UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2010/2011

COURSE NAME	:	PHYSICS III
COURSE CODE	:	DSF 2913
PROGRAMME	:	2 DFA/ 3DFA
EXAMINATION DATE	:	NOVEMBER/DECEMBER 2010
DURATION	:	2 1/2 HOURS
INSTRUCTIONS	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF TWELVE (12) PAGES

Q1 (a) Give a definition for each of the followings:

(i) Coulomb's law of electrostatic force.
(ii) Electrostatic field, E.

(4 marks)

(b) Two equal but opposite charges are separated 15 cm away from each other. Given the magnitude of charges are 2.0×10^{-7} C,

(i) Determine the magnitude and direction of electrostatic field, E in the middle of the two charges.
(ii) Find the magnitude and direction of electrostatic force, F experienced by an electron at this point in (i).

(16 marks)

Q2 (a) A charge of +2.0 μC is located at points A and B which is 10 m and 20 m away, respectively as shown in **Figure Q2(a)**.

(i) Calculate the electric potential at points A, V_A and B, V_B.
(ii) What is the potential difference, V_{AB} between points A and B?

(10 marks)

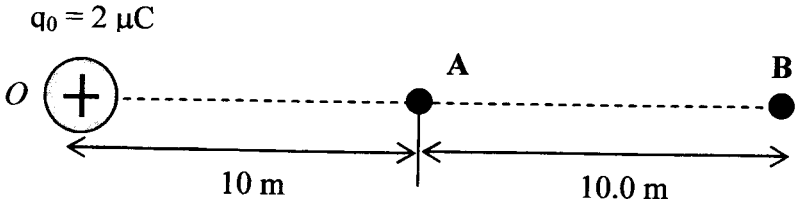


Figure Q2(a).

(b) Determine the electric potential energy, W required to locate the charges, as in **Figure Q2(b)**.
Given a = 0.5 m, b = 0.25 m and q = 4 μC.

(10 marks)

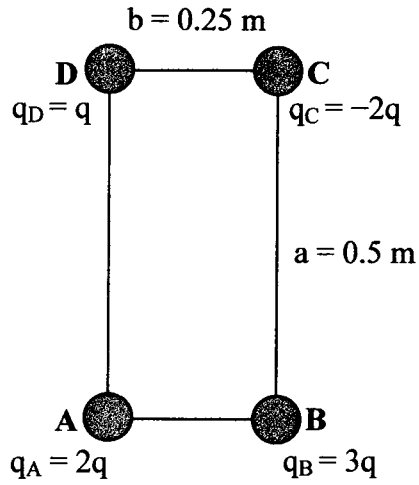


Figure Q2(b)

Q3 (a) A 2.5 m long aluminium rod has a square cross section 1 cm × 5 cm.

(i) Determine the resistance, R of the aluminium rod.
(ii) What is the length, l of the iron wire with diameter 15 mm which has the same resistance as the aluminium rod?
Given the resistivity, ρ of an aluminium rod and iron wire is 2.8×10^{-8} Ω.m and 1.0×10^{-7} Ω.m, respectively.

(10 marks)

(b) A resistor of 0.10 Ω generates energy at a rate of 10 watts when it is connected to a battery with e.m.f of 1.5 V. Determine:

(i) The internal resistance, r of the battery.
(ii) The potential difference, V across the resistor.

(10 marks)

Q4 Referring to **Figure Q4**, calculate:

(a) Currents I_1, I_2 and I_3. (15 marks)

(b) Potential difference between **a** and **b**. (5 marks)

(Hint: use Kirchoff's rule for current and voltage)

