

EASTERN UNIVERSITY, SRI LANKA

FIRST EXAMINATION IN SCIENCE - 2002/2003

FIRST SEMESTER

(JUNE/JULY 2003)

PH 103 ELECTRICITY AND MAGNETISM I

Time: 01 hour.

Answer ALL Questions

1. State Gauss's theorem in electrostatic.

Derive an expression for the electric field intensity due to a uniformly charged non-conducting sphere of total charge Q and radius R at an interior point and at an exterior point.

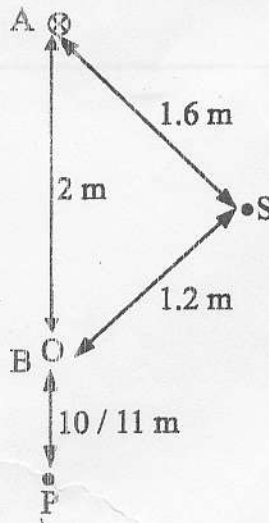
Show that the electric potential V inside the sphere at a distance r from its center is given by

$$V = \frac{Q}{4\pi\epsilon_0 R} + \frac{Q}{4\pi\epsilon_0 R^3} \left[\frac{R^2 - r^2}{2} \right]$$

Calculate the electric potential at a distance 7cm from the center of the sphere, when $Q = 10^{-10}\text{Coulomb}$ and $R = 20\text{cm}$. Assume that $\frac{1}{4\pi\epsilon_0} = 9 \times 10^{-9}\text{Nm}^2\text{C}^{-2}$

2. State Biot-Savart law in a magnetic field.

Derive an equation for magnetic field B due to long straight wire.



Two long straight parallel wires are 2m apart, perpendicular to the plane of paper. The wire A carries a current of 9.6A , directed into the plane of the paper. The wire B carries a current such that the magnetic

field of induction at the point P, at the distance of $\frac{10}{11}m$ from the wire B, is zero.
 Find

- (i) The magnitude and direction of the current in B.
- (ii) The magnitude of the magnetic field of the induction at point S.
- (iii) The force per unit length on the wire B.

Assume that $\mu_0 = 4\pi \times 10^{-7} \text{Hm}^{-1}$

