UNIVERSITI SAINS MALAYSIA

First Semester Examination
2013/2014 Academic Session

December 2013/January 2014

EEE 105 – CIRCUIT THEORY I
[TEORI LITAR I]

Duration : 3 hours
[Masa : 3 jam]

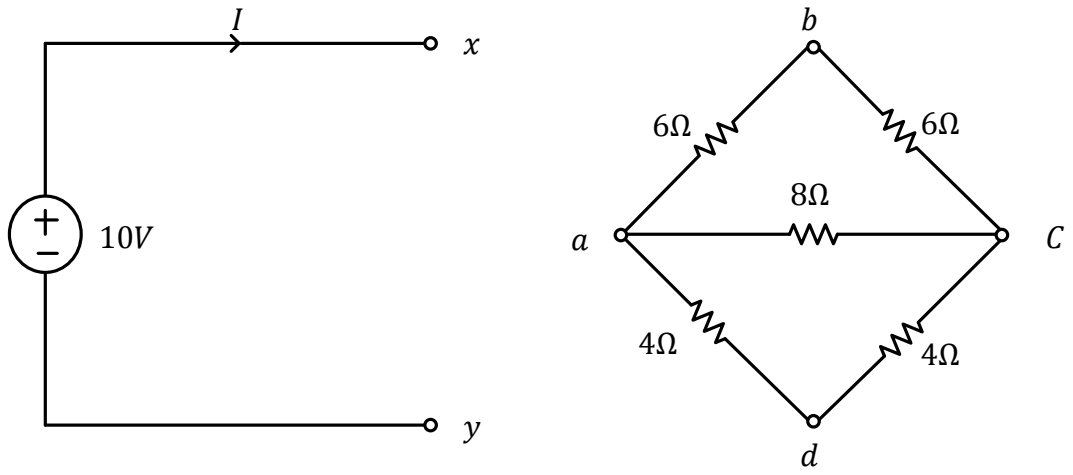
Please check that this examination paper consists of TEN (10) pages of printed material before you begin the examination.
[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEPULUH (10) mukasurat bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: This question paper consists of FIVE (5) questions. Answer **ALL** questions. All questions carry the same marks.
[***Arahan:*** *Kertas soalan ini mengandungi LIMA (5) soalan. Jawab* ***SEMUA*** *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) Anda diberikan dua bahagian untuk satu litar lengkap seperti yang ditunjukkan dalam Rajah 1(a). Bahagian A adalah untuk disambungkan kepada bahagian B. Sambungan manakah yang akan menghasilkan arus I yang lebih tinggi, sama ada di antara terminal $x - y$ dan $b - d$ atau terminal $x - y$ dan $a - c$? Buktikan jawapan anda.

You are given two parts of a complete circuit as shown in Figure 1(a). Part A is to be connected to part B. Which connection will produce higher current I, either between terminal $x - y$ and $b - d$ or terminal $x - y$ and $a - c$? Prove your answer.



Bahagian A
Part A

Bahagian B
Part B

Rajah 1(a)
Figure 1(a)

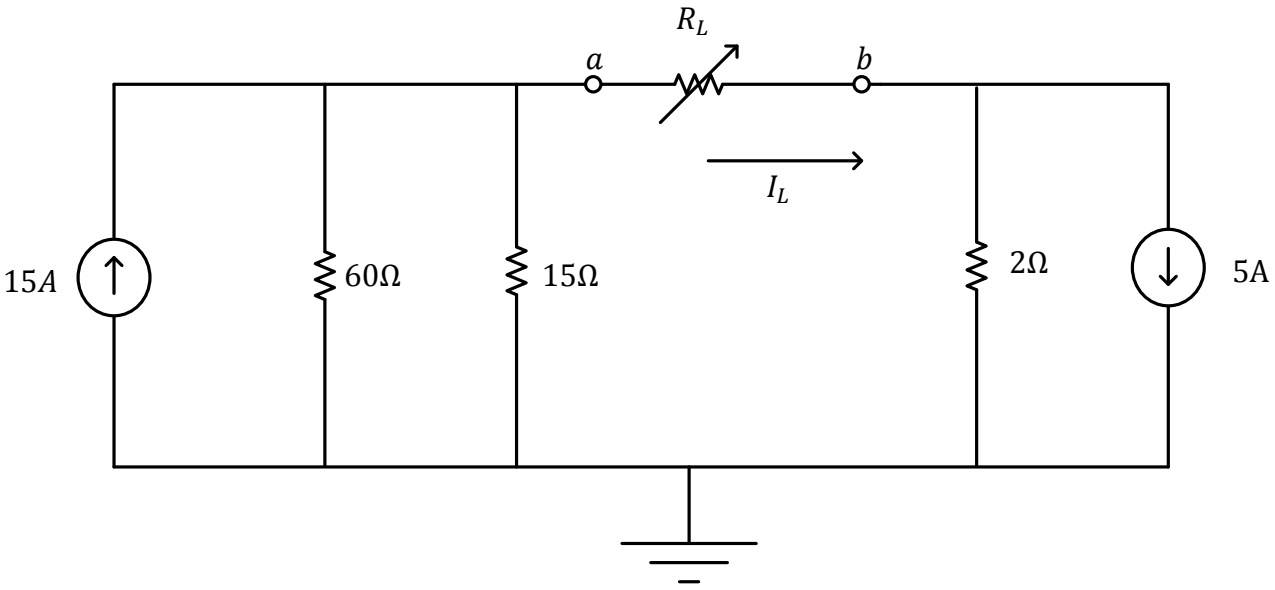
(50 markah/*marks*)