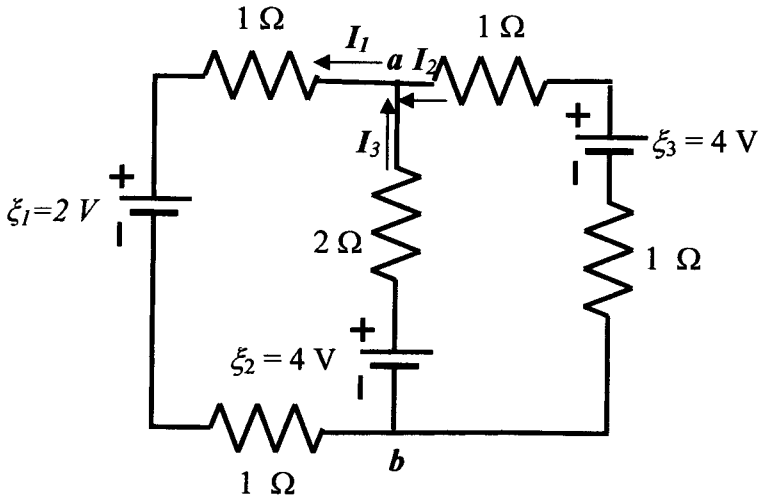


Figure Q4

Q5 A circuit diagram in **Figure Q5** shows a connection of capacitors both in series and parallel. Determine:

(a) The equivalent capacitance, C_{eq} of the circuit, (3 marks)

(b) The charge, Q in the equivalent capacitance, (3 marks)

(c) The charge, Q in each capacitor, (6 marks)

(d) The potential difference, V across each capacitor, (5 marks)

(e) The energy, E required to charge the capacitor, (3 marks)

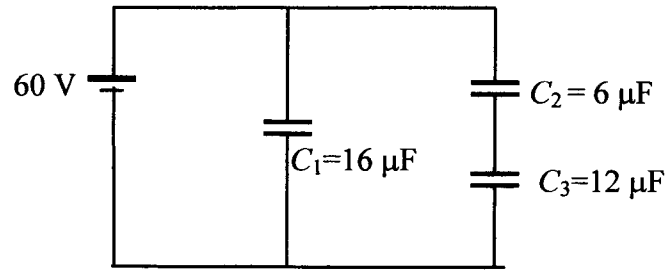


Figure Q5

Q6 (a) Can a transformer be operated using a direct current, d.c? What happens if a transformer designed for a 240 V alternating current, a.c is connected to a 240 V d.c?

(3 marks)

(b) A transformer is connected to a 240 V a.c to supply a-24V low lighting system for a railway model. Given the equivalent resistance for the system is 2 Ω.

Determine:

(i) The ratio of primary, N_p and secondary, N_s coil.
(ii) The secondary current, I_s supplied.
(iii) The power, W transferred to the load.
(iv) The resistance, R which is connected to a-240V supply at this power.

(17 marks)

Q7 (a) State the Faraday's law of electromagnetic induction.

(4 marks)

(b) A square copper coil with dimension 20 cm on each side slides horizontally through a region of uniform magnetic field $\boldsymbol{B}$ = 2.0 T, with constant velocity $v = 0.02\ ms^{-1}$. The direction of magnetic field is perpendicularly upward of the page. The coil is moved from position (P) , (Q), (R) and (S) as shown in **Figure Q7(b)**. The region outside the dotted line has zero magnetic field.

(i) Find the magnitude of the induced, ξ_{emf} in the coil at the position (P) and position (R).
(ii) Determine the direction of the induced current, I in the coil for each position.
(iii) Find the induced current, I in the coil at the position (R) if the coil's resistance is 0.70 Ω.

(16 marks)

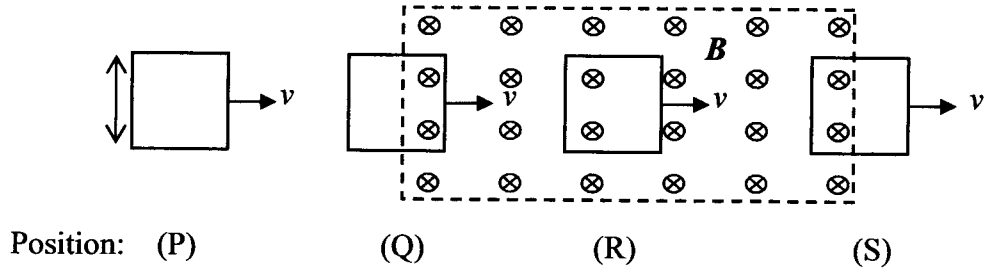


Figure Q7(b)

S1 (a) Berikan takrifan bagi:

(i) Hukum Coulomb.
(ii) Medan elektrostatik, E.

