UNIVERSITI SAINS MALAYSIA

First Semester Examination
2016/2017 Academic Session

December 2016 / January 2017

EEU 104/3 – ELECTRICAL TECHNOLOGY
[TEKNOLOGI ELEKTRIK]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of **THIRTEEN (13)** pages of printed material and **SIX (6)** pages of Appendices before you begin the examination. English version from page **TWO (2)** to page **SEVEN (7)** and Malay version from page **EIGHT (8)** to page **THIRTEEN (13)**.
*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **TIGA BELAS (13)** muka surat beserta **ENAM (6)** mukasurat lampiran bercetak sebelum anda memulakan peperiksaan ini. Versi Bahasa Inggeris daripada muka surat **DUA (2)** sehingga muka surat **TUJUH (7**) dan versi Bahasa Melayu daripada muka surat **LAPAN (8)** sehingga muka surat **TIGA BELAS (13)**.]*

Instructions: This question paper consists 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]*

Answer to any question must start on a new page.
[Mulakan jawapan anda untuk setiap soalan pada muka surat yang baharu].

"In the event of any discrepancies, the English version shall be used".
[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai].

ENGLISH VERSION :-

1. (a) Define in words the following basic terms in electrical and state the unit for each term (where necessary) :
   (i) Direct current (dc)
   (ii) Alternating current (ac)
   (iii) Voltage
   (iv) Power
   (v) Energy
   (vi) Independent source
   (vii) Dependent source
   (viii) Resistance
   (ix) Short circuit
   (x) Open circuit
   (xi) Branch
   (xii) Node
   (xiii) Loop

   (52 marks)

   (b) Define in words the following electrical basic laws:
   (i) Ohm's law
   (ii) Kirchhoff's current law (KCL)
   (iii) Kirchhoff's voltage law (KVL)

   (18 marks)

   (c) The total charge entering a terminal is given by :

   Calculate the current (in mA) at t = 0.5 s.

   (30 marks)

2. (a) For the circuit shown in Figure 2(a) :

   (i) State the elements that constitute a supernode.

   (5 marks)

   (ii) Determine the node voltages, V_1 and V_2 , using nodal analysis.

   (20 marks)

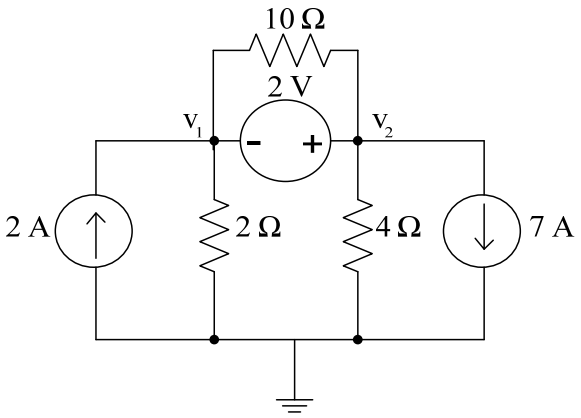

Figure 2(a)

(b) (i) State the elements that constitute a supermesh in the circuit in Figure 2(b).

(5 marks)

(ii) Use mesh analysis to determine i_1, i_2 and i_3 in Figure 2(b).

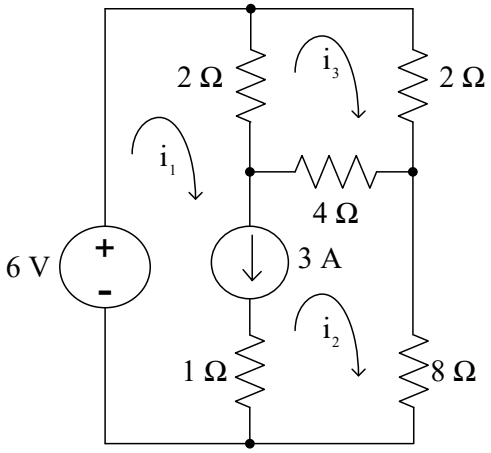

Figure 2(b)

(30 marks)

(c) Draw the Thevenin equivalent circuit for the circuit to the left of the terminals a-b as shown in Figure 2(c).

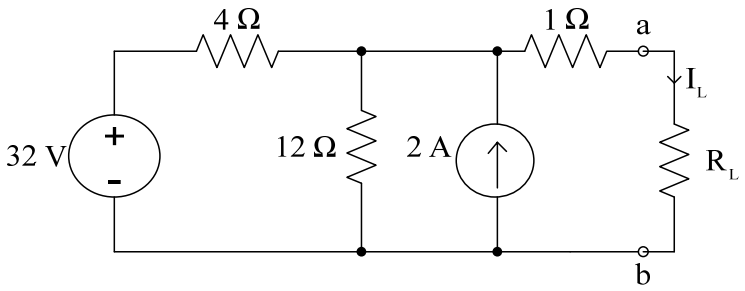

Figure 2(c)

(40 marks)

3. (a) In Figure 3(a), let $v_c(0)$ = 15 V. Find v_c, v_x and i_x for t > 0.

