UNIVERSITI SAINS MALAYSIA

KSCP Examination
Academic Session 2007/2008

June 2008

ZCT 102/4 – Physics II (Electricity and Magnetium)
[Fizik II (Keelektrikan dan Kemagnetan)]

Duration: 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains **EIGHT** printed pages before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **LAPAN** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

Instruction: Answer **ANY FIVE (5)** questions. Students are allowed to answer all questions in Bahasa Malaysia or in English.

*[**Arahan**: Jawab **MANA-MANA LIMA (5)** soalan. Pelajar dibenarkan menjawab semua soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]*

.../2-

1. Three charged particles are located at the corners of an equilateral triangle as shown in Figure 1.
[Tiga zarah bercas berada pada penjuru segitiga samasisi seperti tertera dalam Rajah 1]

(a) Calculate the total electric force on the 7.00 μC charge.
[Hitung jumlah daya elektrik pada cas 7.00 μC.]

(5/100)

(b) Calculate the electric field at the position of the 2.00 μC charge due to the 7.00 μC and – 4.00 μC charges.
[Hitung medan elektrik pada posisi cas 2.00 μC disebabkan oleh cas 7.00 μC dan – 4.00 μC.]

(5/100)

(c) Use your answer to part (c) to determine the force on the 2.00 μC charge.
[Guna jawapan anda dalam (b) untuk menentukan daya ke atas cas 2.00 μC]

(3/100)

(d) Assume that all the three charges are now equal and positive. Sketch the field line in the plane of the charge and find the location of one point (other than ∞) where the electric field is zero.
[Anggapkan bahawa semua cas di atas mempunyai nilai yang sama dan positif. Lakarkan garis medan pada satah cas dan tentukan lokasi titik (selain dari ∞) di mana medan elektrik adalah sifar.]

(7/100)

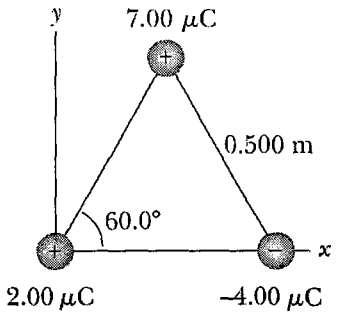

Figure 1 ***[Rajah 1]***

2. (a) State Gauss Law.
[Nyatakan Hukum Gauss]

(4/100)

(b) An insulating solid sphere of radius a has a uniform volume charge density ρ and carries a total positive charge Q as shown in Figure 2(a) and (b).
[Satu sfera rajah berpenebat mempunyai jejari r, ketumpatan cas isipadu ρ malar dan bercas Q positif seperti tertera dalam Rajah 2(a) dan (b).]

i) Calculate the magnitude of the electric field at a point outside the sphere.
[Hitungkan magnitud medan elektrik pada titik di luar sfera.]

(4/100)

ii) Find the magnitude of the electric field at a point inside the sphere
[Tentukan magnitud medan elektrik pada titik di dalam sfera.]

(6/100)

iii) Suppose the radial position $r = a$ is approached from inside the sphere and from outside. Do we obtain the same value of the electric field from both directions (Justify your answer with the aid of a diagram)?
[Andaikan posisi jejari r = a dihampiri dari dalam dan luar sfera. Adakah kita akan memperolehi nilai medan elektrik yang sama dari kedua-dua arah pergerakan.]

(4/100)

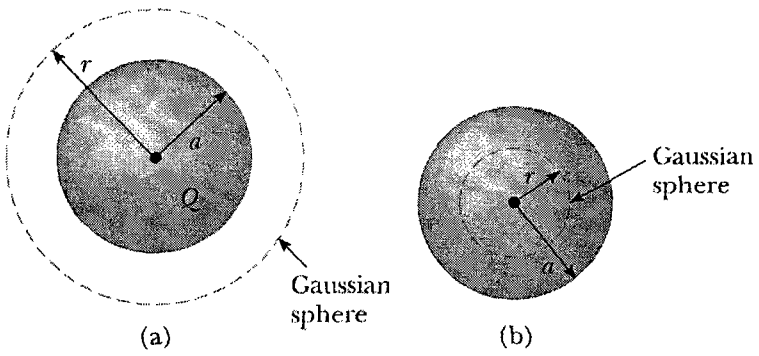

Figure 2 ***[Rajah 2]***

3. (a) Define capacitance.
[Beri tafsiran kapasitan]

