UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	FUNDAMENTALS OF ELECTRIC AND ELECTRONIC
COURSE CODE	:	DAU 10203
PROGRAMME CODE	:	DAU
DATE	:	JULY 2024
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ Closed book 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

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Q1 (a) State Kirchhoff's First and Second Law.

(4 marks)

(b) Find the currents in the circuit shown in **Figure Q1.1.**

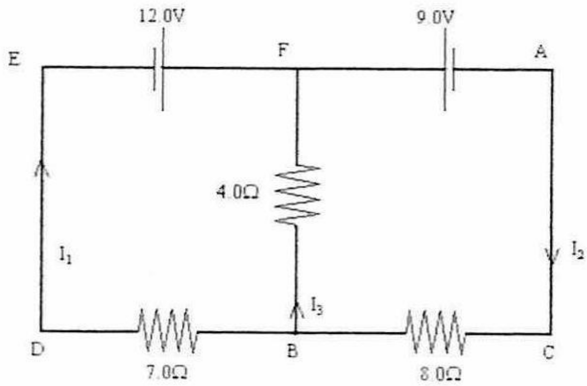

Figure Q1.1

(12 marks)

(c) In the **Figure Q1.2** below identify:

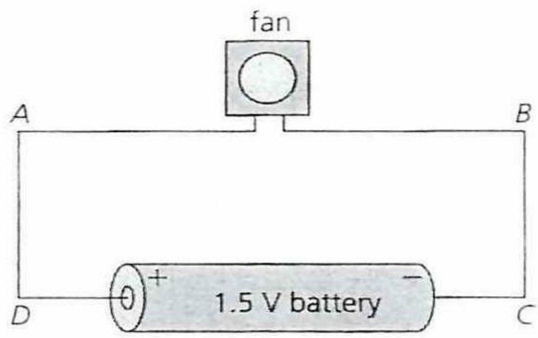

Figure Q1.2

(i) in which direction is the current flowing through the fan

(1 mark)

(ii) in which direction is the current flowing through the battery

(1 mark)

(iii) which terminal of the battery is at the higher potential

(1 mark)

(iv) which side of the fan is at the higher potential.

(1 mark)

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Q2 (a) State Coulomb's Law

(2 marks)

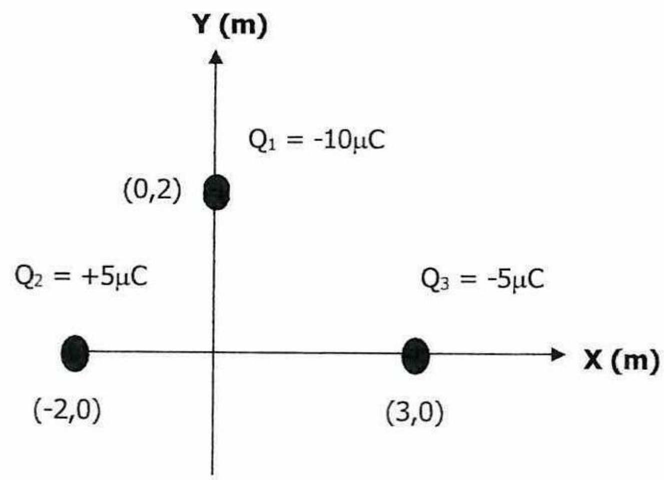

Figure Q2.1

(b) Referring to the **Figure Q2.1**:

(i) Determine the magnitude and direction of electric field at origin (0,0).

(13 marks)

(ii) Calculate the electric potential at origin (0,0).

(5 marks)

Q3 (a) Identify four (4) characteristics of electric field lines.

(4 marks)

(b) Two like charged balloons will repel each other. Identify two (2) variables that will increase the strength of their repulsive force.

(2 marks)

(c) Sketch the electric field lines for two positive charges that are close to each other. Given that the magnitude of one charge is triple the magnitude of the other charge.

(2 marks)

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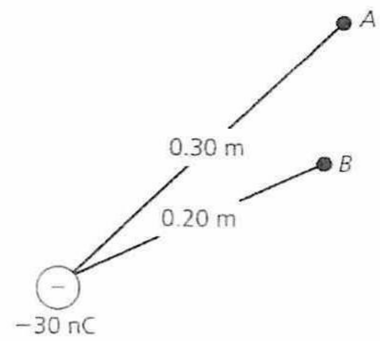

Figure Q3.1

A charge, Q = -30 nC as shown in **Figure Q3.1** is located 0.20 m from point A and 0.30 m from point B.

(d) (i) Calculate the electric potential at point A and point B.

(4 marks)

(ii) If a point charge, q is moved from point A to point B while charge Q is fixed in its place, compute the electric potential experienced by the charge q. Explain does its electric potential decrease or increase.

(4 marks)

(iii) Calculate the work done to move a point charge of − 1.50 nC from point A to point B. Explain is the work done by the electric field or by the electrostatic.

(2 marks)

(iv) Compute the change in electric potential energy as it moves from point A to point B. Explain the electric potential energy increase or decrease.

(2 marks)

Q4 (a) A charged particle passing through a region of magnetic field moves in a straight line. State the direction of the magnetic field with respect to the motion of the particle. Explain your answer.

(2 marks)

(b) A proton moves in a circular path perpendicular to a constant magnetic field strength of 4.0×10^{-3} T. If the momentum of proton is 1.52×10^{-23} $kgms^{-1}$. Determine,

(i) the radius of the circular path

(3 marks)

(ii) the speed of the proton.