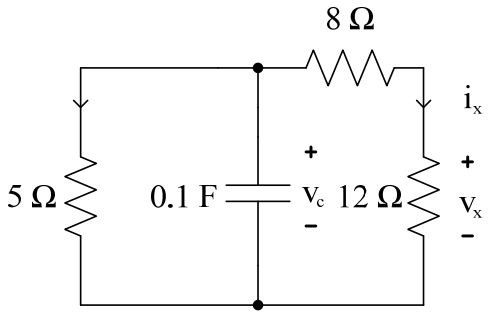

Figure 3(a)

(30 marks)

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

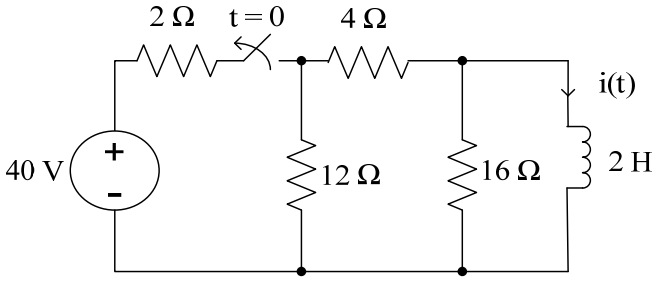

Figure 3(b)

(30 marks)

(c) The switch in Figure 3(c) has been in position A for a long time. At t = 0, the switch moves to B. Determine v(t) for t > 0.

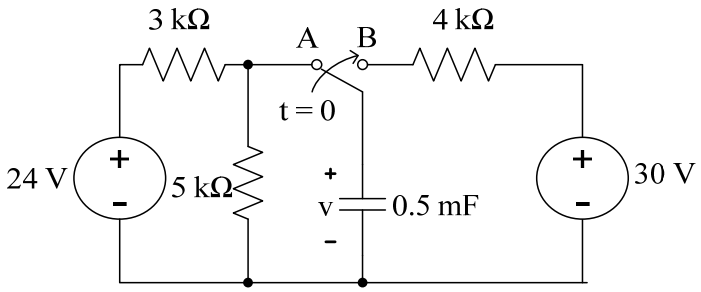

Figure 3(c)

(40 marks)

4. (a) For the circuit shown in Figure 4(a),

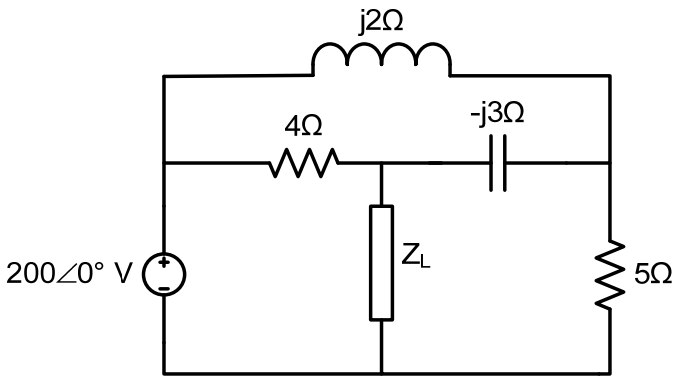

Figure 4(a)

(i) Determine the load impedance Z_L for maximum power transfer.

(40 marks)

(ii) Calculate the maximum power absorbed by the load.

(60 marks)

5.

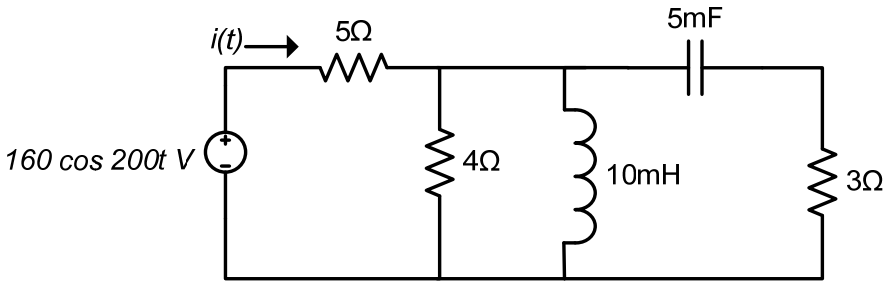

Figure 5

(a) Calculate *i(t)* in the circuit of Figure 5.

