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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
FIRST YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(COMPUTER SCIENCE)

Date: 29th July, 2022
Time: 8.30am –10.30am

KPH 102 - PHYSICS 11

INSTRUCTIONS TO CANDIDATES

ANSWER **QUESTION ONE (COMPULSORY)** AND **ANY OTHER TWO** QUESTIONS

QUESTION ONE (30 MARKS)

a) Explain the following properties of electric charge?
   i) Additivity of electric charges.
   ii) Conservation of electric charges.
   iii) Quantization of electric charges. (6 marks)

b) Differentiate between electric field and electric flux. (2 marks)

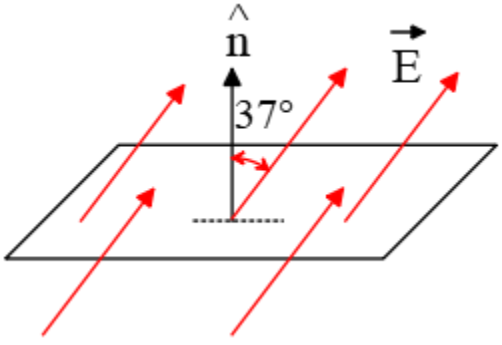
c) If a system has 0 charge overall. Is it true that there are no charges present in the system? Discuss. (4 marks)

d) State the two rules/laws of Kirchhoff's law. (4 marks)

e) Differentiate between capacitance and resistance as used in electric circuits (4 marks)

e) Show that if the resistors with resistances R1, R2 …, Rn are in parallel, then the equivalent resistance Req is always smaller than R1, R2, ..., Rn. (4 marks)

f) In the figure below, a flat surface of sides 10cm×50cm is positioned in the presence of a uniform electric field of unknown strength. The electric flux through this surface is 250Nm^2/C. What is the strength of the electric field? (6 marks)



QUESTION TWO (20 MARKS)

a) A nail contains trillions of electrons. Given that electrons repel from each other, why do they not then fly out of the nail? (4 marks)

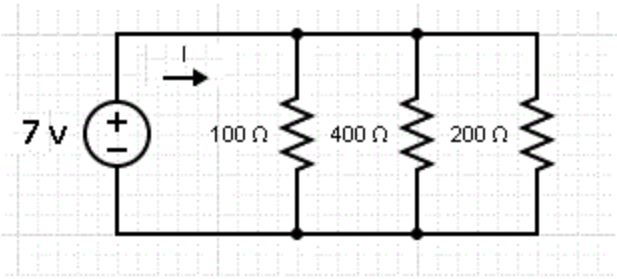
b) State Coulombs' law

(2 marks)

c) Two equal and like charges are placed at a distance d=6 cm. They exert a force $12*10^{-3}$ N on each other. What is the magnitude of each charge? (6 marks)

k = $8.99 \times 10^9 \frac{N \cdot m^2}{C^2}$

d) Find the voltage below and the current passing through each of the resistors in the circuit.



(8 marks)

QUESTION THREE (20 MARKS)

a) With the aid of a well labeled diagram(s). explain the concept of charging objects by induction (10 marks)

b) How many electrons are present in one Coulomb?

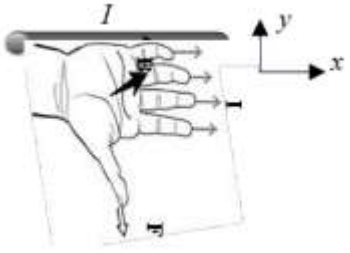
(4 marks)

c) A polythene is rubbed against a woolen cloth, the charge developed on the woolen cloth is 7×10^{-9}C. What is the number of charges transferred? (6 marks)

QUESTION FOUR (20 MARKS)

a) Briefly explain what you understand by magnetic field. (4 marks)

b) A long, straight wire carries a 6.0-A current that is directed in the positive x direction. When a uniform magnetic field is applied perpendicular to a 3.0-m segment of the wire, the magnetic force on the segment is 0.36 N, directed in the negative y direction, as shown. What are the magnitude and direction of the magnetic field? (8 marks)



c) State Faraday's law. (2 marks)

d) Two parallel wires are separated by 0.06 m, each carrying 3A of current in the same direction. What is the magnitude of the force per unit length between the wires? Is the force attractive or repulsive? (6 marks)

QUESTION FIVE (20 MARKS)

a) State Gauss's law as used in electric flux (2 marks)

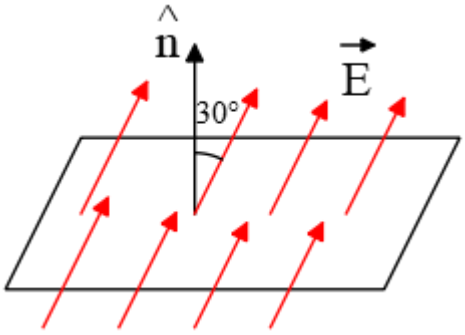
b) Show that (6 marks)

$$\oint \underline{E} \bullet \underline{dA} = \frac{\sum q_{inside}}{\varepsilon_0}$$

c) At the center of a sphere of radius 0.5m a point charge of 2.0μC is placed. What electric flux is passing through the sphere? $\varepsilon = 8.85 \times 10^{-12}\ C^2/Nm^2$

(6 marks)

d) A uniform electric field with a magnitude of E = 400N/C incident on a plane with a surface of area $A=10m^2$ and makes an angle of $\theta=30\circ$ with it. Find the electric flux through this surface?



(6 marks)