(4 markah)

(b) Dua cas sama magnitud tetapi berlawanan tanda dipisahkan sejauh 15 cm antara satu sama lain. Jika magnitud cas-cas ialah 2.0×10^{-7} C,

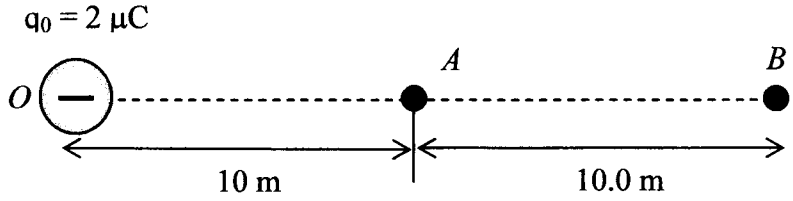
(i) Berapakah magnitud dan arah medan elektrik, E di tengah-tengah garis yang menghubungkan cas-cas tersebut?
(ii) Tentukan magnitud dan arah daya elektrostatik , F yang dialami oleh satu elektron jika diletakkan di titik ini?

(16 markah)

S2 (a) Titik A dan B masing-masing terletak pada jarak 10 m dan 20 m dari satu cas +2.0 μC seperti ditunjukkan dalam **Rajah S2(a).**

(i) Kirakan keupayaan elektrik, V_A di A dan V_B di B.
(ii) Berapakah beza keupayaan, V_{AB} di antara A dan B.

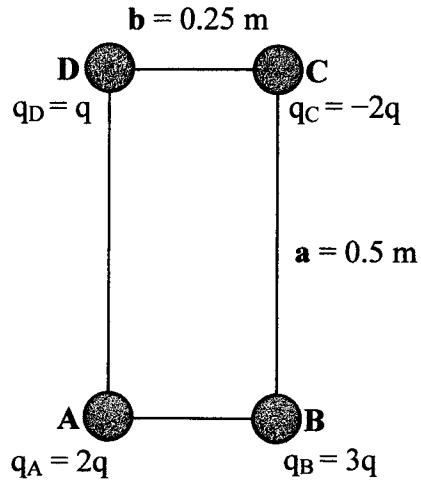
(10 markah)



Rajah S2(a)

(b) Kirakan tenaga, W yang diperlukan untuk menempatkan cas-cas seperti yang ditunjukkan dalam **Rajah S2(b).**
(Diberi a = 0.5 m, b = 0.25 m dan q = 4 μC)

(10 markah)



Rajah S2(b)

S3 (a) Satu rod aluminium yang panjangnya 2.5 m mempunyai keratan rentas segi empat 1 cm × 5 cm.

(i) Kira rintangan, *R* rod aluminium ini.
(ii) Berapakah panjang, *l* satu dawai besi dengan garispusat 15 mm yang mempunyai rintangan yang sama dengan rod aluminium ini? (Kerintangan, ρ aluminium ialah 2.8×10^{-8} Ω.m dan kerintangan,ρ besi ialah 1.0×10^{-7} Ω.m)

(10 markah)

(b) Satu perintang 0.10 Ω menjana haba pada kadar 10 watt dengan menyambungkannya kepada satu bateri yang mempunyai d.g.e 1.5 V.

Kirakan:

(i) Rintangan dalam, *r* bateri,
(ii) Beza keupayaan, *V* yang merentasi perintang tersebut.

