

**W1-2-60-1-6**

## JOMO KENYATTA UNIVERSITY

**OF**

**AGRICULTURE AND TECHNOLOGY**

**YEAR ONE SEMESTER TWO EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN ANALYTICAL CHEMISTRY/APPLIED GEOPHYSICS/CONTROL AND INSTRUMENTATION/ENVIRONMENTAL AND RENEWABLE ENERGY/PHYSICAL SCIENCE**

**SPH 2101: ELECTRICITY AND MAGNETISM I**

**DATE: JUNE 2017 TIME: 2 HOURS**

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

Important constants:

Permitivity of free space 0=8.85x10-12C2N-1m-2

Electron charge,= -1.6x10-1NC

1a) i) State the assumption necessary for the validity of Colomb’s law and give the nature of forces involved (2 marks)

ii) Calculate the value of two equal charges if they repel one another with a force of 0.1N when situated 50cm apart in a vacuum

(3 marks)

b) i) Define electric potential difference and hence deduce the potential at a point (3 marks)

ii) An electron charge is situated in a uniform electric field of intensity 1.2x105Vm-1. Find the force on it (2 marks)

c) i) List down the factors that affect the ability of a capacitor (3 marks)

ii) Find the charges on the capacitors in the figure below and the potential differences across them;

C1=2 μF, C2=1μF and C1=2 μF (5 marks)

d) i) Describe the experimental behavior for current and voltage for an Ohm’c conductor (3 marks)

ii) V=1R is not a definition of Ohm’s law. Discuss

iii) Consider the figure below;

What current is carried by each resistor? (4 marks)

e) i) Illustrate by use of a diagram the magnetic field of a solenoid

(1 mark)

ii) Determine the force on a conductor 40cm in length carrying a current of 80A and lying at an angle of 600 to a magnetic field of that density 0.8T (2 marks)

2a) i) Define a magnetic field and state how the direction is obtained

(2 marks)

ii) There is no magnetic force on a stationary charge. Discuss

(3 marks)

iii) Show that F=IB sinθ, where symbols have their usual meaning

(6 marks)

b) i) Two equal charges of 3x10-10C are located at two of the three corners of an equilateral triangle of side 10cm. calculate the electric intensity at the third corner (6 marks)

ii) List the characteristics of capacitors in series (3 marks)

3a) i) Name two sources of electromotive force (2 marks)

ii) State the rules of finding potential difference in an electrical circuit (2 marks)

b) A battery of electromotive force 1.5V has a terminal potential difference of 1.25V when a resistor of 25is joined to it. Calculate

i) Current flowing (2 marks)

ii) Internal resistance (3 marks)

iii) The potential difference when a resistor of 10 replaces the 2 resistor (3 marks)

c) i) Derive the relationship that shows that the resistance (R) of a conductor depends on its length L, area of cross-section A and the resistivity, , of the conductor (5 marks)

ii) A strip of aluminum has length of 2.5mm and a cross-section of 16mm x 2.5mm. Find the resistance of the strip if the resistivity of aluminum is 2.83x10-9m (3 marks)

4a) i) State Kirchoff’s laws (2 marks)

ii) What is the significance of the first law (1 mark)

iii) For the circuit shown in the figure below find the currents in the two batteries (7 marks)

b) i) Consider the two unlike point charges. Sketch the electric field pattern and demonstrate equipotentials (2 marks)

ii) The potential difference in an electric field is independent of the path taken. Discuss (2 marks)

iii) Show that potential is the line integral of electric field intensity

(6 marks)