Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	PHYSICS FOR ELECTRICAL ENGINEERING
COURSE CODE	:	DAE 13103
PROGRAMME	:	DAE
EXAMINATION DATE	:	DECEMBER 2018/JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

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

Q1 (a) State one difference between base quantity and derived quantity. Give one example for each of the quantity.

(2 marks)

(b) Define electric current and state its SI unit.

(2 marks)

(c) Write the value below into scientific notation with **four (4)** significant figures and SI unit:

(i) 358 200 000 000 °C

(2 marks)

(ii) 0.000 086 600 000 000 zA

(2 marks)

(iii) 578 239 561 g/mm^2

(3 marks)

(iv) 0.000 689 298 219 Ecd/cm^2

(3 marks)

(d) Vector $\vec{A}$ is 25 units in magnitude and points at an angle of 23° above the negative x-axis while vector $\vec{B}$ has negative x component 3.00 units in length and positive y component 2.00 units in length. If $\vec{R} = \vec{A} + \vec{B}$, calculate the magnitude and direction for $\vec{R}$.

(5 marks)

(e) A jeep accelerates from 15 ms^{-1} to a velocity of 25 ms^{-1} in 3 second. Later, it moves with a constant velocity for 7 second. The jeep then slows down and stop after 5 second.

(i) Sketch a velocity-time graph for the whole journey.

(2 marks)

(ii) Compute the total distance travelled.

(4 marks)

Q2 (a) State the **two (2)** factors that influence the kinetic energy of a body.

(2 marks)

(b) Define heat and state **three (3)** methods to transfer its energy.

(5 marks)

(c) A ball of mass 3 kg rolls on the smooth surface as shown in **Figure Q2(c)**. If the ball starts from rest at point A, calculate its speed at point B.

(3 marks)

(d) In **Figure Q2(d)**, a 100 N box (initially at rest) is pushed 10 m up a ramp by a horizontal applied force of 150 N. The ramp is frictionless inclined at angle of 30 °C.

(i) Compute the net work done on the box.

(5 marks)

(ii) Find the power requirement to push up the box in 6 second.

(2 marks)

(e) A 960 g metal object requires 5.02 $x10^3$ J of heat to raise its temperature from 20.0 °C to 40.0 °C. Find the specific heat capacity of the metal.

(2 marks)

(f) Determine the amount of energy required to change a 40 g ice cube from ice at -10 °C to steam at 110 °C. (L_{vwater}= 2.26 x 10^6 J/kg °C, L_{fice}= 335 x 10^3 J/kg °C, c_{water}= 4200 J/kg °C, c_{ice}= 2100 J/kg °C, c_{steam}= 1996 J/kg °C)

(6 marks)

Q3 (a) Define Coulomb's Law.

(3 marks)

(b) Describe zero electric flux and maximum electric flux.

(4 marks)

(c) A point charge Q_1 = - 4.0 nC is placed at coordinate x = 0.60 m and y = 0.80 m. A second point charge Q_2 = + 6.0 nC is placed at coordinate x = 0.60 m and y = 0.0 m. Calculate the magnitude and direction of the net electric field at the origin due to these point charges.

(8 marks)

(d) Consider **three (3)** point charges at the corners of a triangle as shown in **Figure Q3(c)**. Given that Q_1 = + 6.0 x 10^{-9} C, Q_2 = - 2.0 x 10^{-9} C and Q_3 = + 5.0 x 10^{-9} C. Determine the magnitude and direction of the net force experienced by charge Q_3 due to charges Q_1 and Q_2. ($k = 9 \times 10^9$ N m^2 C^{-2})

(10 marks)

Q4 (a) Define electric potential.

(3 marks)

(b) Capacitors can be connected in series or in parallel. Explain the voltage and charges of the capacitors when they are connected in series and in parallel.

(4 marks)

(c) **Two (2)** point charges $Q_1 = +20\ \mu C$ and $Q_2 = -10\ \mu C$ are located 20 cm apart as shown in **Figure Q4(c)**. Calculate;

(i) The potential at point X and Y.

(4 marks)

(ii) Potential difference between point X and Y.