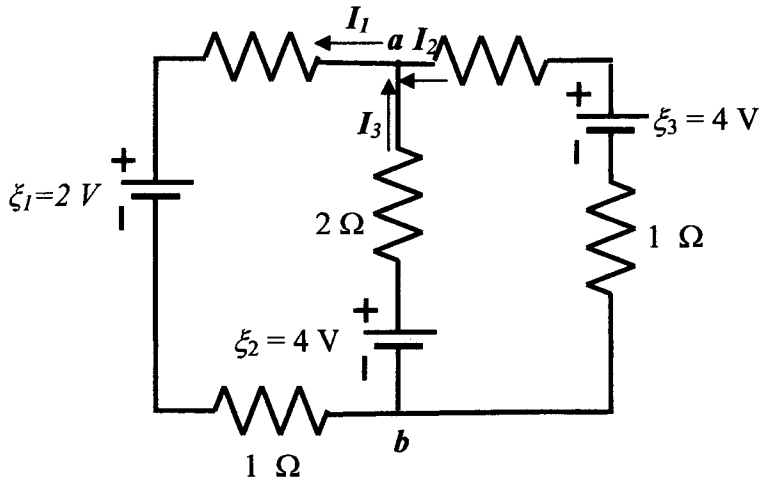
(10 markah)

S4 Berdasarkan **Rajah S4**, kira:

(a) arus I_1, I_2, dan I_3. (15 markah)

(b) Beza keupayaan di antara titik **a** dan **b.** (5 markah)

(Petunjuk: Gunakan Hukum Kirchoff bagi arus dan voltan)



Rajah S4

S5 Litar pada **Rajah S5** menunjukkan sambungan kapasitor secara bersiri dan selari.

Kirakan:

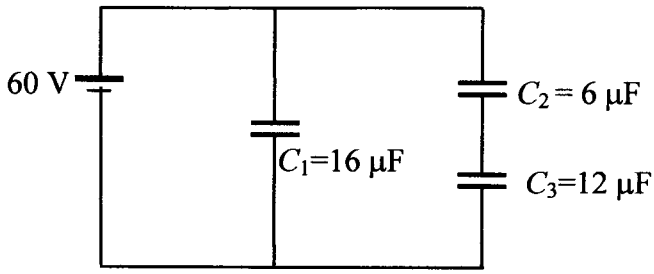
(a) kapasitans setara, C_{eq} litar, (3 markah)

(b) cas, Q di dalam kapasitor setara, (3 markah)

(c) cas, Q di dalam setiap kapasitor, (6 markah)

(d) beza keupayaan, V yang merentasi setiap kapasitor, (5 markah)

(e) tenaga, E diperlukan untuk mengecas kapasitor. (3 markah)



Rajah S5

S6 (a) Bolehkah sebuah transformer digunakan untuk a.t? Apakah yang akan terjadi jika transformer yang direka untuk a.u 240 V disambungkan kepada bekalan a.t 240 V?

(3 markah)

(b) Sebuah transformer disambungkan kepada bekalan a.u 240 V untuk membekalkan 24 V kepada sistem pencahayaan bervoltan rendah bagi sebuah model jalan keretapi kampong. Rintangan setara bagi system ini ialah 2 Ω. Berapakah:

(i) Nisbah lilitan primer, N_p dibandingkan dengan lilitan sekunder, N_s bagi transformer ini?
(ii) Arus sekunder, I_s yang dibekalkan?
(iii) Kuasa,W yang dihantar kepada beban?
(iv) Rintangan, R yang dihubungkan kepada bekalan 240 V yang akan menggunakan kuasa yang sama seperti transformer ini?

(17 markah)

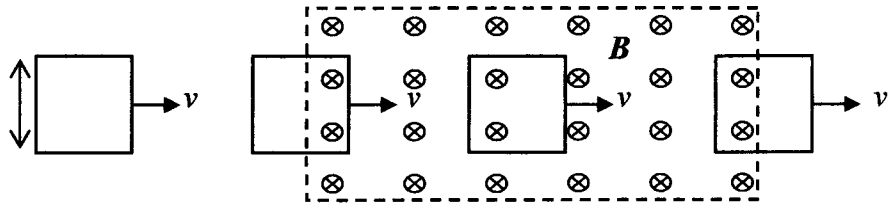
S7 (a) Nyatakan Hukum Faraday bagi aruhan electromagnet.

