EASTERN UNIVERSITY, SRI LANKA

FIRST EXAMINATION IN SCIENCE - 2007/2008

SECOND SEMESTER (PROPER/REPEAT)

(August/September 2009)

PH 103 ELECTRICITY AND MAGNETISM I

LIBRARY
26 OCT 2009
Eastern University, Sri Lanka

Time: 01 hour.

Answer ALL Questions

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1. Define the electric potential in an electrostatic medium. A circular disk of radius uniform positive surface charge density σ on its upper surface.

   (a) What is the electric potential at point P, at a distance r from the disk along its axis?

   (b) Hence show that the electric field at point P is:

$$E=\frac{\sigma}{2\varepsilon_o}\left[1-\frac{r}{\sqrt{r^2+R^2}}\right]$$

   where ε_0 is the primitivity of free space.

   (c) If the potential at the center of the disk is Vo. Then

      (i) What is the total surface charge Q which is uniformly distributed on the dis

      (ii) What is the potential at a point A along the axis of the disk at a distance of from the center of the disk?

2. A long coaxial cable of length l and liner charge density λ consists of a soli cylindrical conductor of radius R_1 and a thin outer cylindrical conducting shell o R_2. The two conductors are connected together by a resistor at one end and i connected to a battery at the other end. Hence there is a current I in the conducto potential difference V between them. Neglect the resistance of the cable.

   (a) Find the magnetic field B in the region between the conductors.

   (b) Find the electric field E in the region between the conductors.

   (c) Hence show that the potential difference V between the conductors is:

$$V=\frac{\lambda}{2\pi\varepsilon_0}\ln\left(\frac{R_2}{R_1}\right)$$

   (d) Also find the capacitance per unit length.

   (e) And calculate the capacitance C when R_1=3 cm, R_2=10 cm and $\varepsilon_0=8.85\times10^{-12}\,C^2N^{-1}m^{-2}$