INTI International University & Colleges

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**January 2021**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI) Diploma in Mechanical Engineering (DMEN)
Course	:	**PHY1121/PHY1131: Physics**
Date of Examination	:	9 March 2021 (Tuesday)
Time	:	12.00noon – 2.15pm Reading Time : Nil
Duration	:	2 Hours 15 Minutes

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks.

Material permitted : Non-Programmable Scientific Calculator

Materials provided : Physics Formulae Booklet

Examiner(s)	:	**Chong Mee Teng**
Chief Moderator	:	Teow Hsien Loong

*This paper consists of **6** printed pages, including the cover page*

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING PROGRAMME (DEEI)
DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
PHY1131 / PHY1121: PHYSICS
FINAL ALTERNAT IVE ASSESSMENT: JANUARY 2021 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks.

Question 1

(a) In the **Figure Q1(a)**, a proton is projected horizontally midway between two parallel plates that are separated by 5.0×10^{-3} m. The electrical field due to the plates has magnitude 610,000 N/C between the plates away from the edges. If the plates are 5.6×10^{-2} m long, find the minimum speed of the proton if it just misses the lower plate as it emerges from the field. Given that the charge of proton, $e = 1.60 \times 10^{-19}$ C, permittivity of free space, $\varepsilon_0 = 8.85 \times 10^{-12}$ $C^2/N \cdot m^2$ and the mass of proton, $m_p = 1.67 \times 10^{-27}$ kg.

(9 marks)

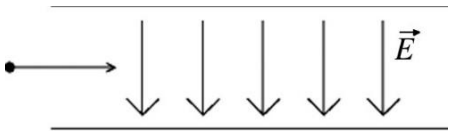

Figure Q1(a)

(b) For the situation shown in **Figure Q1(b)**, compute the electric field, E at point P and the force, F on a charge, -4.0×10^{-8} C placed at point P.

(8 marks)

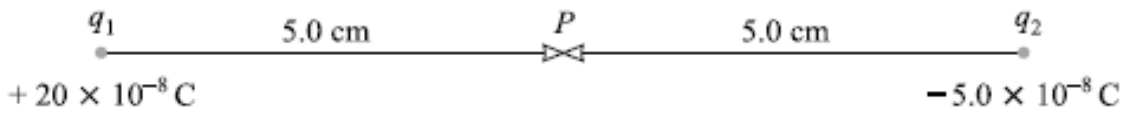

Figure Q1(b)

(c) **Figure Q1(c)** shows electric charges labeled **Q1, Q2, Q3** and some electric field lines in the region surrounding the charges. Interpret the signs of the three charges?

(3 marks)

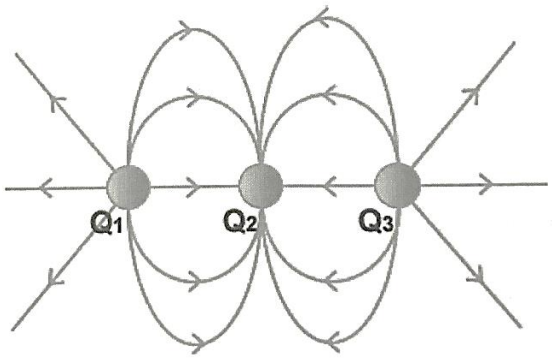

Figure Q1(c)

(d) If the electrical energy costs 25 cents per kilowatt-hour, compute the cost to operate an electric oven for 5.0 hour if it carries a current of 20.0 A at 220 V?

(5 marks)

Question 2

(a) In **Figure Q2(a),** two positive point charges +4.00 μC and +2.00 μC are placed at the opposite corners of a rectangle. Given the Coulomb constant, $k = 8.99 \times 10^9$ N·m^2/C^2, compute:

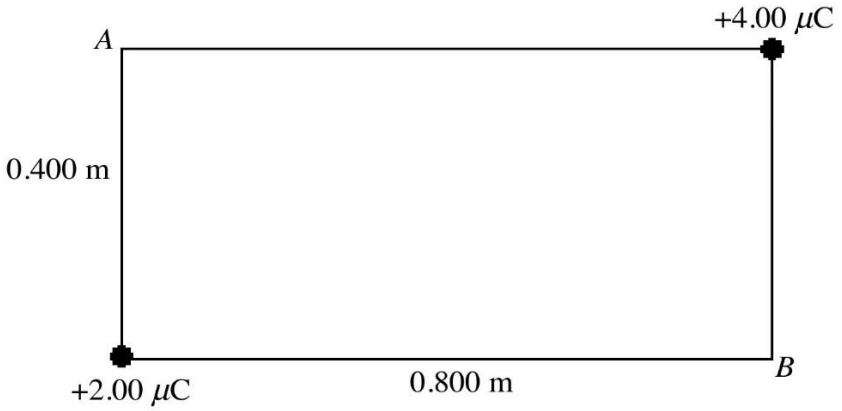

Figure Q2(a)

(i) the potential at point *A* (relative to infinity) due to these charges,

(4 marks)

(ii) the potential at point *B* (relative to infinity) due to these charges.

(4 marks)

(b) A parallel plate capacitor consists of two plates, each with area 200 cm^2, separated by a 4.0 x 10^{-3} m air gap. (Given the permittivity of free space, $\varepsilon_o = 8.85 \times 10^{-12}$ Fm^{-1})

(i) Compute its capacitance.

