EASTERN UNIVERSITY, SRI LANKA

FIRST EXAMINATION IN SCIENCE - 2002/2003

(FIRST SEMESTER)

(JUNE-AUGUST 2004)

EXTERNAL DEGREE

EXTPH 103-ELECTRICITY AND MAGNETISM I

Time: 01 hour.

Answer All questions.

1. Define terms Electric potential and Electric potential difference in an electrostatic medium.

   (a) Show that the potential difference between two points A and B in an Electric field $\vec{E}$ is given by

   $$V_B - V_A = -\int_A^B \vec{E}.\vec{dr}$$

   where the symbols have their usual meanings.

   (b) An insulating sphere of radius a has a uniform positive charge density with total charge Q. Find

   (i) The Electric field at a point inside and outside the sphere.

   (ii) The Electric potential at a point inside and outside the sphere.

   (iii) The Electric potential on the surface of the sphere.

2. State Biot-Savart Law to find the Magnetic field due to a current element. Clearly identify each term involved in the law.

   A current I circulates in a thin wire circular loop of radius R. Find the magnetic field at the point lying on the axis of the loop at a distance d from its center. Deduce the magnetic field

   (i) at the center of the loop

   (ii) when $d \gg R$

   A circular loop of radius $R = 5cm$ carries a current $30A$. Calculate the magnetic field produced by the loop

   (i) at a distance $3cm$ on the axis of the loop.

   (ii) at the center of the loop.

   Illustrate clearly the Magnetic field lines.
   Assume that $\mu_0 = 4\pi \times 10^{-7} Hm^{-1}$.