KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE CERTIFICATE OF PRE- UNIVERSITY PHYSICS

COURSE CODE: **PPHYS 011**

COURSE TITLE: **ELECTRICITY MAGNETISM & MODERN PHYSICS**

STREAM: **SEMESTER ONE**

DAY: **WEDNESDAY**

TIME: **9.00 – 11.00 A.M.**

DATE: **09/12/2009**

INSTRUCTIONS:

Answer question ONE and any other two.

You may need the following constants:

$\varepsilon_0 = 8.85x10^{12}\ F/m$

$\mu_0 = 4\pi x10^{-7}\ Tm/A$

$h = 6.626x10^{-34}\ \mathbf{m^2\ kg\ /\ s}$

PLEASE TURN OVER

Question ONE (30 marks)

(a) (i) Define electric current. Give its SI units (3 marks)
(ii) State how electrons can be made to move in a conductor. (2 marks)

(b) Explain why if temperature in a conductor is increased, resistance increases. (2 marks)

(c) Sketch the electric field lines of
(i) Positive isolated point charge (1 mark)
(ii) Dipole (2 marks)

(d) (i) Define electric potential (2 marks)
(ii) Calculate the electric potential due to a 4 uC charge at a point 2 mm away. (3 marks)

(e) Illustrate the construction of the following types of capacitors
(i) Aluminum foil (3 marks)
(ii) Mica (3 marks)

(f) Calculate the magnetic field of a long straight conductor carrying a current of 10 A at a distance 8 cm from the wire. (3 marks)

(g) State why a voltmeter has a very high resistance (2 marks)

(h) Define the following terms:
(i) Photoelectric effect (2 marks)
(ii) Work function of a material (2 marks)

Question TWO (20 marks)

(a) (i) State Ohm's law (2 marks)
(ii) Give the difference between Ohmic and non-ohmic materials (3 marks)

(b) (i) Define capacitance. Give its SI units. (3 marks)
(ii) You are provided with $2\mu F$, $3\mu F$ and $5\mu F$ capacitors. Show mathematically and diagrammatically how the capacitors can be combined to give
I. $10\mu F$ (4 marks)
II. $2.5\mu F$ (4 marks)
III. $1.6\mu F$ (4 marks)

Question THREE (20 marks)

(a) (i) With the aid of a diagram, explain the principle operation of a galvanometer. (7 marks)
(ii) State how a galvanometer can be converted into
I. an ammeter (2 mark)
II. a voltmeter (2 mark)
(iii) Design a 0-10 A range ammeter with a FSD current of 1 mA and a coil resistance of 20 ohms. (9 marks)

Question FOUR (20 marks)

(a) (i) State the condition for photoelectric effect to occur (2 marks)

(ii) Describe one application of photoelectric phenomena (3 marks)

(ii) If a light with a frequency of radiation of $8x10^{14}$ Hz is shone on metal and photoelectrons are ejected with a maximum kinetic energy of $1.6x10^{-19}$ J, what is the work function of the material? (5 marks)

(b) Define

(i) radioactivity (2 marks)

(ii) half-life of a radioactive material (2 marks)

(c) Derive the half-life equation of a radioactive decay. (6 marks)