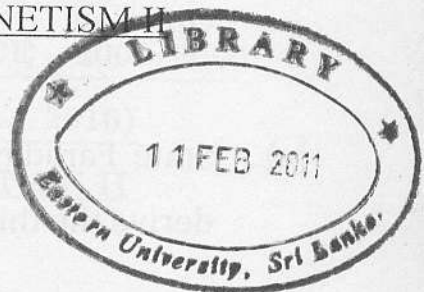


EASTERN UNIVERSITY, SRI LANKA
SECOND EXAMINATION IN SCIENCE - 2008/2009
SECOND SEMESTER (PROPER/REPEAT)

(Sep/Oct 2010)

PH 207 ELECTRICITY AND MAGNETISM II



Time: 01 hour.

Answer ALL Questions

1. Define the terms polarization vector \mathbf{P} and displacement vector \mathbf{D} in a dielectric medium.

A spherical capacitor of inner radius a and outer radius b charged with Q coulomb's. The capacitor is filled with a dielectric, whose dielectric constant varies as: $\epsilon = \epsilon_1 + \epsilon_2 \frac{1}{r^2}$ where ϵ_1 and ϵ_2 are constants and $\epsilon_1 > \epsilon_2$.

- Find the Displacement Vector $\mathbf{D}(r)$.
- Determine the Electric Field $\mathbf{E}(r)$.
- Hence, find the Potential difference V between the spherical cells.
- Find the Polarization Vector $\mathbf{P}(r)$.
- Calculate the Capacitance of the Capacitor.

2. (a) Starting with Gauss's theorem in electrostatics, prove the First Maxwell's equation;

$$\vec{\nabla} \cdot \vec{E} = 0$$

- (b) State Biot-Savart Law and from this derive the second Maxwell's equation;

$$\vec{\nabla} \cdot \vec{B} = 0$$

- (c) State Faradays Law of electromagnetic induction and from this derive the third Maxwell's equation;

$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

- (d) State Amperes Circuital Law and from this and using Maxwell's assumptions derive the fourth Maxwell's equation;

$$\vec{\nabla} \times \vec{B} = \mu_0 \frac{\partial \vec{D}}{\partial t}$$

Where the symbols have their usual meanings and assume that the medium is free space.