. Calculate the degree of polarization for ordinary light reflected from glass with refractive index 1.5 at an angle of incidence of 45.
9. Write the boundary conditions for reflection of electromagnetic wave at the boundary of a conducting surface
10. Define radiation reaction.

**Part B**

**Answer any four questions (4 x 7.5 = 30)**

1. i) Derive Gauss’s law in differential form. (4)

ii) Find the capacitance per unit length of two co-axial metal cylindrical tubes of radii a   
and b (3.5)

1. Derive the theory of multipole expansion of magnetic vector potential
2. Obtain the Neumann’s formula for mutual inductance between a pair of coils.
3. Establish the wave equations for E and B. Derive the expression for energy and momentum of electromagnetic waves
4. Derive the Abraham-Lorentz formula for the radiation reaction? Obtain the Lienard-Wiechart potentials for a moving point charge

**Part C**

**Answer any four questions (4 x 12.5 = 50)**

1. Show that the electrostatic potential in a charge free region satisfies the Laplace’s equation. Find a charge distribution that would produce a potential ф=
2. i) A spherical shell of radius R, carrying a uniform surface charge σ, is set spinning at angular velocity. Find the vector potential it produces at a point P outside the sphere.

ii) State Biot-Savart law. Find the volume current density when current I is uniformly distributed over a wire of circular cross section, with radius R.

1. Explain the concept of potential formulation of electrodynamics. Elucidate the difference between Coluomb and Lorentz gauge?
2. Discuss the phenomenon of reflection and transmission of electro- magnetic waves at the boundary between two linear dielectric media in the case of oblique incidence and hence find expressions for the reflection and transmission coefficients
3. Explain the theory of magnetic dipole radiation to obtain expression for power radiated.