(4 markah)

(a) Gegelung segiempat sama berdimensi 20 cm setiap sisi meluncur secara mendatar melalui suatu rantau medan magnet seragam **B** = 2.0 T dengan halaju malar,v = 0.02 ms^{-1}. Arah medan magnet adalah tegak lurus ke atas mukasurat. Gegelung ini bergerak dari kedudukan (P) , (Q), (R) dan (S) seperti pada **Rajah S7(b)**. Rantau di luar garis putus-putus mempunyai medan magnet sifar.

(i) Kirakan magnitud aruhan daya gerak elektrik, ξ_{emf} bagi gegelung pada kedudukan (P) dan (R).
(ii) Tentukan arah arus aruhan, I pada gegelung pada setiap kedudukan, (P), (Q), (R) dan (S).
(iii) Kirakan arus aruhan, I pada gegelung pada kedudukan (R) sekiranya rintangan, R pada gegelung adalah 0.7 Ω.

(16 markah)



Kedudukan: (P) (Q) (R) (S)

Rajah S7(b)

PEPERIKSAAN AKHIR

SEMESTER / SESI : SEM I / 2010/2011
MATA PELAJARAN : FIZIK III
KURSUS: 2/3 DFA
KOD MATA PELAJARAN: DSF 2913

LIST OF CONSTANTS AND FORMULA

Acceleration due to the gravity $g = 9.8\ ms^{-2}$
Speed of light $c = 3 \times 10^{8}\ ms^{-1}$
Elementary charge $e = 1.6 \times 10^{-19}\ C$
Electron mass $m_e = 9.1 \times 10^{-31}\ kg$
Permittivity constant $\varepsilon_\circ = 8.85 \times 10^{-12}\ C^2N^{-1}m^{-2}$
Coulomb constant $k = 9.0 \times 10^{9}\ Nm^2C^{-2}$
Permeability constant $\mu_\circ = 1.26 \times 10^{-6}\ NA^{-2}$
Planck's constant $h = 6.63 \times 10^{-34}\ Js$

$$F_{12} = \frac{kq_1q_2}{r^2}$$

$$E = \frac{F}{q_\circ} \quad ; E = \frac{kq}{r^2}$$

$$V = \sum \frac{kq}{r}$$

$$C = \frac{Q}{V}$$

$$C = \frac{K\varepsilon_\circ A}{d}$$

$$K = \frac{C}{C_\circ} = \frac{V_\circ}{V}$$

$$U = \frac{1}{2}CV^2 = \frac{1}{2}QV$$

$$V = IR$$

$$R_{eq} = R_1 + R_2 + ..$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + ..$$

$$V_{ab} = \varepsilon - Ir = IR$$

$$P = V_{ab}I = I^2R$$

$$V_{ab} = V_b - V_a$$

$$\sum I = 0$$

$$\sum \Delta V = 0$$

$$\sum \varepsilon = \sum IR$$

$$F = qvB\sin\theta$$

$$F = ilb\sin\theta$$

$$F_{21} = \frac{\mu_\circ I_1 I_2 l_2}{2\pi d}$$

$$B = \frac{\mu_\circ I}{2\pi r}$$

$$B = \mu_\circ nI$$

$$\phi = BA\cos\theta$$

$$\varepsilon = -\frac{\Delta\phi}{\Delta t}$$

$$\varepsilon = -Blv$$

$$E = hf = h\frac{c}{\lambda}$$

$$E = \Phi + K_{max}$$

$$p = \frac{h}{\lambda} \ ; \ p = \sqrt{2mK}$$

$$K_{max} = eV_\circ$$