(2 marks)

(iii) Work done to move charge $Q3 = +5\ \mu C$ from point X to Y.

(2 marks)

(d) A 12 V potential difference is applied to the terminal as shown in **Figure Q4(d)**.

(i) Calculate the total capacitance across the terminal.

(3 marks)

(ii) Determine the charge and voltage across each capacitor.

(7 marks)

Q5 (a) Define Ohm's Law.

(2 marks)

(b) Explain the factors that affect the resistance of a wire.

(4 marks)

(c) A 115 m long copper wire has a resistance of 8.0 Ω. Calculate the diameter of the wire.

(4 marks)

(d) **Figure Q5(d)** shows resistors connected in series and parallel.

(i) Calculate the equivalent resistance, R_{EQ}.

(6 marks)

(ii) If the circuit is supplied with a 12 V dc voltage. Calculate the power dissipated by the equivalent resistance, R_{EQ}.

(2 marks)

(iii) Resistors connected in parallel versus resistors connected in series. Briefly discuss power dissipation in both connections.

(2 marks)

(e) Two resistors 15 Ω and 30 Ω are connected in parallel. The current through the 15 Ω resistor is 3 A. Calculate;

(i) The current in the 30 Ω resistor.

(1 marks)

(ii) The power dissipated by each resistor.

(4 marks)

Q6 (a) Explain the Ampere's Law and state the related equation.

(3 marks)

(b) An electron is moving at 3.0×10^{8} ms^{-1} perpendicular to a 0.8 T magnetic field.
(The electron charge = 1.6×10^{-19} C, electron mass = 9.1×10^{-31} kg).
Find:

(i) The magnitude of the acceleration of the electron.

(3 marks)

(ii) The radius of the circle in which the electron moves.

(2 marks)

(c) An electron travels at a speed of 2.0×10^{-4} ms^{-1} through a uniform magnetic field of magnitude 1.2×10^{-3} T. The directions of velocity and magnetic field are shown in **Figure Q6(c)**.

(i) Calculate the magnetic force experienced by the electron.

(3 marks)

(ii) Determine the direction of magnetic force experienced by the electron.

(1 marks)

(iii) Redraw **Figure Q6(c)** and mark the direction of force on your drawing.

(1 marks)

(d) **Figure Q6(d)** shows **two (2)** long parallel wires separated by a distance of 15 cm. Current in wire X and Y are 8 A and 12 A respectively. If a third wire 25 cm in length is placed on point P 3 cm from wire X and parallel to the wires.

Find the force experienced by this wire which carries a current of 6 A upwards. (Arrows shows the direction of current) (Given: $\mu_o = 1.26 \times 10^{-6}$ Hm^{-1})

(6 marks)

(e) A single circular loop of wire is carries a current of 14 A. Its radius is 5 cm. A uniform magnetic field, B = 30 mT. The angle between the plane of the circular loop and the direction of the magnetic field is 30°. If $\mu_o = 1.26 \times 10^{-6}$ Hm^{-1}, find

(i) The magnetic moment of the circular loop.

(3 marks)

(ii) The torque on the entire circular loop.

(3 marks)

– END OF QUESTIONS –

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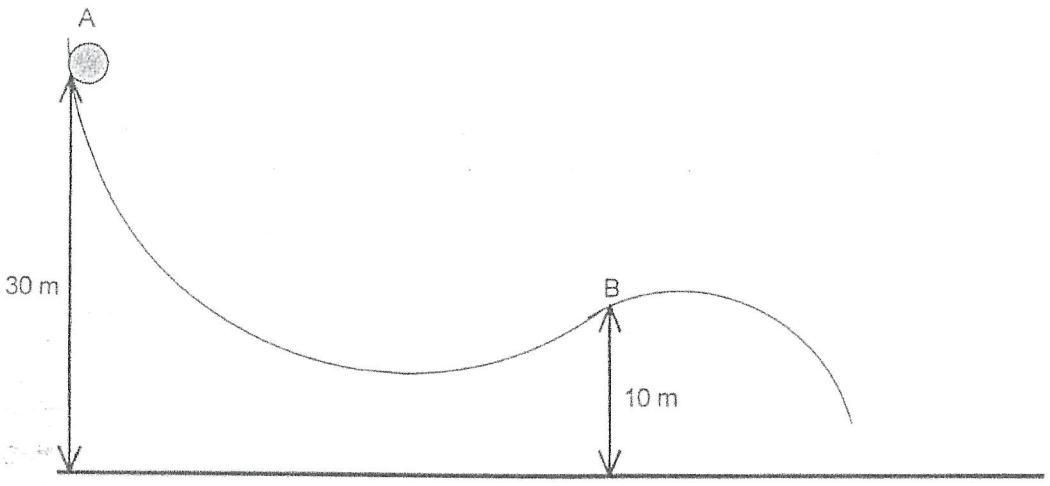

