INTERNATIONAL UNIVERSITY OF EAST AFRICA

'Learning to Succeed'

HIGHER EDUCATION CERTIFICATE

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: HEC

YEAR/SEM: YEAR 1/SEMESTER 2

COURSE CODE: FDN 1209

NAME: FOUNDATION PHYSICS TWO

DATE: 2025-04-25

TIME: 2:00-5:00PM

INSTRUCTIONS TO CANDIDATES:

1. Read the instructions very carefully
2. The time allowed for this examination is STRICTLY three hours
3. Read each question carefully before you attempt and allocate your time equally between all the Sections
4. Write clearly and legibly. Illegible handwriting cannot be marked
5. Number the questions you have attempted
6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks
7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A Attempt ALL Questions (Each question carries 4 marks)

Question 1:

1. Three capacitors of 3, 2, and 6 micro faraday connected in series with a battery of 10 V. Find the charge on 3 Micro faraday capacitors.

Question 2:

A current of 12A flows through a copper wire of area $3mm^2$. The number of free electrons per m^3 is 10^{30}. Find the drift velocity of the electron.

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Question 3:

A conductor of length 15cm carrying a current of 6A is placed in magnetic field of flux density 0.8T. calculate the force on the conductor when placed;

(i) At 60 degrees to the field

(ii) At 45degrees to the field

Question 4:

The electrostatic force between two charges is 24 N. If the distance between them is halved, what is the new force?

Question 5:

a) State the ohms law of electricity
b) State at least two limitations of ohms law

Question 6:

A horizontal wire carrying current of 8A lies in a vertical magnetic field of 0.32T. calculate the force on the wire per unit length

Question 7:

A metal wire contains 5×10^{22} electrons per cm^3 and has cross-sectional area of $1mm^2$.If the electrons move along the wire with a mean drift velocity of $1mms^{-1}$, Calculate;

(i) current density

(ii) current in the wire

Question 8:

A 12 V battery is connected across an unknown resistor. If a current of 2 mA is flowing through the circuit. Find the value of the resistance.

Question 9:

a) Define the term surface charge density
b) With a well labelled diagram, show the distribution of charges on a sharp pointed conductor.

Question 10:

Three capacitors of capacitance 10 micro farad, 5 micro farad and 20 micro farad are connected in series with a 14 V dc supply. Find the charge on 5 micro Farad capacitor.

Se **narks)**

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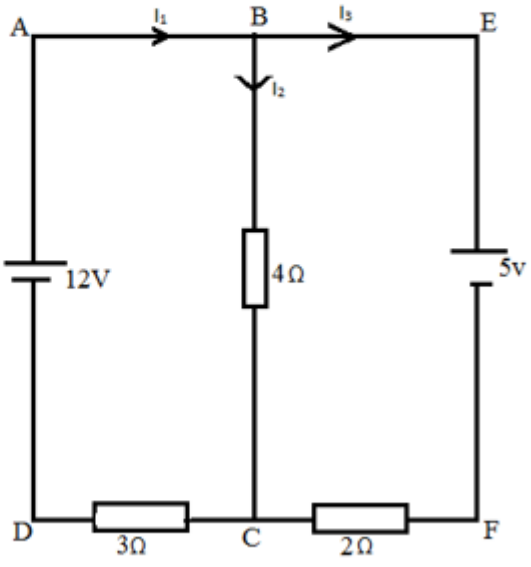
a) State the Kirchoff's law of;
   i) Current
   ii) Voltage
b) Calculate the current flowing through each resistor
c) Calculate the current flowing through each resistor



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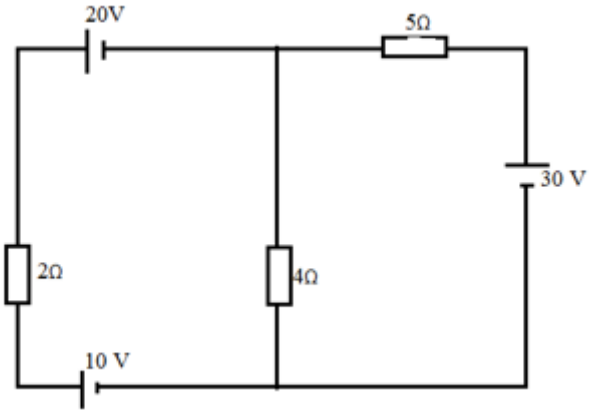
C) Calculate the current passing through each of the resistors below



