UNIVERSITI SAINS MALAYSIA

First Semester Examination

2014/2015 Academic Session

December 2014/January 2015

EEU 104 – *ELECTRICAL TECHNOLOGY*
[*TEKNOLOGI ELEKTRIK*]

Duration : 3 hours

[Masa : 3 jam]

Please check that this examination paper consists of **EIGHT (8)** pages printed material and **TWO (2)** pages of Appendix before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **LAPAN (8)** mukasurat bercetak beserta Lampiran **DUA (2)** muka surat bercetak sebelum anda memulakan peperiksaan ini.]*

Instructions: This question paper consists of of SIX (6) questions. Answer **FIVE (5)** questions. All questions carry the same marks.

[***Arahan:*** *Kertas soalan ini mengandungi ENAM (6) soalan. Jawab **LIMA (5)** soalan. Semua soalan membawa jumlah markah yang sama.]*

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]

1. (a) Calculate the current flowing into resistor 12kΩ in Figure 1.
Hitung nilai arus yang melalui perintang 12kΩ pada Rajah 1.

(50 marks/*markah*)

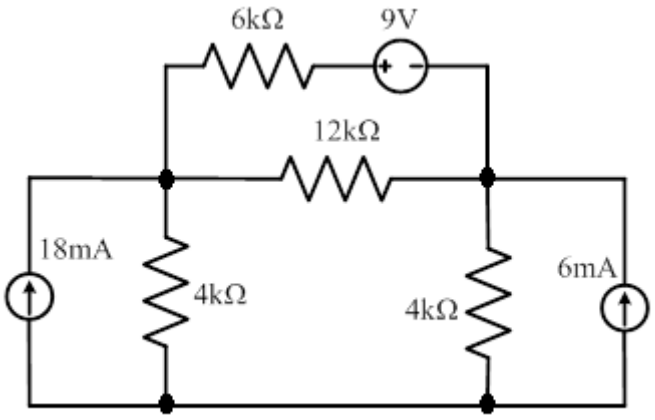

Figure 1
Rajah 1

(b) Verify the calculated current *i* in the above Question 1(a) by using the superposition theorem.
Sahkan nilai arus yang anda telah hitung dalam Soalan 1(a) di atas dengan menggunakan teorem superposisi.

(50 marks/*markah*)

2. (a) Referring to the circuit shown in Figure 2(a), show that the current $i(t)$ in the circuit is expressed as the equation below,

Merujuk kepada litar pada Rajah 2(a) di bawah, tunjukkan bahawa arus $i(t)$ *pada litar tersebut apabila* $t > 0$ *adalah seperti persamaan dibawah,*

$$i(t) = \frac{\mathrm{V_s}}{\mathrm{R}} + \left(I_o - \frac{\mathrm{V_s}}{\mathrm{R}}\right) e^{-t/\tau} \quad \text{(A)}$$

The variable I_o is the current in the circuit at time $\mathrm{t} = 0^-$ and τ is a time constant.

Pembolehubah I_o *adalah arus yang mengalir dalam litar pada ketika* $t = 0^-$ *dan* τ *adalah pemalar masa.*

(50 marks/*markah*)

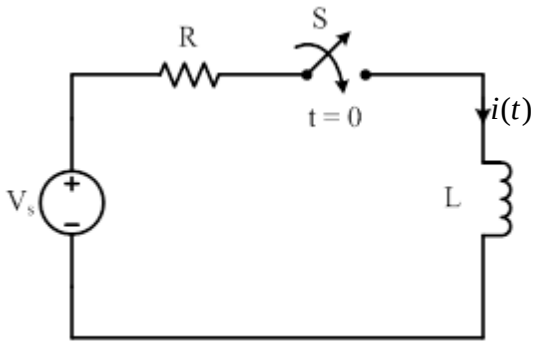

Figure 2(a)

Rajah 2(a)

(b) The circuit shown in Figure 2(b) is assumed already in steady-state condition prior to the switch *S* being CLOSE at time t =0s. Therefore, determine the voltage across resistor 4Ω in this circuit for time t > 0s and draw this voltage equation.

Litar pada Rajah 2(b) diandaikan telah sedia dalam keadaan mantap sebelum suis S di TUTUP pada masa t = 0s. Berikutan dengan itu, tentukan voltan yang merintangi perintang 4Ω dalam litar tersebut untuk masa t > 0s serta lakarkan persamaan voltan tersebut.

