

Angka Giliran : _____

UNIVERSITI SAINS MALAYSIA

First Semester Examination
2016/2017 Academic Session

December 2016 / January 2017

EEE 105/3 – CIRCUIT THEORY 1 [TEORI LITAR 1]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of **TWELVE (12)** pages of printed material and **SIX (6)** pages of Appendix before you begin the examination. English version from page **TWO (2)** to page **SEVEN (7)** and Malay version from page **EIGHT (8)** to page **TWELVE (12)**.

*Sila pastikan bahawa kertas peperiksaan ini mengandungi **DUA BELAS (12)** muka surat bercetak beserta Lampiran **ENAM (6)** mukasurat 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 **DUA BELAS (12)**.*

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]*

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].

You are not allowed to bring this question paper out of the examination hall.

[Anda tidak dibenarkan membawa kertas soalan ini keluar daripada dewan peperiksaan].

ENGLISH VERSION :-

1. (a) Based on your knowledge about laws and theorems in electrical circuit, identify circuits shown in Figure 1(a)(i) and 1(a)(ii) (if any) which do not obey the laws and/or theorems. Explain your answer.

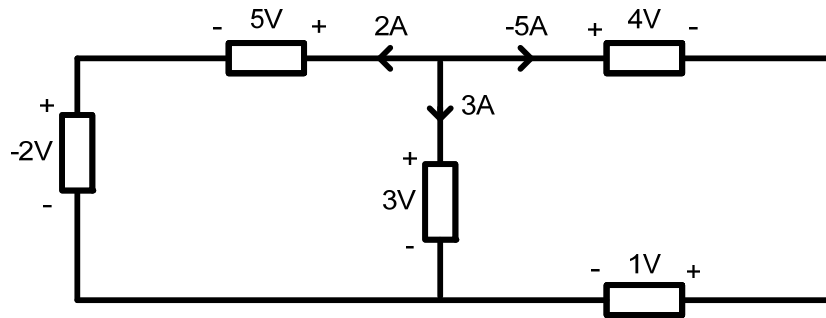


Figure 1(a)(i)

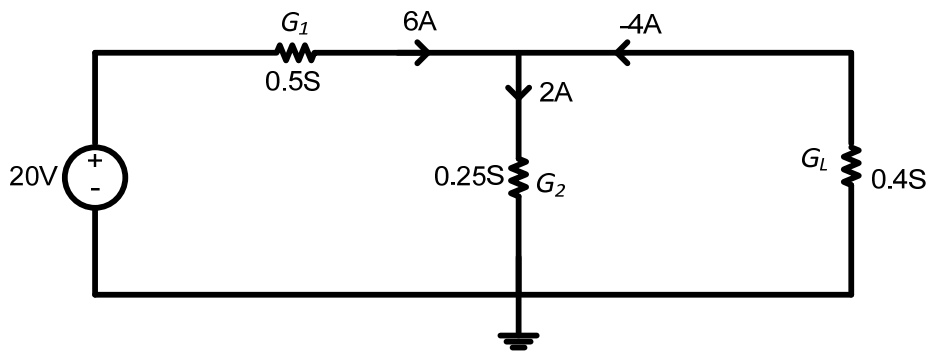


Figure 1(a)(ii)

(50 marks)

- (b) Answer the following question based on Figure 1(b).
- (i) By using **mesh analysis**, find V_x and all node voltages.
 - (ii) Then, find the power supplied by voltage source, 3V.

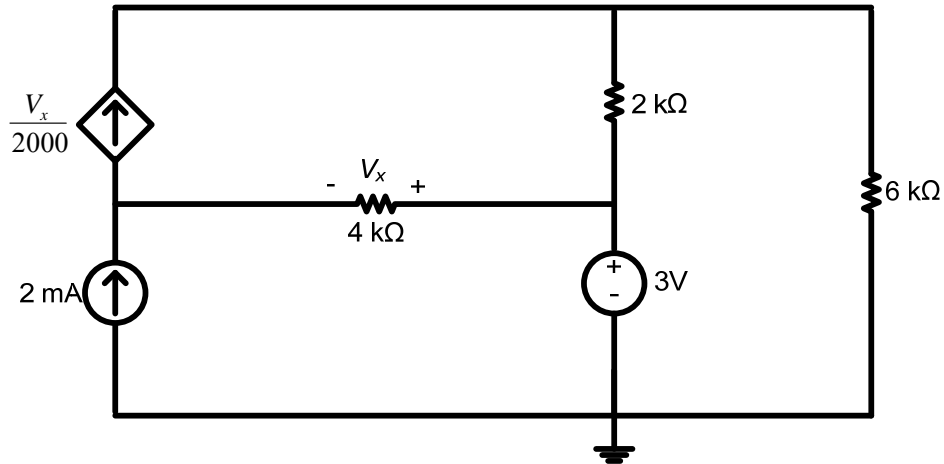


Figure 1(b)

(50 marks)

2. (a) By using **nodal analysis**, find V_x and V_y in the circuit shown in Figure 2(a).

