Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	PHYSICS III
COURSE CODE	:	DAS 24603
PROGRAMME CODE	:	DAU
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN SECTION A AND **THREE (3)** QUESTIONS IN SECTION B

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THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

SECTION A

Q1 (a) Define Magnetic Field.

(2 marks)

(b) An alpha particle, α ($\alpha = 2e^-$) is moving at 2.50×10^6 ms^{-1} perpendicular to a 1.50 T magnetic field. If the charge of an electron is 1.60×10^{-19} C and the mass of an alpha particle is 6.68×10^{-27} kg, calculate:

(i) the magnitude of the force acting on the alpha particle due to the magnetic field.

(ii) the radius of the circle in which the alpha particle moves.

(6 marks)

(c) A current is flowing through a wire as shown in **Figure Q1 (c)**. Determine the directions of magnetic fields due to the current flowing in the wire at Points P and Q (either out of or into the page), and state the rule used to determine the direction.

(3 marks)

(d) Two long straight parallel wires both carrying current of 3.50 A and 5.80 A in the same direction as shown in **Figure Q1 (d)**. Find:

(i) the magnitude and direction of the magnetic field on wire A due to wire B.

(ii) the magnitude and direction of the magnetic field on wire B due to wire A.

(iii) the magnitude and direction of the magnetic force experienced by a 35 cm length of wire A.

(9 marks)

Q2 (a) **Figure Q2 (a)** shows a two loop circuit connected in parallel. The current I_1 that passed through R_1 is 1.41 A. Given; $R_1 = 2\,\Omega$, $R_2 = 1\,\Omega$, $R_3 = 0.5\,\Omega$, $R_4 = 7\,\Omega$, $R_5 = 1.5\,\Omega$, $V_2 = 15\,V$, and $V_3 = 18\,V$. By using Kirchhoff's Law, calculate:

(i) the current I_2 and I_3.

(ii) the voltage V_1.

(12 marks)

(b) Four resistors are connected in a closed circuit as shown in **Figure Q2 (b).** Given the battery with an e.m.f of 9 V and internal resistance of 4 Ω, and $R_1 = 4\,\Omega$, $R_2 = 2\,\Omega$, $R_3 = 10\,\Omega$, and $R_4 = 12\,\Omega$. Find:

(i) the equivalent resistance for external loaded.

(ii) the current drawn from the battery.

(8 marks)

SECTION B

Q3 (a) Two like-charged balloons will repel each other. List **two (2)** variables or quantities that will increase the strength of their repulsive force.

(2 marks)

(b) By referring to the **Figure Q3 (b)**, calculate the vector components (in x and y components) of electrostatic force on charge Q_3 due to the other charges.

(10 marks)

(c) A 11 μC and a 13 μC charges are separated by 18 cm as shown in **Figure Q3 (c)**. If the point P is the point of zero net electric field, find the value of x.

(8 marks)

Q4 (a) Draw an electric field lines for following conditions:

(i) two opposite sign charges

(ii) two identical sign charges.

(4 marks)

(b) Two point charges Q_1 and Q_2 are placed near to point A as shown in **Figure Q4 (b)**. Calculate:

(i) the magnitude and direction of resultant electric field at point A.

(ii) the electric potential between point A and B if the electric field from point A to point B calculated from **Q4 (b)(i)** is constant.

(16 marks)

Q5 (a) State **two (2)** benefits of using dielectric materials in a capacitor.

(2 marks)

(b) By referring to the **Figure Q5 (b)**, the values of capacitor are C_1 = 2 μF, C_2 = 4 μF, C_3 = 6 μF, C_4 = 8 μF, and C_5 = 10 μF. Calculate:

(i) the equivalent capacitance.

(ii) the potential difference across capacitor C_3.

(9 marks)

(c) Two square conductor plates of 15 cm on each side which are separated by 5.50 mm are inserted with two types of dielectric as shown in **Figure Q5 (c)**. Half of the space is filled with glass while the other half is filled with paper. The dielectric constant of glass and paper are 3.90 and 2.50 respectively. Determine:

(i) the capacitance of this combination.