FIGURE Q2(c)

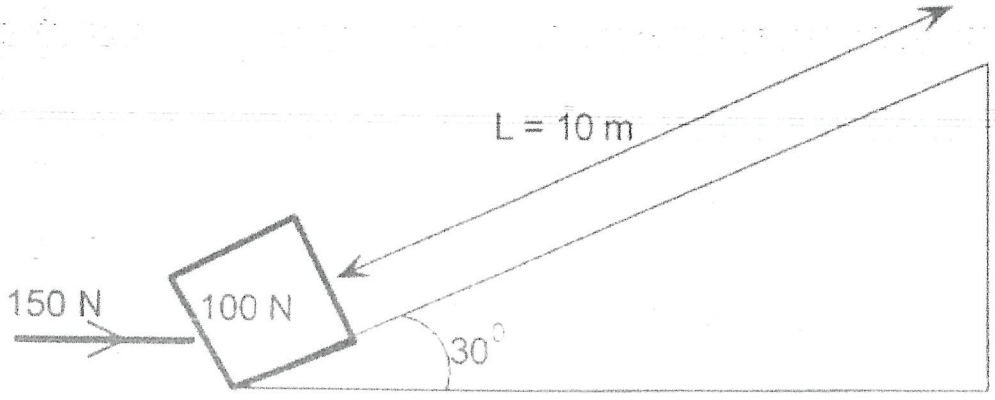

FIGURE Q2(d)

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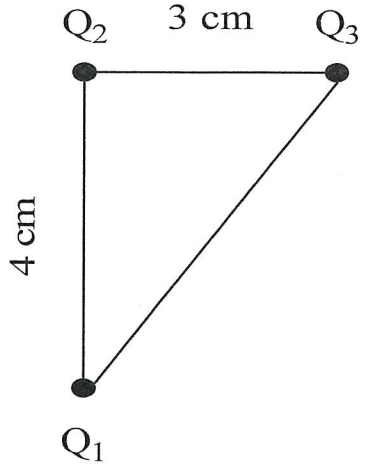

FIGURE Q3(c)

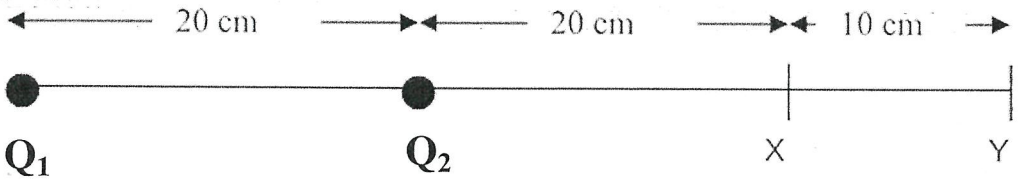

FIGURE Q4(c)

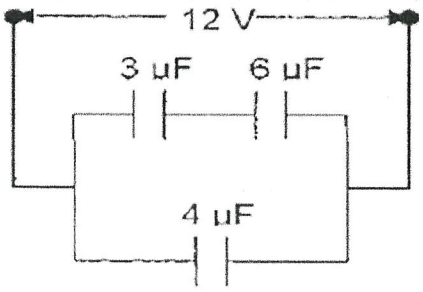

FIGURE Q4(d)