(50 marks)

(b) A 3-phase source delivers 4 kVA to a wye connected load with a phase voltage of 208 V and a power factor of 0.9 lagging. Calculate the source line current and the source line voltage.

(20 marks)

(c) A 4200-V, three phase transmission line has an impedance of 4 + jΩ per phase. If it supplies a load of 1 MVA at 0.75 power factor (lagging), find :-

(i) The complex power.
(ii) The power loss in the line.
(iii) The voltage at the sending end.

(30 marks)

6. (a) A 240 V / 2400-Vrms step-up ideal transformer delivers 50 kW to a resistive load. Calculate:

(i) The turns ratio.
(ii) The primary current.
(iii) The secondary current.

(20 marks)

(b) A 1200/240-Vrms transformer has impedance 60 $\angle$-30°Ω on the high-voltage side. If the transformer is connected to a 0.8 $\angle$10°Ω load on the low -voltage side, determine the primary and secondary currents when the transformer is connected to 1200 Vrms.

(40 marks)

(c) For the circuit in Figure 6(c),

(i) Determine the turns ratio, n, that will cause maximum average power transfer to the load.

(ii) Calculate that maximum average power.

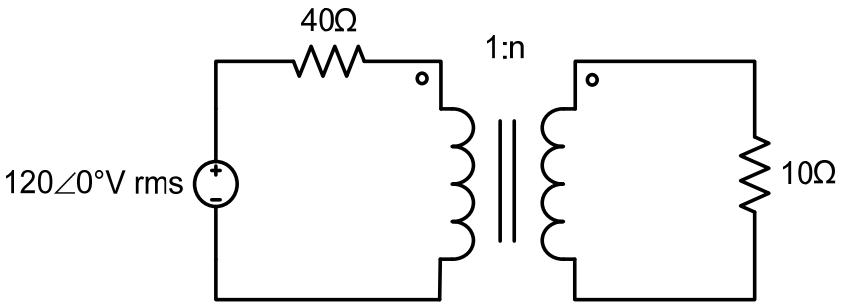

Figure 6(c)

(40 marks)

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VERSI BAHASA MELAYU :-

1. (a) Takrifkan dengan perkataan terma asas elektrikal yang berikut dan nyatakan unit bagi setiap terma (di mana perlu) :

(i) Arus terus (AT)
(ii) Arus ulang-alik (AU)
(iii) Voltan
(iv) Kuasa
(v) Tenaga
(vi) Punca tak bergantung
(vii) Punca bergantung
(viii) Rintangan
(ix) Litar pintas
(x) Litar buka
(xi) Cabang
(xii) Nod
(xiii) Gelung

(52 markah)

(b) Takrifkan dengan perkataan hukum asas elektrik yang berikut :

(i) Hukum Ohm
(ii) Hukum arus Kirchhoff (KCL)
(iii) Hukum voltan Kirchhoff (KVL)

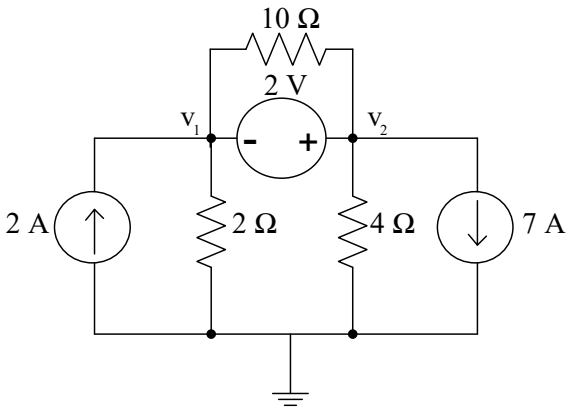
(18 markah)

(c) Jumlah cas memasuki terminal adalah berikut :

Kirakan arus (dalam mA) pada t = 0.5 s.