(ii) the energy stored in this capacitor if a battery of 26 V is connected across the plates.

(9 marks)

Q6 (a) Sketch a current-voltage (I-V) graph that represent an ohmic devices.

(2 marks)

(b) A current of 2.50 A is carried by a copper wire of radius 3.50 mm and length 5.40 m. The resistivity of copper is 1.70×10^{-8} Ωm. Calculate:

(i) the resistance of the copper wire.

(ii) the potential difference across the copper wire.

(iii) the drift velocity of electron if the copper wire contains 8.50×10^{28} electrons per cubic meter.

(8 marks)

(c) Six resistors, each with resistance of 5 Ω are arranged as shown in the **Figure Q6 (c)**. Calculate the equivalent resistance between point A and point B.

(10 marks)

Q7 (a) Define Faraday's Law of Induction.

(2 marks)

(b) A circular coil is placed in a magnetic field directed 30° to the normal of the coil. The coil has 200 turns and radius of 2.8 cm. from the graph of magnetic field variation versus time as shown in **Figure Q7 (b)**. Determine:

(i) the magnetic flux linkage through the coil at the maximum magnetic field.

(ii) the e.m.f. induced in the coil during the first 10 s.

(iii) the e.m.f. induced in the coil between 10 s to 15 s.

(iv) From the sign of the induced e.m.f. in **Q7 (b)(ii)** and **Q7 (b)(iii)**, conclude the relation between magnetic flux and induced e.m.f.

(12 marks)

(c) A step-down transformer has 330 turns in the primary coil and 20 turns in secondary coil. The primary coil is connected to an AC power supply of 120 V and a current of 0.75 A is drawn when the power supply is turned on. Calculate:

(i) the voltage across the secondary coil.

(ii) the current in the secondary coil.

(6 marks)

-END OF QUESTION-

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2018/2019
COURSE NAME : PHYSICS III
PROGRAMME CODE : DAU
COURSE CODE : DAS 24603

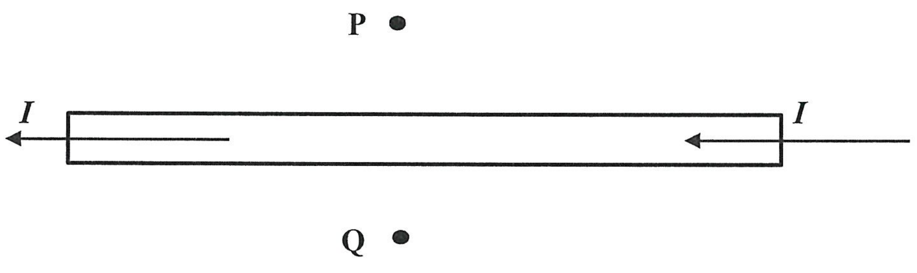

Figure Q1 (c)

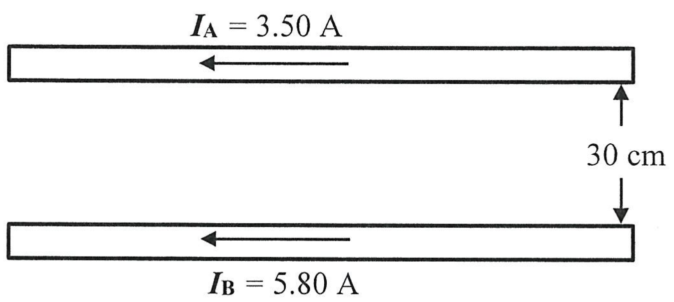

Figure Q1 (d)

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2018/2019
COURSE NAME : PHYSICS III