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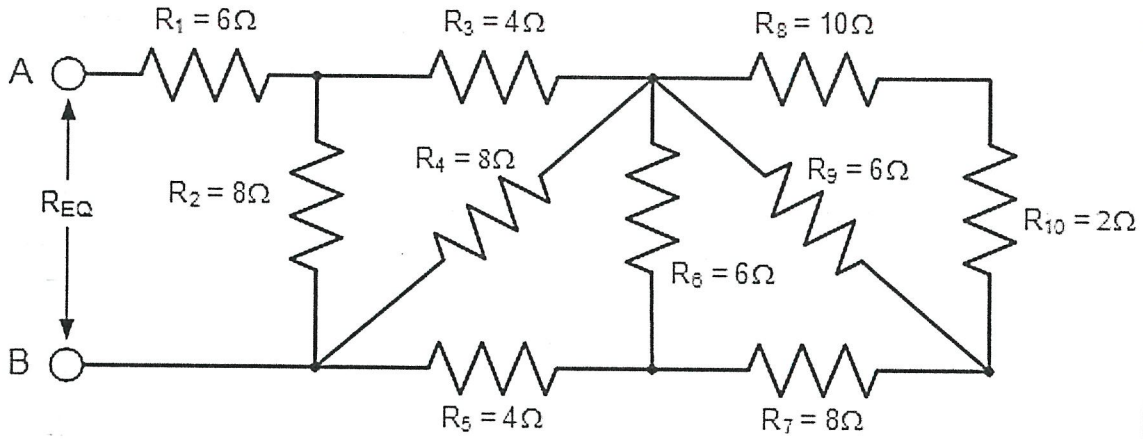

FIGURE Q5(d)

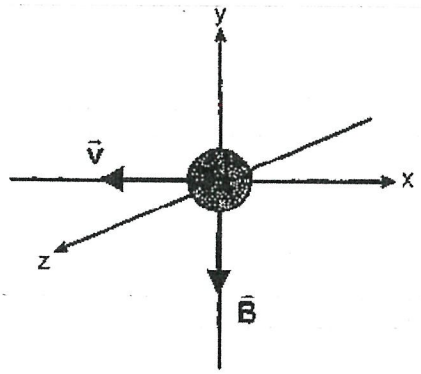

FIGURE Q6(c)

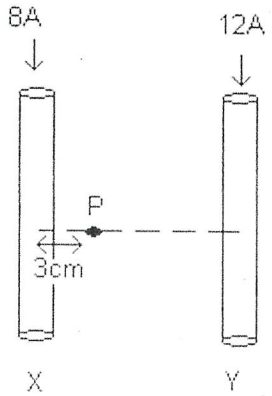

FIGURE Q6(d)

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LIST OF FORMULAE: Constant acceleration in linear motion

Final velocity	$v = v_o + at$
Final velocity	$v^2 = {v_o}^2 + 2as$
Displacement	$s = \frac{1}{2}(v_o + v)t$
Displacement	$s = v_o t + \frac{1}{2}at^2$
Displacement	$s = vt - \frac{1}{2}at^2$

LIST OF FORMULAE: Work, Energy and Power

Kinetic energy	$K = \frac{1}{2}mv^2$
Gravitational potential energy	$U_g = mgh$
Power	$P = Fv$
Work done by non-conservative forces	$W_{nc} = \Delta K + \Delta U$

LIST OF FORMULAE: Specific heat and latent heat

Rate of conduction heat transfer	$\frac{Q}{t} = \frac{\kappa A(T_{hot} - T_{cold})}{d}$
Specific heat	$Q = mc(\Delta T)$
Latent heat	$Q = mL$

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LIST OF FORMULAE: Force and electric field caused by electric charges

Force	$F = k\frac{q_1 q_2}{r^2}$
Electric field	$E = k\frac{q}{r^2}$

LIST OF FORMULAE: Resistance

Resistance	$R = \rho\frac{L}{A}$

LIST OF FORMULAE: Resistivities of conductor metal

Type	Resistivity, ρ (Ω m)
Silver	1.47×10^{-8}
Copper	1.72×10^{-8}
Gold	2.44×10^{-8}
Aluminium	2.75×10^{-8}
Tungsten	5.25×10^{-8}
Steel	20×10^{-8}