(2/100)

(b) A spherical capacitor consists of a spherical conducting shell of radius b and charge $-Q$ concentric with a smaller conducting sphere of radius a and charge Q as shown in Figure 3. Find the capacitance of this device.
[Satu kapasitor sfera terdiri daripada luaran sfera berkonduksi jejari b dan cas –Q sepusat dengan sfera berkonduksi yang kecil jejari a dan cas Q seperti dalam Rajah 3. Tentukan nilai kapasitan peranti ini.]

(6/100)

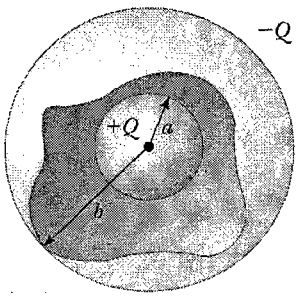

Figure 3 ***[Rajah3]***

(c) A group of capacitors are connected as shown in Figure 4, where C_1 = 5.00 μF, C_2 = 10.0 μF and C_3 = 2.00 μF.
[Sejumlah kapasitor disambung mengikuti rajah 4 di mana C_1 = 5.00 μF, C_2 = 10.0 μF dan C_3 = 2.00 μF.

i) Find the equivalent capacitance between points a and b.
[Tentukan kapasitan setara di antara titik a dan b]

(6/100)

ii) What charge is stored in C_3 if the potential difference between points a and b is 60.0 V?
[Berapakah cas yang terhimpun dalam C_3 jika beza keupayaan antara titik a dan b adalah 60.0 V?]

(6/100)

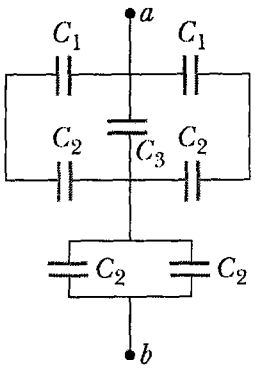

Figure 4 ***[Rajah 4]***

4. (a) State the TWO Kirchoff's rules and its mathematical representation.
[Nyatakan DUA petua Kirchoff dan sebutan matematiknya.]

(4/100)

(b) Figure 5 shows a network of resistors connected to two power supply.
[Rajah 5 menunjukkan jaringan perintang yang dihubungkan kepada dua pembekal kuasa.]

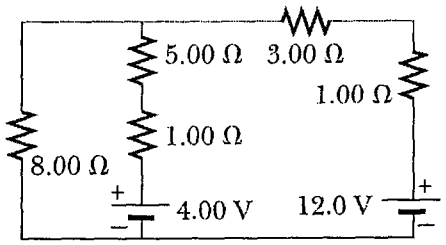

Figure 5 ***[Rajah5]***

i) Determine the current in each branch.
[Tentukan arus pada setiap cabang.]

(10/100)

ii) Show on diagram above the total number and the position of ammeters and voltmeters needed to measure every different current and potential difference.
[Lakarkan dalam rajah jumlah kedudukan ammeter dan voltmeter diperlukan untuk menyukat setiap arus dan beza upaya.]

(4/100)

.../6-

iii) The circuit is left connected for 2.00 minutes. Find the energy delivered by each battery.
[Litar dalam Rajah 5 dibiarkan berhubung selama 2 minit. Kirakan tenaga yang dibekalkan oleh setiap bateri.]

(2/100)

5. (a) A uniform magnetic field exerts a net force on a magnetic dipole. A strong magnet is placed under a horizontal conducting ring of radius r that carries current I as shown in Figure 6.
[Medan magnet yang sekata akan mengenakan daya pukal ke atas magnet dwikutub. Satu magnet kuat diletakkan di bawah gelung pengkonduksi melintang yang berjejari r dan membawa arus I seperti dalam Rajah 6.]