(b) Berdasarkan Rajah 1(b), dapatkan
Based on Figure 1(b), find

(i) Arus Norton I_N pada terminal $a-b$. Guna analisa jejaring.
Norton current I_N at terminal $a-b$. Use mesh analysis.

(ii) Rintangan setara Norton, R_N pada terminal $a-b$
Norton equivalent resistance, R_N at terminal $a-b$

(iii) Jika $R_L = 5\Omega$, cari I_L
If $R_L = 5\Omega$, find I_L

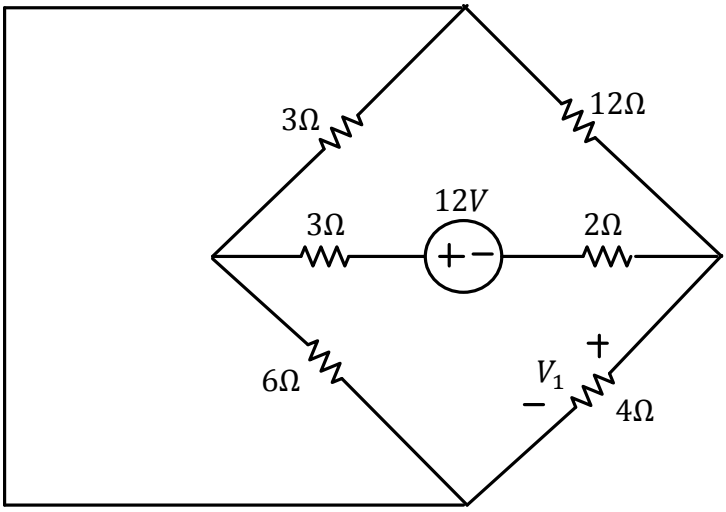


Rajah 1(b)
Figure 1(b)

(50 markah/*marks*)

2. (a) Dapatkan voltan V_1 untuk litar dalam Rajah 2(a) dengan hanya menggunakan konsep pembahagian arus atau voltan. (Jangan guna analisis nod atau jejaring)

Determine the voltage V_1 for the circuit in Figure 2(a) by only the use of current or voltage division concepts. (Do not use nodal or mesh analysis)



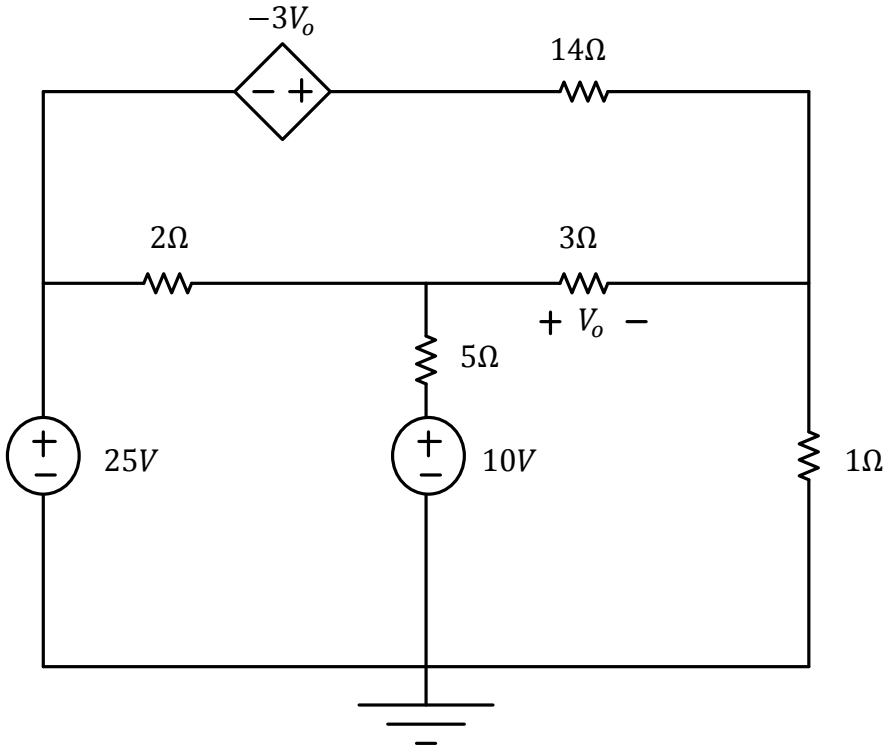
Rajah 2(a)

Figure 2(a)

(40 markah/*marks*)

(b) Dengan menggunakan analisis nod, dapakan voltan pada setiap nod dan kuasa yang dihantar ke sumber voltan bersandar dalam litar yang ditunjukkan dalam Rajah 2(b).