(30 markah)

2. (a) *Bagi litar yang ditunjukkan dalam Rajah 2(a) :*



Rajah 2(a)

(i) *Nyatakan elemen-elemen yang membentuk super nod.*

(5 markah)

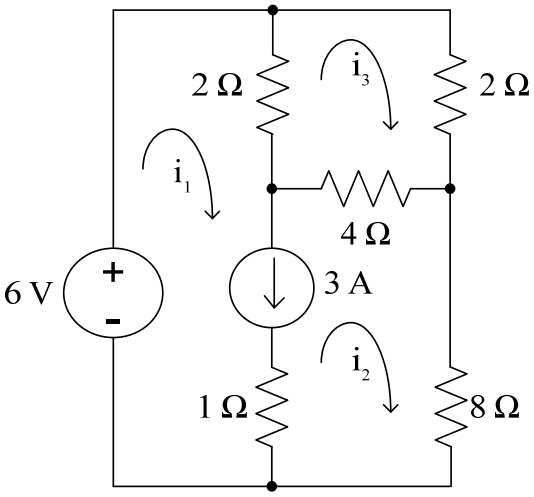
(ii) *Kirakan voltan nod, V_1 dan V_2 , menggunakan analisa nod.*

(20 markah)

(b) (i) *Nyatakan elemen-elemen yang membentuk super gelung bagi litar dalam Rajah 2(b).*

(5 markah)

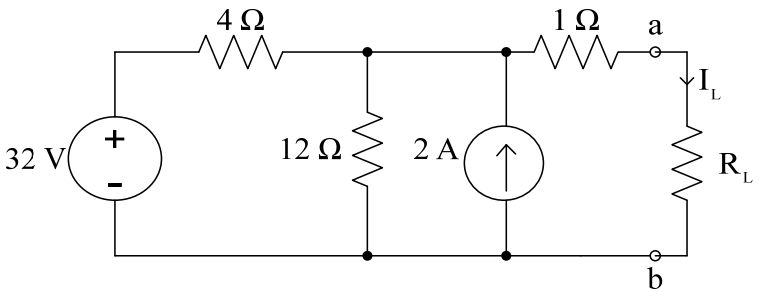
(ii) *Guna analisa gelung untuk mengira i_1 , i_2 dan i_3 dalam Rajah 2(b).*



Rajah 2(b)

(30 markah)

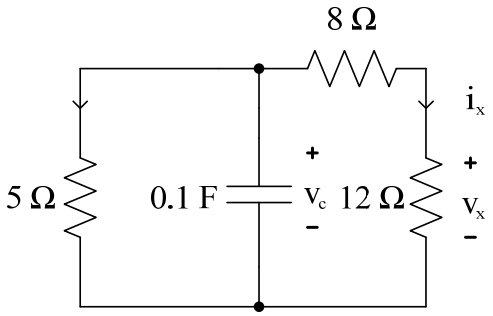
(c) *Lukis litar setara Thevenin bagi litar di sebelah kiri terminal a-b seperti yang ditunjukkan dalam Rajah 2(c).*



Rajah 2(c)

(40 markah)

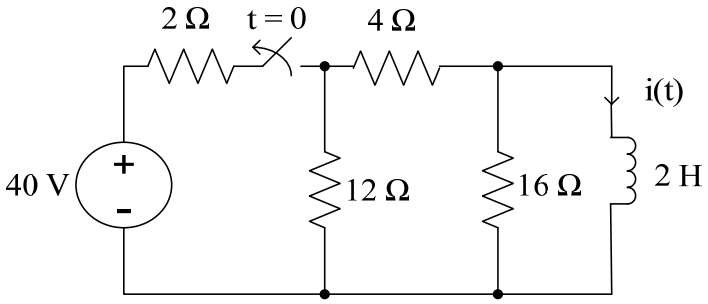
3. (a) *Dalam Rajah 3(a), biar $v_c(0) = 15$ V. Tentukan v_c, v_x dan i_x bagi $t > 0$.*



Rajah 3(a)

(30 markah)

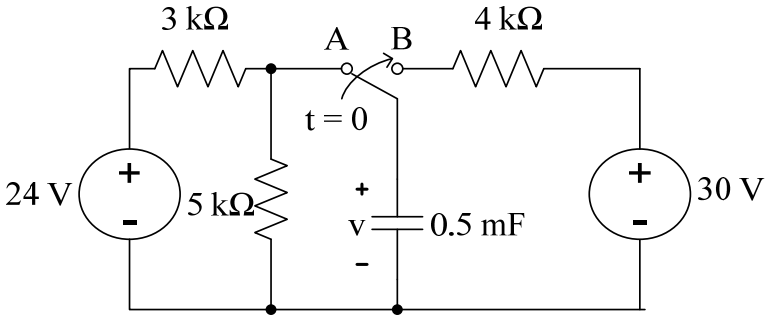
(b) *Suis dalam litar Rajah 3(b) telah tutup bagi satu jangka masa yang panjang. Pada t = 0, suis telah dibuka. Tentukan i(t) bagi $t > 0$.*



Rajah 3(b)

(30 markah)