PROGRAMME CODE : DAU
COURSE CODE : DAS 24603

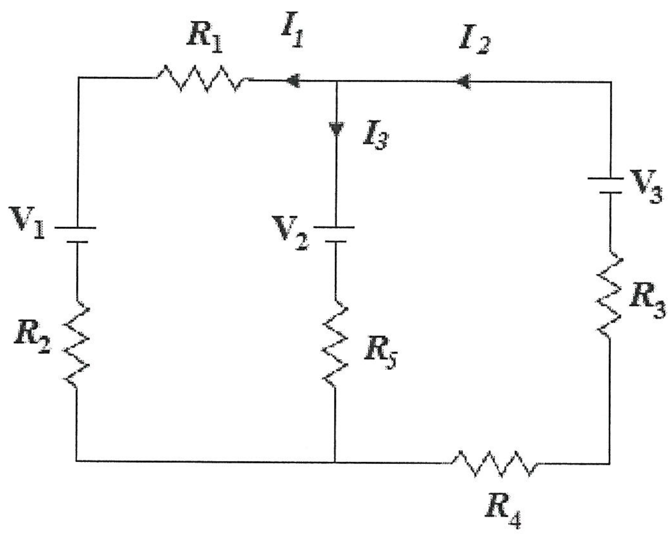

Figure Q2 (a)

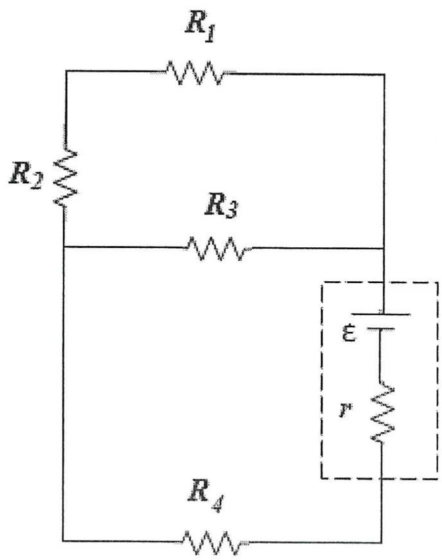

Figure Q2 (b)

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2018/2019
COURSE NAME : PHYSICS III
PROGRAMME CODE : DAU
COURSE CODE : DAS 24603

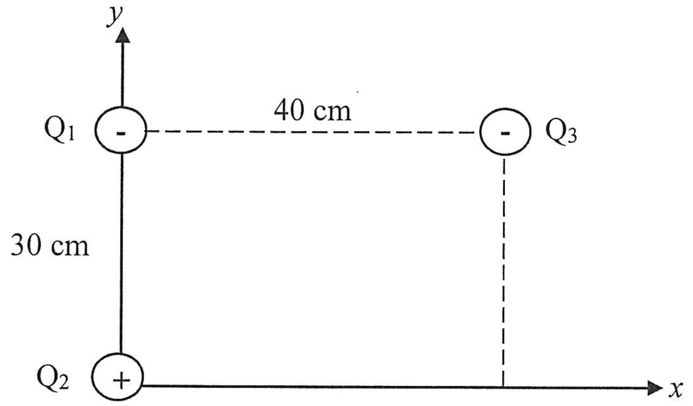

Figure Q3 (b)

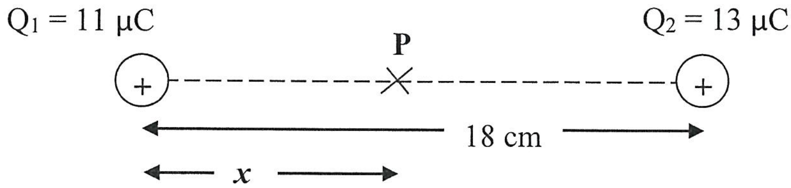

Figure Q3 (c)

