THE CATHOLIC UNIVERSITY OF EASTERN AFRICA
A. M. E. C. E. A

GABA CAMPUS - ELDORET

MAIN EXAMINATION

SEPTEMBER – DECEMBER 2021 TRIMESTER

FACULTY OF SCIENCE

BACHELOR OF SCIENCE

DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE

CMT 100: PHYSICS FOR COMPUTER SCIENCE

Date: December 2021	**Duration:** 2 Hours
Instructions: Answer Question **ONE** and any other **TWO** Questions	

Useful Constants

Mass of Proton = 1.67×10^{-27} kg

Electron charge = -1.6×10^{-19} C

Permittivity of free space $\varepsilon_0 = 8.85 \times 10^{-12}$ C2 N.m2

QUESTION ONE

a) i) State Coulomb's law **(2 marks)**

   ii) Calculate the force between an electron and a proton separated by a distance of 1.5×10^{-9} m **(3 marks)**

a) i) Explain two properties of the electric charge **(4 marks)**

b) ii) State any two methods of charging a conductor **(2 marks)**

c) i) With the aid of a well labeled diagram, show that the equivalent capacitance C_{eq} of three capacitors C_1, C_2 and C_3 connected in series is given by

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

   (3 marks)

d) i) State Amphere's law **(2 marks)**

   ii) State four properties of magnetic forces. **(4 marks)**

   iii) Distinguish between electrostatics and magnetism. **(2 marks)**

ISO 9001:2015 Certified by the Kenya Bureau of Standards.

e) i). List for applications of capacitors. **(4 marks)**

ii). Calculate the work done by an ideal battery of terminal potential 12 V on a unit charge passing from the positive to the negative terminal of the battery **(4 marks)**

QUESTION TWO

a) i) State the Ohm's law. **(2 marks)**

ii) A storage capacitor on a random access memory (RAM) chip has a capacitance of 55 pF. If it charged to 5.3 V, how many excess electrons are there on its negative plate? **(3 marks)**

b) i) The electron gun is one of the very important part of cathode ray tube. List any THREE components of the electron gun and their functions.

(6 marks)

ii) Using appropriate diagrams, draw magnetic field lines in relation to two magnets. **(4 marks)**

QUESTION THREE

a) i) Define electric potential **(2 marks)**

ii) Three capacitors $C1 = 12\mu F$, $C2 = 5.3\mu F$ and $C3 = 4.5\mu F$ are connected as illustrated below.
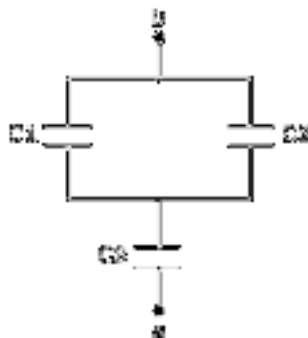
Find the equivalent capacitance. A potential difference of 12.5V is applied to the terminals a,b. Calculate the charge on the capacitor C1.

(5 marks)

iii) List three types of magnetic materials and describe how they work.

(9 marks)

b) i). Consider a 5nC test charge placed at a point such that it experiences a force of 2×10^{-4} N in the x-direction. Calculate the Electric field E.

(4 marks)

QUESTION FOUR

a) i) Using a diagram, explain how a Cathode Ray Tube (CRT) works

(6 marks)

ii) Differentiate between ohmic and non-ohmic conductors.

(4 marks)

b) i). A uniform magnetic field B with magnitude 1.2mT, points vertically upwards throughout the volume of the room in which you are sitting. A 5.3MeV proton moves horizontally from south to north through a certain point in the room. What magnetic deflecting force acts on the proton as it passes through this point? The proton mass is 1.6×10^{-27}kg. **(5 marks)**

a) i). State Kirchhoff law of electricity. **(2 marks)**

ii). Calculate the work done by an ideal battery of terminal potential 12V on a unit charge passing from the positive to the negative terminal of the battery.

(3 marks)

QUESTION FIVE

a) i). Derive the relationship for the total resistance when resistors are connected in parallel. **(4 marks)**

ii). Draw a current-voltage curve for an ohmic conductor.
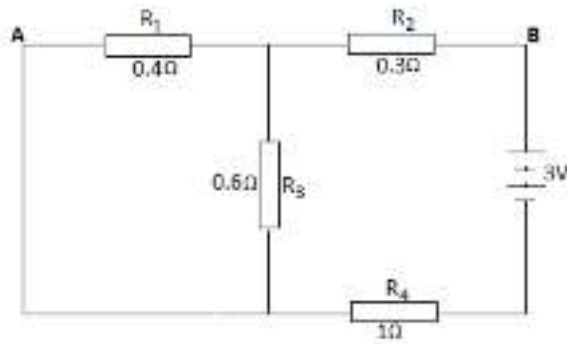
(2 marks)

iii) State and explain two methods of charging a conductor

(2 marks)

b). i) The figure below shows a circuit in which the emf,

E = 3V, Resistance $R_1 = 0.4\Omega$,

$R_2 = 0.3\ \Omega$, $R_3 = 0.6\ \Omega$ and $R_4 = 1\ \Omega$.

Calculate:-

    i)   The equivalent resistance between A and B.   **(4 marks)**

    ii) The electric potential across R_1.   **(4 marks)**

    iii) The current through R_3.   **(4 marks)**

END