KABARAK   **UNIVERSITY**

UNIVERSITY EXAMINATIONS
2009/2010 ACADEMIC YEAR
FOR THE DEGREE OF BACHELOR OF SCIENCE IN
EDUCATION SCIENCE

COURSE CODE: **PHYS 110**

COURSE TITLE: **ELECTRICITY AND MAGNETISM**

STREAM: **SESSION I**

DAY: **MONDAY**

TIME: **2.00 – 4.00 P.M.**

DATE: **30/11/2009**

INSTRUCTIONS:
1. Part I: Question 1 is compulsory and carries 30 marks.
2. Part II: Each question carries 20 marks. Attempt any two questions.

PLEASE TURN OVER

PART I: QUESTION 1 IS COMPULSORY AND CARRIES 30 MARKS.

QUESTION 1

(a) Consider two conducting rods of equal length having but different diameters obtained from the same material. Provide a basic but convincing argument about the difference in their resistivity. In particular why the rod with a larger diameter has a lower resistivity. Use any appropriate equation to argue your case. (3 marks)

(b) Draw I-V curves for an ohmic and non-ohmic conductors (4 marks)

(c) What is magnetism? (1 marks)

(d) State Kirchoff's current and voltage laws (3 marks)

(e) A proton moves in a straight line from point 'a' to point 'b' inside a linear accelerator, a total distance d = 0.50 m. The electric field is uniform along this line with magnitude $E = 1.5 \times 10^7$ V/m $\equiv 1.5 \times 10^7$ N/C in the direction from a to b. Determine: the force on the proton, the work done on it by the field, the potential difference V_a-V_b (6 marks)

(f) Write Coulombs and Gauss's laws and state any similarities and differences if any (4 marks)

(g) The figure below shows a multi-loop containing one ideal battery and four resistances with the following values $R_1 = 20\Omega$, $R_2 = 20\Omega$, E = 12V, $R_3 = 30\Omega$ and $R_4 = 8\Omega$.
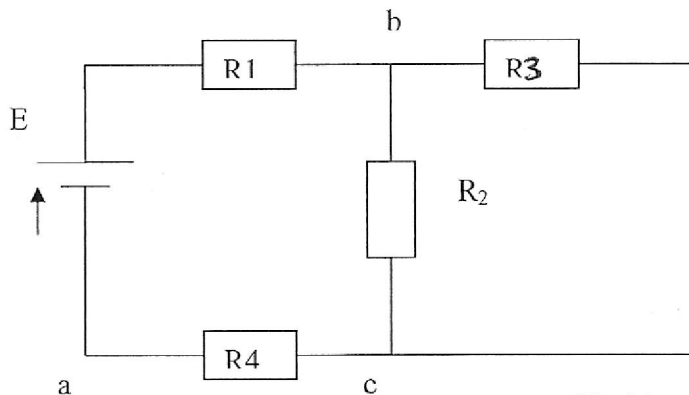

Fig 31

(i) What is the current through the battery? (5 marks)
(ii) What is the current I_2 through R_2? (2 marks)
(iii) What is the current I_3 through R_3? (2 marks)

PART II: EACH QUESTION CARRIES 20 MARKS. ATTEMPT ANY TWO QUESTIONS.

QUESTION 2

(a) State the origin of magnetism (4 marks)

(b) Identify the usual symbols H and B used in magnetism. Indicate the units in each case (4 marks)

(c) Provide a definition and two examples of the types of materials for the following classification of magnetic phenomena

(i)   Diamagnetism and Diamagnetic materials (4 marks)

(ii)   Ferromagnetism and Ferromagnetic materials (4 marks)

(iii)   Paramagnetism and Paramagnetic materials (4 marks)

QUESTION 3

(a) State the significance of Gauss's law (6 marks)

(b) How would one obtain Coulomb's law from Gauss's law (8 marks)

(c) Explain applications associated with Gauss's law and related to the Faraday cage. State applications of the Faraday cage concept. (6 marks)

QUESTION 4

(a) Derive Ampere's law. One straight wire which carries a current of 10A north and another straight wire carries a current of 5A west. What is the direction and magnitude of the magnetic field 0.25 m above the point where the wires intersect?

(14 marks)

(b) State Faraday's law of electromagnetic induction. (2 marks)

(c) State four ways of energy losses in a transformer. (4 marks)