By using nodal analysis, determine the voltage at each node and the power delivered to the dependent voltage source in the circuit shown in Figure 2(b).



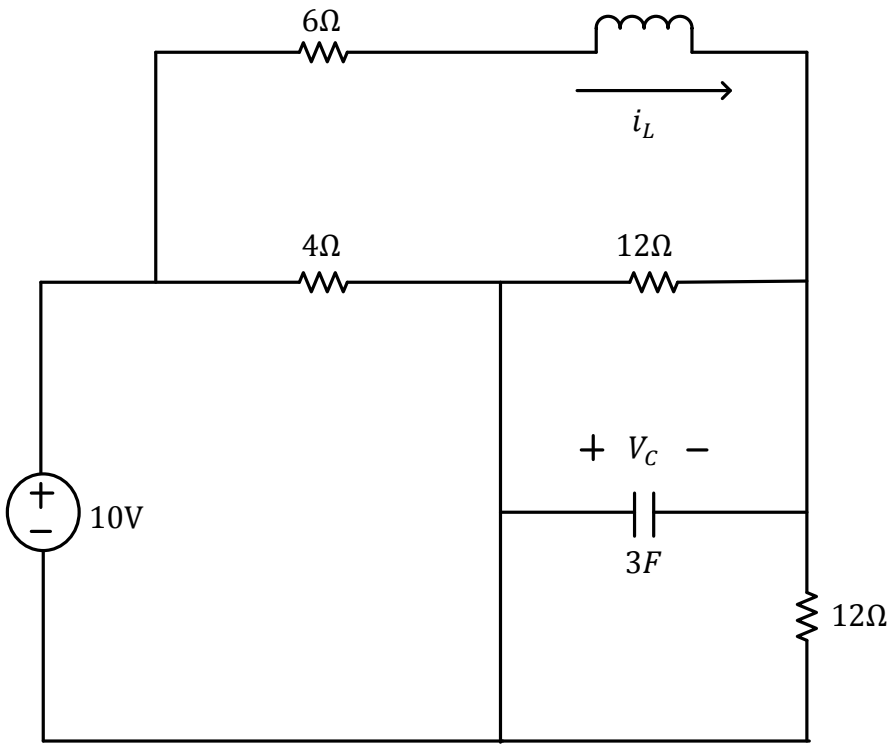
Rajah 2(b)

Figure 2(b)

(60 markah/*marks*)

3. (a) Dapatkan V_C, i_L dan tenaga yang disimpan di dalam kapasitor dan induktor untuk litar ditunjukkan pada Rajah 3(a) dibawah keadaan dc.

Determine V_C, i_L and the energy stored in the capacitor and inductor for circuit as shown in Figure 3(a) under dc conditions.



Rajah 3(a)

Figure 3(a)

(50 markah/*marks*)

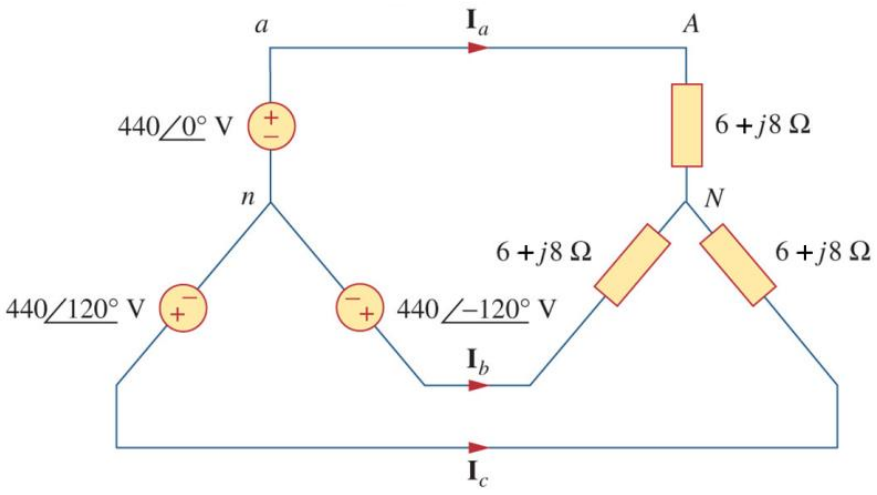
(b) Litar dalam Rajah 3(b) menunjukkan satu sumber voltan tiga-fasa sambungan-Y mengirimkan bekalan elektrik kepada beban seimbang tiga-fasa sambungan-Y.

