Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	PHYSICS FOR ELECTRICAL ENGINEERING
COURSE CODE	:	DAE 13103
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
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 **SIX (6)** PAGES

Q1 Work, energy and power are basic concept in physics.

(a) Define the principle of work, energy and power.

(6 marks)

(b) A car of mass 1500 kg moves with constant speed of 20 ms^{-1} along a straight road. If the air resistance and the road friction against the car is 150 N, determine the power of the engine of the car.

(4 marks)

(c) Consider a person on a sled sliding down a 100 m long hill on a frictionless 30° incline. The mass is 20 kg, and the person has a velocity of 2 m/s down the hill when they're at the top. How fast is the person traveling at the bottom of the hill?

(10 marks)

Q2 Electric field is also called as electric field intensity or electric field strength.

(a) State **two (2)** fundamental law of electric force as deduced by Coulomb's Law.

(4 marks)

(b) Two positive point charges, q_1= +16μC and q_2= +4.0μC are separated in a vacuum by a distance of 3.0 m as shown in **Figure Q2.1.** Find the distance, *d* of point P on the line between the charges where the net electric field is zero.

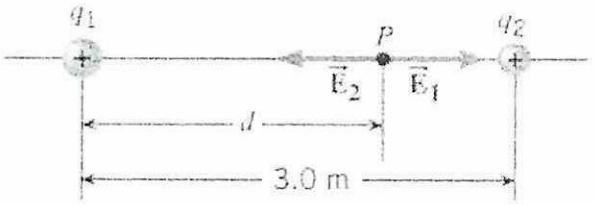

Figure Q2.1

(6 marks)

(c) In the Bohr model of the hydrogen atom, the electron is in orbit about the nuclear proton at a radius of 5.29x10^{-11} m as shown in the **Figure Q2.2**. By assuming the orbit to be circular, determine the speed of the orbiting electron. Given the mass of electron (me) is 9.11 x 10^{-31} kg.

Figure Q2.2

(10 marks)

Q3 Electrical potential is a measure of the potential energy per unit charge.

(a) Describe the relation between electrical potential and electrical field.

(4 marks)

(b) Two (2) point charges are arranged as in **Figure Q3.1** below. Calculate

(i) Potential at point **X**

(ii) Potential at point **Y**

(iii) Difference potential between point **X** and **Y**

(iv) Work done to move point charge $q = 20\mu C$ from **X** to **Y**

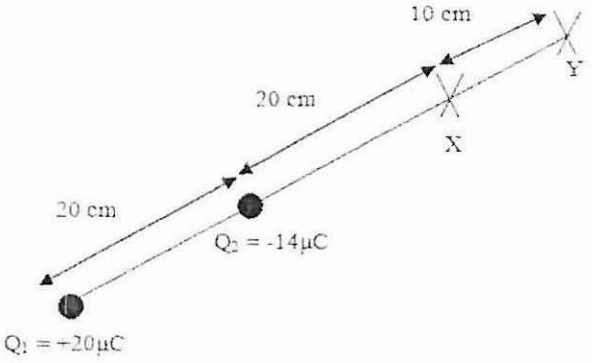

Figure Q3.1

(12 marks)

(c) Calculate the equivalent capacitance of the combination in **Figure Q3.2**

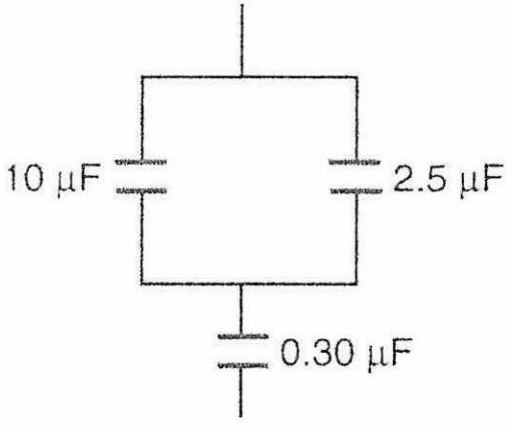

Figure Q3.2

(4 marks)

Q4 An electric current is the measure of the flow of electric charge through a material.