(50 marks/*markah*)

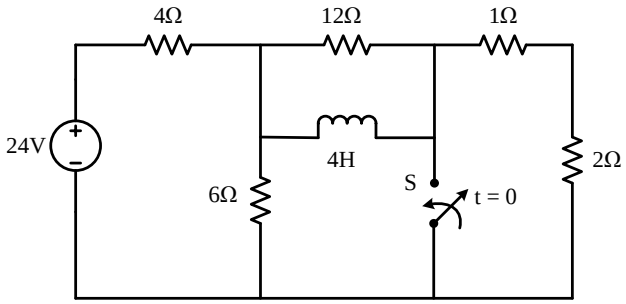

Figure 2(b)
Rajah 2(b)

3. (a) The switch in Figure 3(a) has been in position “a” for a long time, until t = 4 s when it is moved to position “b” and left there. Determine *v(t)* at t = 10 s.

Suis dalam Rajah 3(a) adalah pada kedudukan “a” bagi satu jangka masa yang lama, sehinggalah t = 4 s apabila ia berubah ke kedudukan “b” dan kekal di situ. Tentukan v(t) pada t = 10 s.

(50 marks/*markah*)

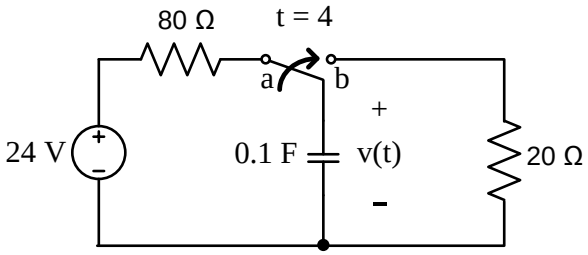

Figure 3(a)
Rajah 3(a)

(b) The switch in the circuit in Figure 3(b) has been closed for a long time. At t = 0, the switch is opened. Determine the value of $i(t)$ for t > 0.

Suis dalam litar Rajah 3(b) telah tutup bagi satu jangka masa yang lama. Pada t = 0, suis dibuka. Tentukan $i(t)$ bagi t > 0.

(50 marks/*markah*)

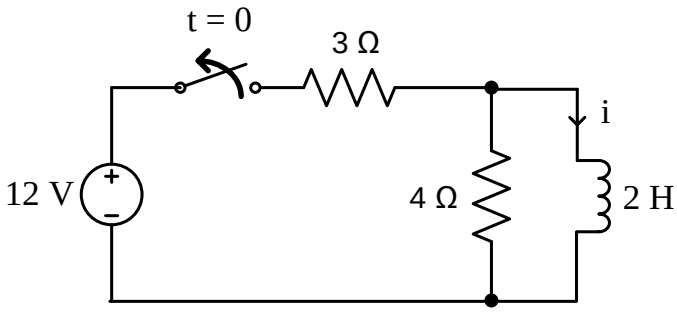

Figure 3(b)

Rajah 3(b)

4. (a) If V_s = 5 cos 2t V in the circuit of Figure 4(a), find V_o.

Jika V_s = 5 cos 2t V dalam litar Rajah 4(a), tentukan V_o.

(40 marks/*markah*)

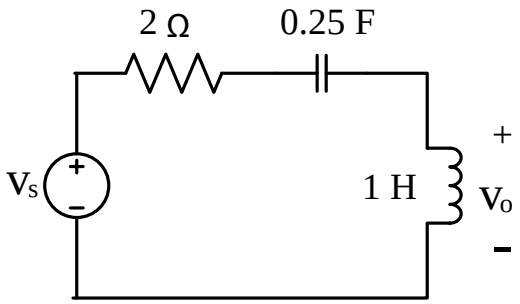

Figure 4(a)

Rajah 4(a)

(b) Find $i(t)$ in the circuit of Figure 4(b).

Tentukan $i(t)$ dalam litar Rajah 4(b).

(60 marks/*markah*)

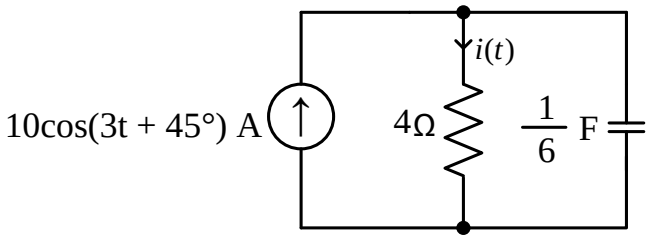

Figure 4(b)

Rajah 4(b)

5. (a) A 110-V rms, 60-Hz source is applied to a load impedance *Z*. The apparent power entering the load is 120 VA at a power factor of 0.707 lagging.