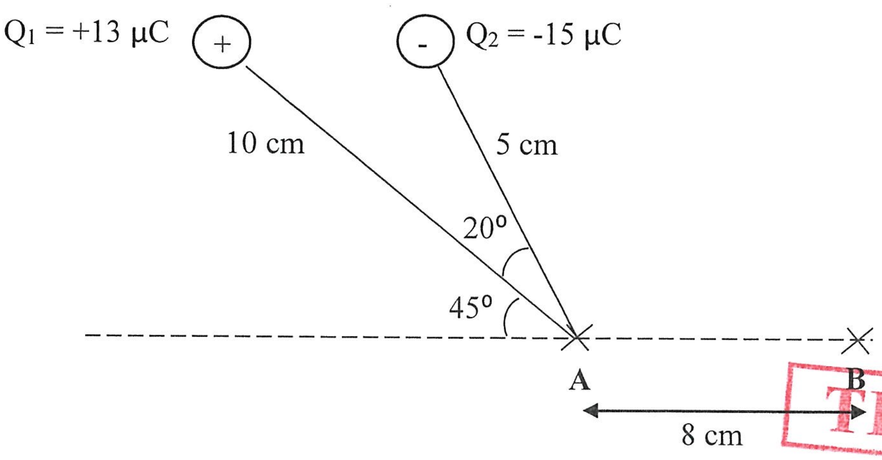

Figure Q4 (b)

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2018/2019
COURSE NAME : PHYSICS III

PROGRAMME CODE : DAU
COURSE CODE : DAS 24603

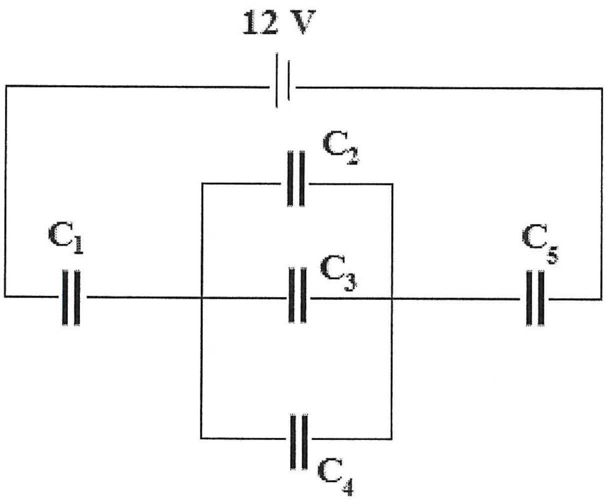

Figure Q5 (b)

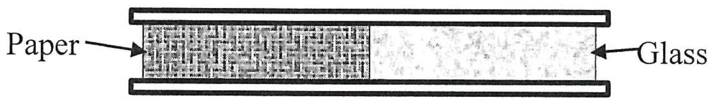

Figure Q5 (c)

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2018/2019
COURSE NAME : PHYSICS III
PROGRAMME CODE : DAU
COURSE CODE : DAS 24603

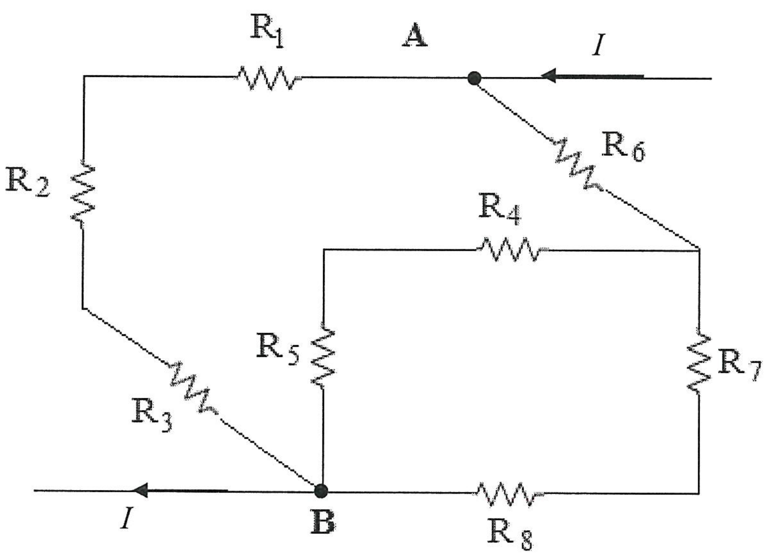

Figure Q6 (c)