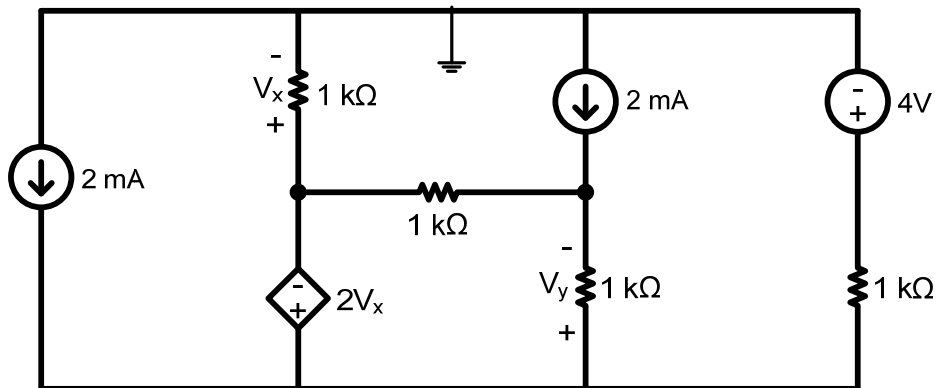


Figure 2(a)

(50 marks)

(b) Answer the following question based on Figure 2(b).

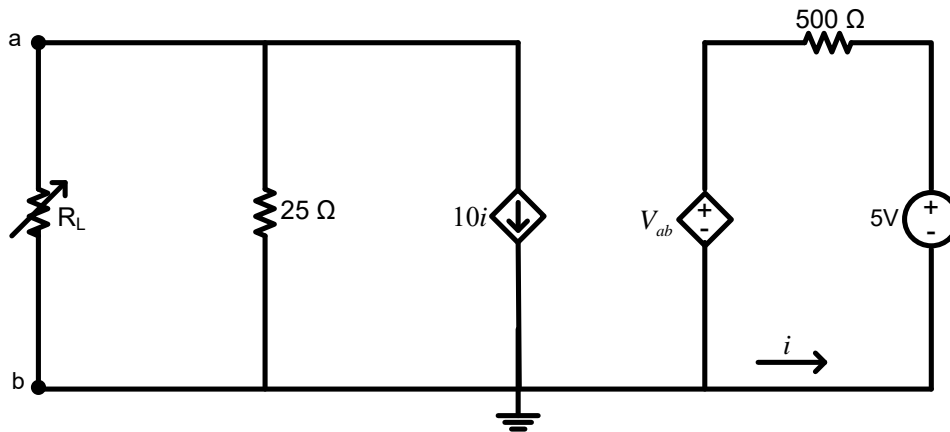


Figure 2(b)

- (i) By using **Thevenin Theorem**, find Thevenin voltage, V_{TH} at terminal a-b.
- (ii) By using **Norton Theorem**, find Norton current, I_N at terminal a-b.
- (iii) From (i) and (ii), find Thevenin resistance, R_{TH} at terminal a-b.
- (iv) Sketch the Norton equivalent circuit.

(50 marks)

3. (a) The current flows through an initially uncharged 4 capacitor is shown in Figure 3(a). Find the equation for voltage across the capacitor. Then, find the equation for the power absorbed by the capacitor.