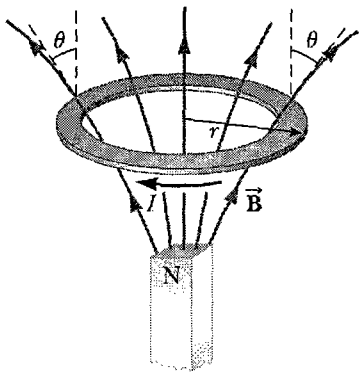

Figure 6 ***[Rajah 6]***

i) If the magnetic field $\vec{B}$ makes an angle θ with the vertical at the ring's location, what are the magnitude and direction of the resultant magnetic force on the ring?
[Jika medan magnet $\vec{B}$ berada pada sudut θ dengan menegak pada kedudukan gelung, apakah magnitud dan arah daya gabungan daya magnet ke atas gelung tersebut?]

(10/100)

(b) A Hall-effect probe operates with a 120 mA current. When the probe is placed in a uniform magnetic field of magnitude 0.080 T, it produces a Hall voltage of 0.700 μV.
[Penduga kesan Hall beroperasi dengan arus 120 mA. Apabila penduga tersebut diletak dalam medan magnet sekata bermagnitud 0.080 T, ia menghasilkan voltan Hall 0.700 μV.]

.../7-

i) When it is used to measure an unknown magnetic field, the Hall voltage is 0.330 μV. What is the magnitude of the unknown field?
[Apabila digunakan untuk menyukat medan magnet yang tidak diketahui, voltan Hall adalah 0.330 μV. Apakah magnitud medan tersebut?]

(5/100)

ii) The thickness of the probe in the direction of $\vec{B}$ is 2.00 mm. Find the density of the charge carriers, each of which has charge of magnitude *e*.
[Ketebalan penduga pada arah $\vec{B}$ adalah 2.00 mm. Tentukan ketumpatan pembawa cas yang setiap satu mempunyai cas bermagnitud e.

(5/100)

6. (a) State Faraday's and Lenz law.
[Nyatakan hukum Faraday's and Lenz.]

(4/100)

(b) A loop of wire in the shape of a rectangle of width *w* and length *l* and a long, straight wire carrying a current *I* lie on the tabletop a shown in Figure 7.
[Satu gelung wayar dalam bentuk segi empat tepat mempunyai lebar w dan lebar l. Satu wayar lurus membawa arus 1 berada disisinya seperti dalam Rajah 7.]

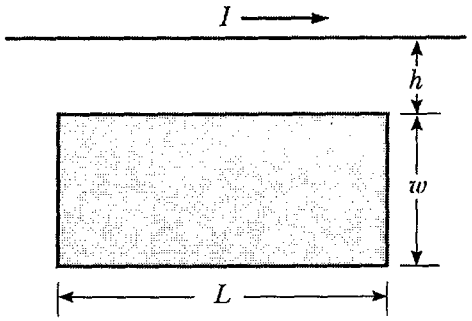

Figure 7 ***[Rajah 7]***

i) Determine the magnetic flux through the loop due to the current I
[Tentukan fluks kemagnetan merentasi gelung disebabkan oleh arus I .]

(8/100)

ii) Suppose the current is changing with time according to $I = a + bt$, where a and b are constants. Determine the emf that is induced in the loop if b = 10.0 A/s, h = 1.00 cm, w = 10.0 cm and L = 100 cm.
[Andaikan arus berubah mengikut masa, $I = a + bt$, dimana a dan b adalah malar. Tentukan bahawa dge yang teraruh dalam gelung jika b = 10.0 A/s, h = 1.00 cm, w = 10.0 cm dan L = 100 cm.]

(6/100)

iii) What is the direction of the induced current in the rectangle?
[Apakah arah arus yang teraruh dalam segi empat tepat?]

(2/100)

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