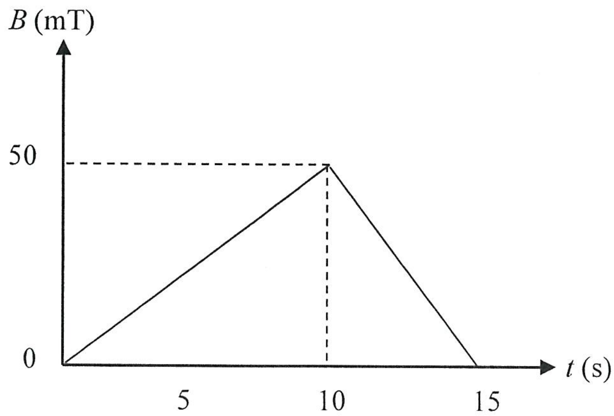

Figure Q7 (b)

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2018/2019
COURSE NAME : PHYSICS III
PROGRAMME CODE : DAU
COURSE CODE : DAS 24603

FORMULA

$q = \pm ne$	P: $C_{eq} = C_1 + C_2$	$B = \mu nI$
$F_{12} = k\frac{q_1 q_2}{r^2}$	S: $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$	$B = \frac{\mu_o I}{2\pi r}$
$E = \frac{kQ}{r^2}$	$U = \frac{1}{2}CV^2$	$B = N\frac{\mu_o I}{2\pi r}$
$F = qE$	$Q = It$	$\Phi_B = BAcos\theta$
$\phi_{enclosed} = \oint_{closed\ system} \vec{E}\cdot d\vec{A}$	$R = \frac{\rho L}{A}$	$\Phi_B = NBAcos\theta$
$\phi_{enclosed} = \frac{q_{enclosed}}{\varepsilon_o}$	$\sigma = \frac{1}{\rho}$	$\varepsilon = -N\frac{\Delta\Phi_E}{\Delta t}$
$\Phi_E = EAcos\theta$	$V = IR$	$E = vB$
$V = \frac{W}{q}$	$P = \frac{QV}{t}$	$I = \frac{BLv}{r}$
$W = qEd$	$I = nAve$	$V = BLv$
$\Delta W = -\Delta U$	$J = nve$	$V = Ed$
$\|R\| = \sqrt{x^2 + y^2}$	$V_{ab} = \varepsilon - Ir$	$F_B = qvBsin\theta$
$V = \frac{kQ}{r}$	$I = \frac{\varepsilon}{R + r}$	$\frac{V_S}{V_P} = \frac{N_S}{N_P}$
$tan\theta = \frac{y}{x}$	S: $R_{eq} = R_1 + R_2$	$\frac{V_S}{V_P} = \frac{I_P}{I_S}$
$C = \frac{\varepsilon_o A}{d}$	P: $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$	$r = \frac{mv}{qB}$
$C = \frac{Q}{V}$	$F_C = \frac{mv^2}{r}$	$EA = \frac{Q}{\varepsilon_o}$
$C = \frac{\kappa\varepsilon_o A}{d}$	$F = ILBsin\theta$	TERBUKA

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LIST OF CONSTANT

1. Gravity acceleration, $g = 9.81\ \text{m}\cdot\text{s}^{-2}$
2. Rydberg constant, $R = 1.097 \times 10^{7}\ \text{m}^{-1}$
3. Permeability of free space, $\mu_o = 4\pi \times 10^{-7}\ \text{N}\cdot\text{m}^{-1}$
4. Permittivity of free space, $\varepsilon_o = 8.854 \times 10^{-12}\ (\text{N}\cdot\text{m})^{-2}\cdot\text{C}^{2}$
5. Planck constant, $h = 6.63 \times 10^{-19}\ \text{J}\cdot\text{s}$
6. Speed of light in air, $c = 3.00 \times 10^{8}\ \text{m}\cdot\text{s}^{-1}$
7. Charge of electron, $e = 1.602 \times 10^{-19}\ \text{C}$
8. Coulomb constant, $k = 9.0 \times 10^{9}\ \text{N}\cdot\text{m}^{2}\cdot\text{C}^{-2}$
9. Resistivity of copper, $\rho_{copper} = 1.67 \times 10^{-8}\ \Omega\cdot\text{m}$
10. Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg
11. Mass of proton, $m_p = 1.673 \times 10^{-27}$ kg
12. 1 mole = 6.02×10^{23} atoms