Question 2:

a) Define the following terms

i) Electric field

ii) Electric field lines

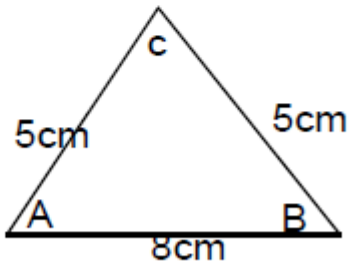
b) (i) State at least four properties of electric field lines

(ii) Sketch the electric fields for two oppositely charged parallel plates

c) i) Define the meaning of electric flux and state the formula

(ii) State the Gauss' law of electrostatics

d) Two-point charges A and B of charges $0.10\mu C$and $0.05\mu C$ respectively placed 8cm apart as shown below



Find the resultant electric field intensity at C

Question 3:

a) I) State at least 4 properties of magnets

iii) Explain briefly how an electromagnet can be made

iv) State three ways how a strength of an electromagnet can be improved

v) Differentiate between step-up transformer and a step-down transformer

b) An $a.\ c$ transformer is used to provide a voltage of 4000V for operating a T.V tube. If the transformer has 5000 turns on primary and is connected to 240V mains supply. How many turns are in the secondary coil.

c) I) Define the term magnetic flus density

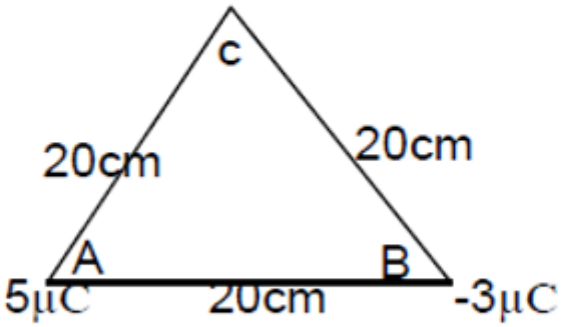
ii) A straight horizontal rod of mass 200g and length 0.2m is placed in a uniform horizontal magnetic field 0.25T perpendicular to it. Calculate the current through the rod if the force acting on it just balances its weight.

Question 4:

a) I) State the coulomb's law of electrostatics

b) I) Two-point charges of $8\mu C$ and $7\mu C$ are placed in liquid of relative permittivity $9.0x10^{9}Nm^{2}C^{-2}$ at distance 5cm apart. Calculate the force between them.

c) Two-point charges $Q1$, and $Q2$andare placed at different corners of an equilateral triangle of 20 cm each side. Find the resultant electric field intensity at C



Find the resultant electric field intensity at C

d) Describe briefly how a lightening conductor safe guards a house from the effect of thunder and lightening

Question 5:

a) Define the following

i) Ferromagnetic material

ii) Para magnetic material

b) (i) With the help of a drawing, explain briefly how a material can be magnetized by any method of your choice

(ii) Outline at least 4 properties of magnets field line

C) i) With the help of a drawing, explain briefly how an electromagnet can be made

ii) Outline three ways how the strength of an electromagnet can be increased.

d) A conductor of length 12m carrying a current of 2A is placed in magnetic field of flux density 0.125T. Calculate the force on the conductor when placed;

(i) At right angle to the field

(ii) At 80^0 to the field

(iii) At 70^0 to the field

Question 6:

a) Define the following terms as used in atomic physics

i) Radioactivity

ii) Nuclear fusion

iii) Nuclear fission

b) Derive the relationship between the following items

i) $N = N_0 e^{-\lambda t}$

ii) $\lambda = \frac{0.693}{t_{\frac{1}{2}}}$

C) Given the element ${}^{244}_{94}Pu$. Find the following

i. Number of protons

ii. Number of electrons

iii. Number of electrons in the above element

d) (I) A sample of radioactive waste has a half-life of 80 years. How long will it take for its activity to fall to 20% of its current value

(ii) A sample of radioactive material has an activity $9.0 \times 10^{12}\ Bq$. The material has half life of 80s. how long will it take for the activity to fall to $2.0 \times 10^{12} Bq$.