(a) Explain the differences of direct current (DC) and alternating current (AC).

(4 marks)

(b) A radius of 100 m of length copper wire is 0.6 mm. When connected to a potential of 2 V, a current of 4 A exists in the wire. Find the resistivity of this wire.

(4 marks)

(c) **Figure Q4.1** shows a circuit consisting of 5 resistors connected to a 24 V battery. If $R_1 = 10\ \Omega$ and $R_2 = 15\ \Omega$, calculate

(i) The equivalent resistance of this circuit

(ii) The current through R_2

(iii) The power dissipated in R_2

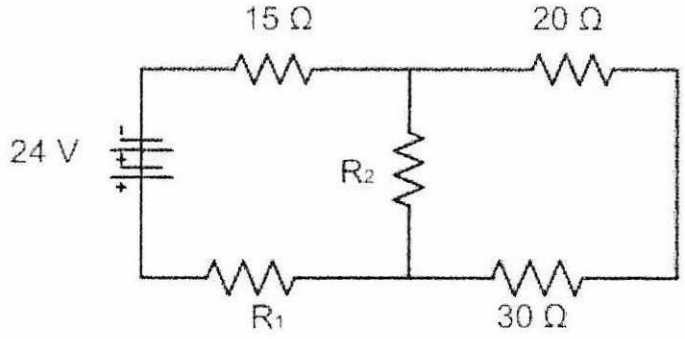

Figure Q4.1

(12 marks)

Q5 Magnetism refers to physical phenomena arising from the force caused by magnets, objects that produce fields that attract or repel other objects.

(a) Explain Flemming's left hand rule with proper sketching to shows the magnetic force on a current carrying wire.

(4 marks)

(b) A wire carrying a 30.0 A current passes between the poles of a strong magnet that is perpendicular to its field and experiences a 2.16 N force on the 4.00 cm of wire in the field. What is the average field strength?

(4 marks)

(c) Three parallel wires determine as A, B and C in **Figure Q5.1**, carrying currents of 3 A, 5 A and 4 A, respectively as shown below. Compute the magnetic force experienced by a 35 cm length of wire C.

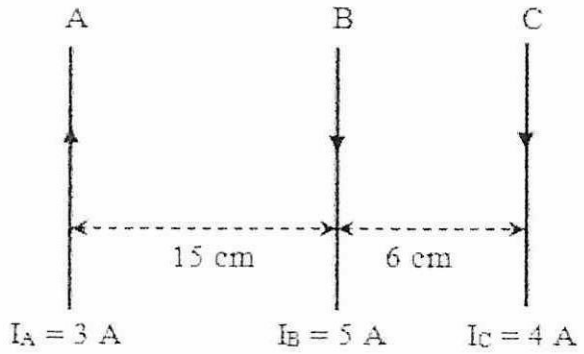

Figure Q5.1

(12 marks)

- END OF QUESTIONS -

APPENDIX A List of Formula

1. $v = u + at$
2. $v^2 = u^2 + 2as$
3. $s = \frac{1}{2}(u + v)t$
4. $s = ut + \frac{1}{2}at^2$
5. W = F x d
6. $P = \frac{Q}{t}$
7. Q = mL
8. Q = mcΔT
9. $F = k\frac{|q_1||q_2|}{r^2}$; k is Coulomb's constant = 8.99×10^9 N·m²/C².
10. $E = k\frac{|q|}{r^2}$
11. $F = ma_c = mv^2/r$
12. $R = \sqrt{x^2 + y^2}$
13. $\tan\theta = \frac{x^2}{y^2}$
14. Q = CV
15. V = Ed
16. Cd = εo εr A ; εo = 8.85 x 10^{-12}
17. V = IR
18. P = I^2 R