Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
200 level 1st Semester Examination – July / Aug. 2016
SCT 251-2 Electricity and Magnetism

Uva Wellassa University

Instructions to candidates
Duration: Two (02) hours
Number of questions: Four (4)
Answer **all** questions
Mark allocation: 200

1.

a. Write down the equation for Gauss's law of electrostatics and identify each term.

(10 marks)

b. Find the Electric field of a non-conducting infinite planer charge distribution (surface charge density +σ) using the Gauss's law.
(Justify the reasons if you are to neglect any component)

(25 marks)

c. Using the result from part (b), determine the electric field (both inside and out) of a parallel plate capacitor.
Indicate the direction of the Electric field.

(20 marks)

d. Write down the relationship between the electric potential (V) and the electric field (E)

(05 marks)

e. Derive an equation for the capacitance (C) of a parallel plate capacitor in terms of A (area of a plate), d (distance between two plates) and ϵ (permitivity).

(20 marks)

2. An electric dipole consists of two equal and opposite charges (q) seperated by a distance 2a as shown in the figure 01.

a. Show that the potential at point P along the x axis far away from the dipole (r >> a) is given by $v = \frac{q\,a}{2\pi\varepsilon r^2}$.
Write down any assumptions you use in this section.

(20 marks)

b. Use the above expression to determine the electric field at point P. Indicate the direction of the electric field.

(20 marks)

40
32 33

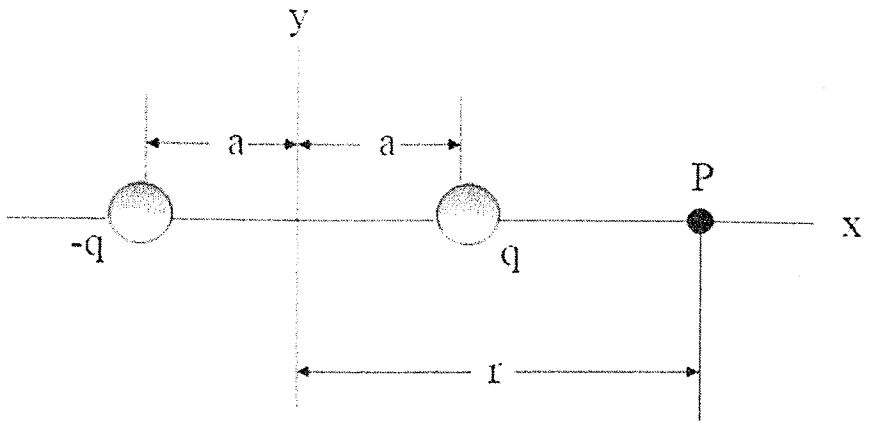

Figure 01

3.

a. Write down the four Maxwell's equations.

(10 marks)

b. Derive the unmodified Maxwell's 4th equation $\nabla \times B = \mu_0 J$ using the Amphere's law where J is the current density.

(15 marks)

c. Considering the charge conservation, the continuity equation is given by $\nabla \cdot J = -\frac{\partial \rho}{\partial t}$ (where ρ is the charge density).

Check the consistency of the Maxwell's 4th equation.

(15 marks)

d. Obtain the modified Maxwell's 4th equation.

(15 marks)

4. A strong magnet is placed under a horizontal conducting ring of radius r which carries a current I as shown in figure 02. If the magnetic field lines make an angle θ with the vertical at the ring's location, find the magnitude and the direction of the resultant force on the ring.

(Justify the reasons if you are to neglect any component)

(25 marks)

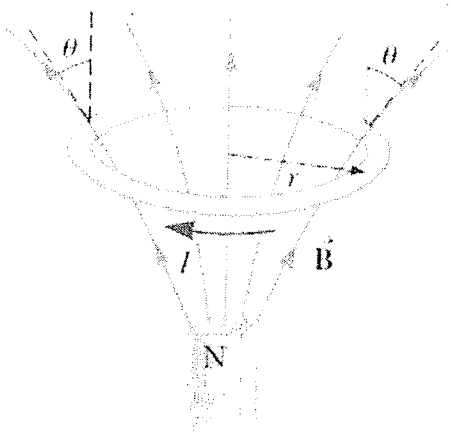

Figure 02