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

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1. Define the terms polarization vector **P** and displacement vector **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: $\varepsilon=\varepsilon_1+\varepsilon_2\frac{1}{r^2}$ where ε_1 and ε_2 are constants and $\varepsilon_1>\varepsilon_2$.

   a) Find the Displacement Vector **D**(r).

   b) Determine the Electric Field **E**(r).

   c) Hence, find the Potential difference V between the spherical cells.

   d) Find the Polarization Vector **P**(r).

   e) Calculate the Capacitance of the Capacitor.

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

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

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

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

(c) State Faradays Law of electromagnetic induction and from thi 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' 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 th medium is free space.