(3 marks)

(ii) If the capacitor was connected across a 500 V source, compute the energy stored in it?

(4 marks)

(iii) Compute the value of electric field, *E* between the plates.

(2 marks)

(c) If a particle with a charge of 2.0 C moves through a potential difference of 12 V, compute the magnitude of the change in kinetic energy?

(3 marks)

(d) An electric heater is to be made from nichrome wire. Nichrome has a resistivity of 1.0×10^{-6} Ωm at the operating temperature of the heater. The heater is to have a power dissipation of 60 W when the potential difference across its terminals is 12 V. For the heater operating at its designed power,

(i) show that the resistance of the nichrome wire is 2.4 Ω.

(2 marks)

(ii) compute the length of nichrome wire of diameter 8.0×10^{-4} m required for the heater.

(3 marks)

Question 3

(a) Four capacitors are connected across a 90-V voltage source as shown in the **Figure Q3(a)**. Compute the equivalent capacitance for the circuit.

(6 marks)

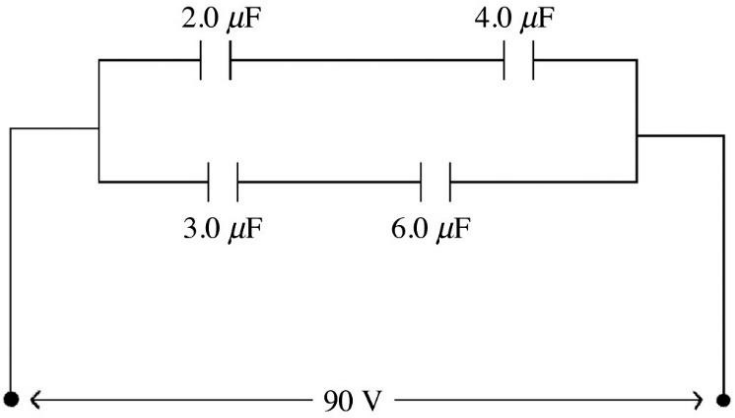

Figure Q3(a)

(c) Compute the equivalent resistance in the circuit shown in **Figure Q3(b)**.

(5 marks)

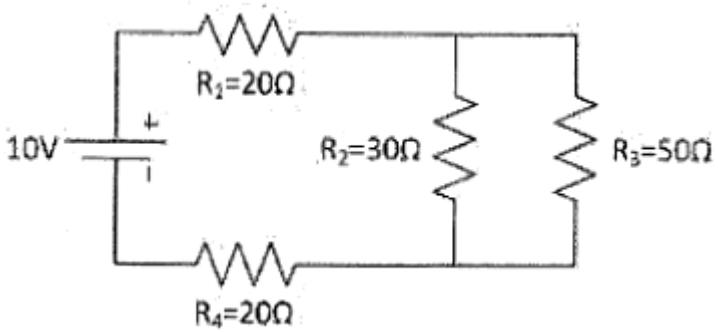

Figure Q3(b)

(c) Two long parallel wires carry currents of 20 A and 5 A in opposite directions. The wires are separated by 0.20 m. Compute the magnetic field midway between the two wires?

(6 marks)

(d) Interpret the followings:

(i) the semiconductors, conductors and insulators on the basic of band gap,

(3 marks)

(ii) the hole in a semiconductor and the hole current,

(3 marks)

(iii) the doping process.

(2 marks)

Question 4

(b) In **Figure Q4(a),** an electron travelling with a speed of 6.5×10^7 m/s enters a region of uniform magnetics field of flux density 0.316 T. It then emerges from the field at ***P***.

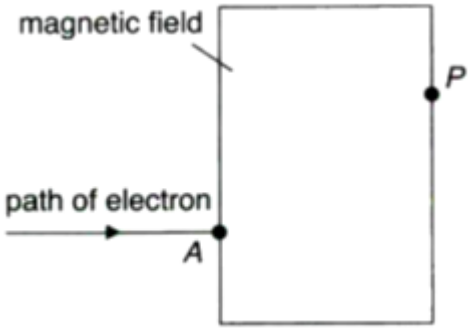

Figure Q4(a)

(i) Sketch the path of the electron from *A* to *P*.

(2 marks)

(ii) Sketch the path of the electron after emerging from the field.

(2 marks)

(iii) Compute the direction of the magnetic field.

(2 marks)

(iv) Compute the speed of the electron after emerging from the field.

(2 marks)

(b) A proton is fired into a magnetic field of strength, $B = 0.16$ T. The velocity of the proton is 8.0×10^6 ms^{-1} at right angles to the field. (Given mass of proton, $m_p = 1.673 \times 10^{-27}$ kg and charge of proton, $e = 1.6 \times 10^{-19}$ C)

(i) Compute the magnitude of the force on the proton.

(3 marks)

(ii) Sketch the path followed by the proton in the magnetic field. Show the direction of the magnetic force on the proton in your diagram.

(3 marks)

(iii) Interpret the reason the proton moves in a circular path.

(3 marks)

(c) (i) Explain how are a *p*-type and a *n*-type semiconductor formed?

(3 marks)

(ii) Explain what is the majority carrier in a *n*-type semiconductor? How is the process of its majority carriers produced?

(3 marks)

(iii) Explain what is a *pn* junction.

(2 marks)

~THE END~