The following circuit in Figure 3(b) shows a Y-connected three-phase voltage source supplying electricity to a balanced Y-connected three-phase load.

(i) Kirakan arus-arus fasa $\boldsymbol{I}_a$, I_b dan I_c
Calculate the phase currents $\boldsymbol{I}_a$, I_b *and* I_c

(ii) Kirakan kuasa sebenar ***P*** dan kuasa regangan ***Q*** yang diterima oleh setiap beban.

Calculate the real power ***P*** *and reactive power* ***Q*** *absorbed in each load.*



Rajah 3(b)
Figure 3(b)

(50 markah/*marks*)

4. (a) Kirakan persamaan kompleks berikut dan berikan jawapan anda dalam format segiempat.

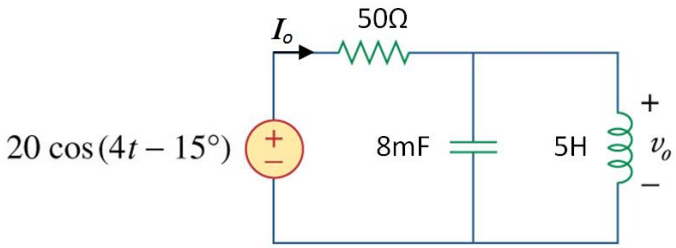
Evaluate the following complex number and give your answer in rectangular form.

$$\frac{2+j3}{1-j6}+\frac{7-j8}{-5+j11}$$

(25 markah/*marks*)

(b) Merujuk kepada Rajah 4(b), tukarkan litar domain masa berikut kepada litar setara domain pemfasa.

Referring to Figure 4(b), transform the following time-domain circuit into the equivalent phasor domain circuit.



Rajah 4(b)

Figure 4(b)

(25 markah/*marks*)

(c) Kirakan arus I_o dan berikan ia dalam domain masa.

Calculate the current I_o and express it in time domain.

(25 markah/*marks*)

(d) Kirakan voltan v_o dan berikan ia dalam domain masa.

Calculate the voltage v_o and express it in time domain.

(25 markah/*marks*)

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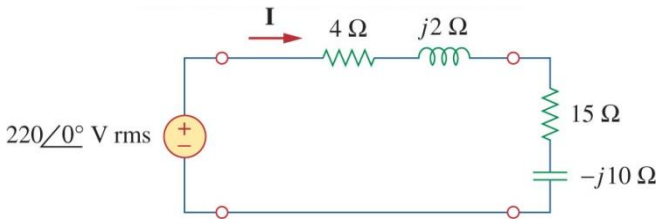
5. (a) Untuk litar di Rajah 5(a):
For the circuit in Figure 5(a):

(i) Kirakan arus ***I***
Calculate the current ***I***

(ii) Kirakan faktor kuasa bagi keseluruhan litar seperti dilihat oleh sumber voltan

Calculate the power factor of the entire circuit as seen by the voltage source

(50 markah/*marks*)



Rajah 5(a)
Figure 5(a)

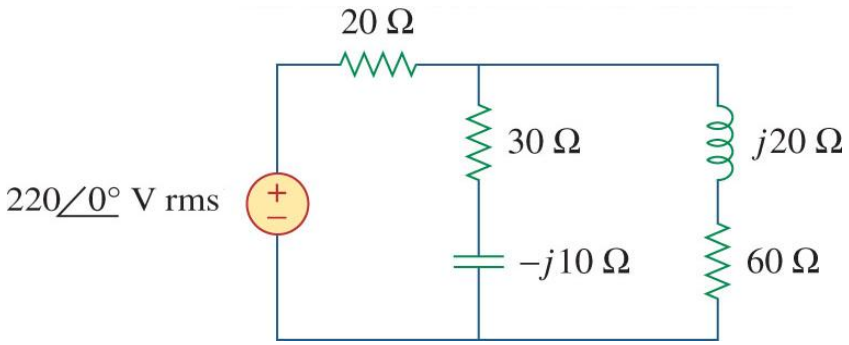
(b) Untuk litar di Rajah 5(b):

For the circuit in Figure 5(b):

(i) Kirakan kuasa sebenar ***P*** yang dihantar oleh sumber voltan
*Calculate the real power **P** delivered by the voltage source.*

(ii) Kirakan kuasa reaktif ***Q*** yang dihantar oleh sumber voltan
*Calculate the reactive power **Q** delivered by the voltage source*

(50 markah/*marks*)



Rajah 5(b)
Figure 5(b)

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