Suatu sumber 110-V rms, 60-Hz dikenakan kepada impedans beban Z. Kuasa nyata memasuki beban adalah 120 VA pada 6actor kuasa 0.707 ketinggalan.

i) Calculate the complex power.
Hitung kuasa kompleks.

(10 marks/*markah*)

ii) Find the rms current supplied to the load.
Cari arus rms yang dibekalkan ke beban.

(10 marks/*markah*)

iii) Determine Z.
Tentukan Z.

(10 marks/*markah*)

iv) Assuming that Z = R + jϖL, find the values of R and L.
Andaikan Z = R + jϖL, cari nilai R dan L.

(10 marks/*markah*)

(b) A regular household system of a single-phase three-wire allows the operation of both 120-V and 240-V, 60-Hz appliances. The household circuit is modeled as shown in Figure 5. Calculate:

Suatu sistem rumah kediaman biasa terdiri dari fasa-tunggal tiga-dawai yang membolehkan operasi peralatan pada kedua 120-V dan 240-V, 60-Hz. Model rumah tersebut ditunjukkan dalam Rajah 5. Hitungkan:

i) currents $\mathbf{I}_1$, $\mathbf{I}_2$, & $\mathbf{I}_n$,
arus-arus $\boldsymbol{I}_1$, $\boldsymbol{I}_2$, & $\boldsymbol{I}_n$

(40 marks/*markah*)

ii) the total complex power supplied,
jumlah kuasa kompleks dibekalkan

(15 marks/*markah*)

iii) the overall power factor of the circuit.
factor kuasa keseluruhan litar

(5 marks/*markah*)

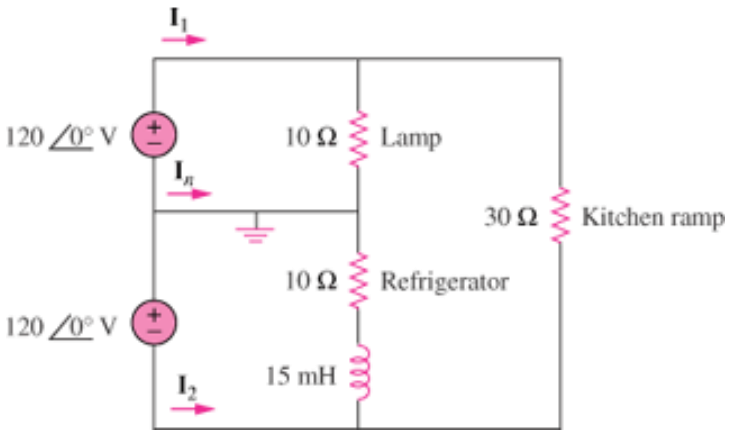

Figure 5
Rajah 5

6. (a) A small industry operates from 220 volts, 50 Hz supplied by the utility. The small industry represents a load to the utility that represents 22,000 watts and a power factor of 0.8. Develop the equivalent circuit for the load. Determine the value of a capacitor to correct the circuit to unity power factor.

Satu industri kecil beroperasi dari sumber utiliti 220 volt, 50 Hz. Industri kecil ini mewakili satu beban kepada utiliti bernilai 22, 000 watt dan faktor kuasa 0.8. Bangunkan litar setara bagi beban. Tentukan nilai kapasitor untuk membetulkan litar kepada faktor kuasa uniti.

(50 marks/*markah*)

(b) In the ideal autotransformer of Figure 6, calculate $\mathbf{I}_1$, $\mathbf{I}_2$, and $\mathbf{I}_o$. Find the average power delivered to the load.

Bagi autotransformer unggul dalam Rajah 6, hitungkan $\boldsymbol{I}_1$, $\boldsymbol{I}_2$, *dan* $\boldsymbol{I}_o$. *Carikan kuasa purata yang dibekalkan ke beban.*

(50 marks/*markah*)

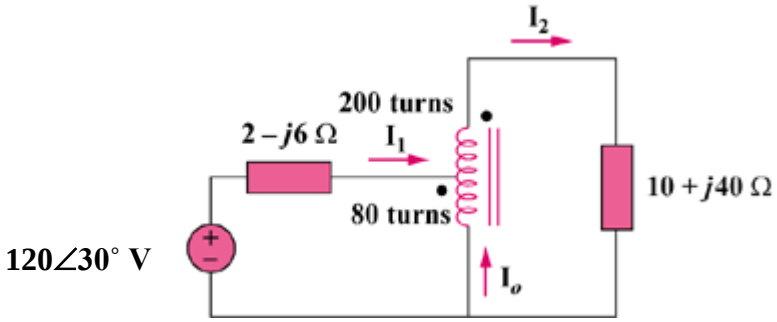

Figure 6

Rajah 6

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