(3 marks)

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(c) A solenoid has 25 turns per cm, and carries a current of 5.00 mA. An electron inside the solenoid moves in a circular path with a speed of $1.50 \times 10^5 ms^{-1}$.

(i) Determine the magnetic field strength in the solenoid.

(5 marks)

(ii) Determine the magnetic force on the electron. State the reason why the force does not increase the kinetic energy of the electron.

(4 marks)

(iii) Sketch a vector diagram to show the direction of velocity $\boldsymbol{v}$, the magnetic field $\boldsymbol{B}$ and the magnetic force $\boldsymbol{F}$ for the electron.

(3 marks)

Q5 (a) Differential between Faraday's law and Lenz's law of electromagnetic induction.

(2 marks)

(b) An elastic metal loop which is stretched to a radius of 14 cm, and is placed in uniform magnetic field is shown in the **Figure Q5.1** below.

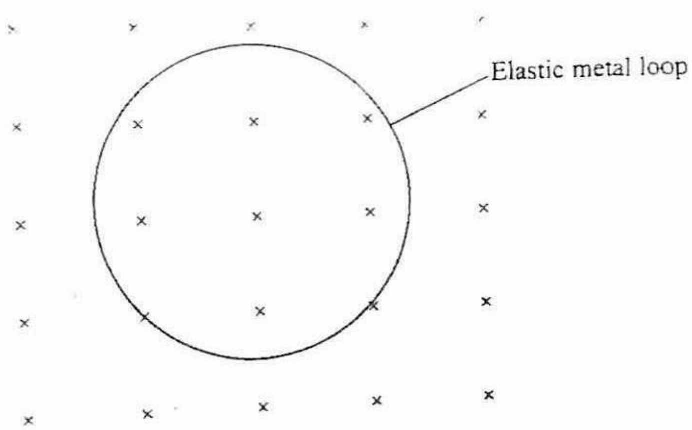

Figure Q5.1

The magnetic flux density of 0.75 T passes perpendicular through the plane of the loop. The loop suddenly shrinks to a radius of 9.0 cm in 0.16 s.

(i) Determine the induced e.m.f in the loop.

(4 marks)

(ii) State the direction of induced current.

(1 mark)

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(d) A d.c. motor draws an initial current of 1.2 A from a 3.0 V battery at the moment it is switched on. The current is 0.84 A when the armature of the motor spins at a speed of 45 revolutions per second. When this motor is loaded, it spins at 25 revolution per second. Determine,

(i) the resistance of the armature coil of the motor.

(3 marks)

(iii) the back e.m.f produced when the motor spins at 45 revolution per second.

(3 marks)

(iv) the output power of the motor 45 revolution per second.

(4 marks)

(v) The back e.m.f at 25 revolution per second.

(3 marks)

- END OF QUESTIONS -

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FORMULA

$E = hf$	$V = IR$	$n = \frac{N}{L}$	$F = \frac{\mu_0}{2\pi}(\frac{I_1 I_2}{d})l$
$A = \pi r^2$	$U = mgh$	$\Delta K = -\Delta U$	$F = \frac{\mu_0}{2\pi}(\frac{I_1}{d})l$
$\phi = hf_o$	$L = mvr = \frac{nh}{2\pi}$	$W_n = \Delta K$	$F = Bqv \sin \theta$
$K = eV_s$	$R = \sqrt{R_x^2 + R_y^2}$	$W = F\Delta x$	$\varepsilon = Blv \sin \theta$
$hf = K_{max} + \phi$	$E = \frac{F}{q}$	$W = q\Delta V$	$B = \mu_o nI$
$LP = m \cdot v$	$J = \frac{I}{A}\theta$	$q = ne$	$\Delta\Phi = \Phi_2 - \Phi_1$
$K = \frac{ke^2}{2r}$	$\frac{V_s}{V_p} = \frac{N_s}{N_p}$	$B = \frac{\mu_o I}{2\pi d}$	$E = \frac{q}{4\pi\varepsilon_o (r)^2}$
$E = \frac{kQ}{d^2}$	$C = \frac{\varepsilon_o A}{d}$	$K = \frac{1}{2}mv^2$	$f_o = \frac{\phi}{h} = \frac{hc}{h\lambda}$
$F = \frac{kq_1 q_2}{d^2}$	$\varepsilon = -N\frac{d\Phi}{dt}$	$v = \frac{BI}{neA}$	$e = -1.6x10^{-19}\,C$
$P = I^2 R$	$\varepsilon = -L\frac{dI}{dt}$	$E = \frac{\sigma}{\varepsilon}$	$\Phi = NBA\,kos\,\theta$
$F = mv^2$	$\phi = \frac{hf_0}{e}$	$k = \frac{1}{4\pi\varepsilon_0}$	$\hbar = 6.63\,x\,10^{-34}\,Js$
$v = \frac{L}{t}$	$v = \frac{LI}{ne}$	$v = \frac{I}{neA}$	$\varepsilon = BAN\,\omega \sin \omega t$
$F = \frac{ke^2}{r}$	$C = \frac{\varepsilon_r \varepsilon_o A}{d}$	$\Phi = BA$	$c = 3.0\,X\,10^8\,ms^{-1}$
$I = \frac{Q}{t}$	$U = -\frac{ke^2}{r}$	$C = \frac{Q}{V}$	$\mu_o = 4\pi\,x 10^{-7} Tm$

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