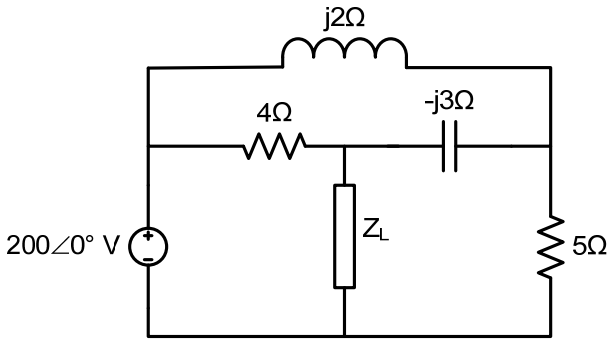
(c) *Suis dalam Rajah 3(c) telah berada di kedudukan A bagi satu jangka masa yang panjang. Pada t = 0, suis berubah ke B. Tentukan v(t) bagi t > 0.*



Rajah 3(c)

(40 markah)

4. *Bagi litar yang ditunjukkan dalam Rajah 4,*



Rajah 4

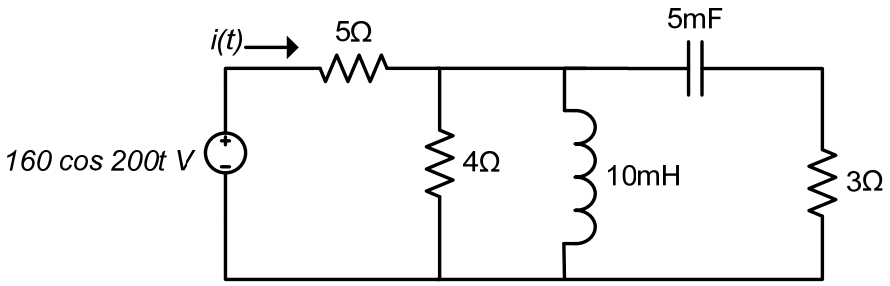
(i) *Tentukan impedans beban Z_L untuk pemindahan kuasa maksimum.*

(40 markah)

(ii) *Hitung kuasa maksimum yang diserap oleh beban tersebut.*

(60 markah)

5. (a) *Hitung i(t) di dalam litar Rajah 5(a).*



Rajah 5(a)

(50 markah)

(b) *Satu sumber 3 fasa menyampaikan 4 kVA kepada beban sambungan wye dengan voltan fasa 208 V and faktor kuasa 0.9 ketinggalan. Hitung arus talian sumber and voltan talian sumber.*

(20 markah)

(c) *Satu talian penghantaran 3 fasa mempunyai impedans sebanyak 4 + jΩ per fasa. Jika ia membekalkan beban sebanyak 1MVA pada factor kuasa ketinggalan 0.75, hitung:-*

(i) Kuasa kompleks.
(ii) Kehilangan kuasa dalam talian.
(iii) Voltan pada hujung hantaran.

(30 markah)

6. (a) *Sebuah pengubah ideal langkah naik 240 V / 2400-Vrms menyampaikan 50 kW kepada rintangan berbeban. Hitung:-*

(i) Nisbah belitan.
(ii) Arus primer.
(iii) Arus sekunder.

(20 markah)

(b) *Sebuah pengubah 1200/240-Vrms mempunyai impedans 60 ∠-30 °Ω pada voltan bahagian tinggi. Jika pengubah ini disambungkan kepada beban 0.8 ∠10 °Ω pada voltan bahagian rendah, tentukan arus primer dan arus sekunder apabila pengubah disambungkan kepada 1200 Vrms.*

(40 markah)

(c) Dalam litar di Rajah 6(c),

(i) Tentukan nisbah belitan, n, yang akan menyebabkan pemindahan kuasa purata yang maksimum kepada beban.

(ii) Kira kuasa purata maksimum.

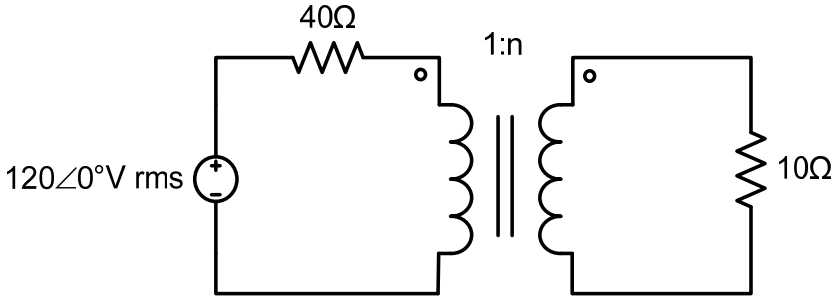


Figure 6(c)

(40 markah)

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