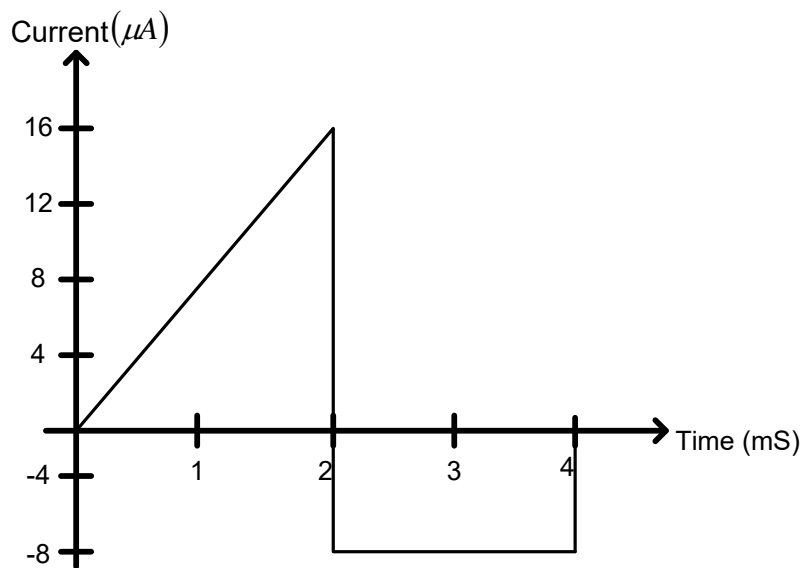


Figure 3(a)

(50 marks)

- (b) (i) The voltage $v = 12 \cos(60t + 45^\circ)$ is applied to a 0.1 H inductor. Find steady-state current, $i(t)$, through the inductor. (15 marks)
- (ii) If voltage $v = 6 \cos(100t - 30^\circ)$ is applied to a 50 μF capacitor, calculate the current through the capacitor. (15 marks)
- (iii) Find $i(t)$ in the circuit shown in Figure 3(b).

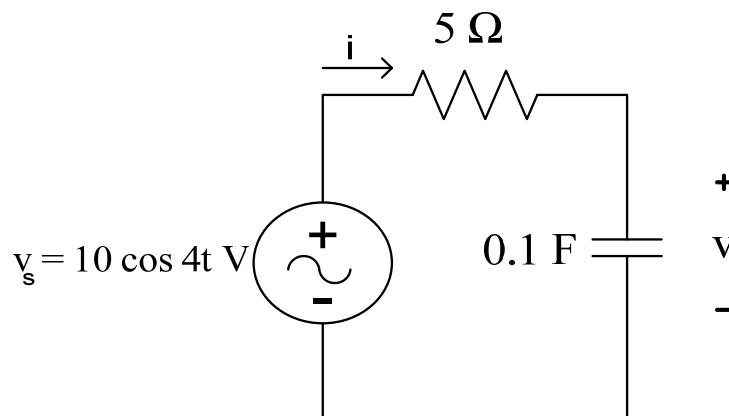


Figure 3(b)

(20 marks)

4. (a) The switch in the circuit in Figure 4(a) has been closed for a long time, and it is opened at $t=0$.
- (i) Find $v(t)$ for $t > 0$.
- (ii) Calculate the initial energy stored in the capacitor.

(40 marks)

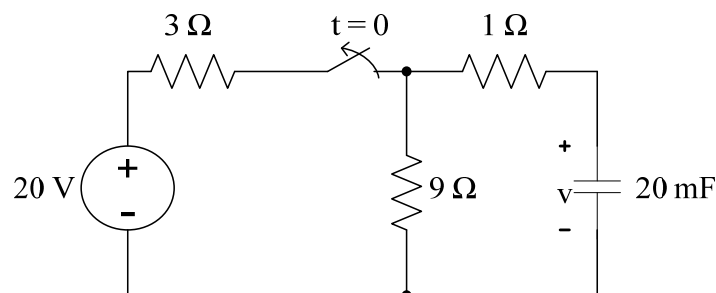


Figure 4(a)

- (b) In the circuit shown in Figure 4(b), find i_o , v_o , and i for all time, assuming that the switch was open for a long time for .

(60 marks)

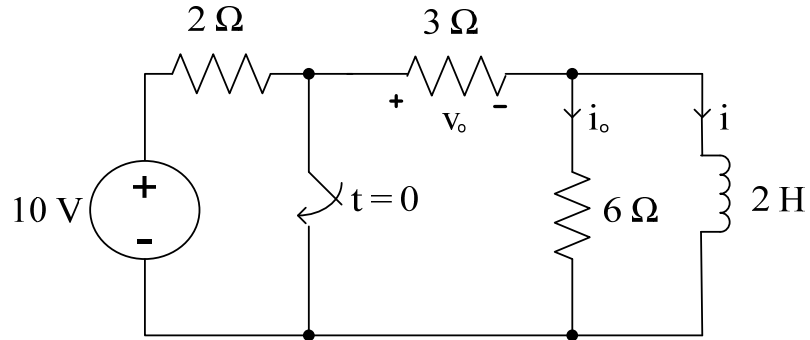


Figure 4(b)

5. (a) Determine and draw the Thevenin equivalent circuit for the circuit shown in Figure 5(a) as seen from terminals a-b.

(55 marks)

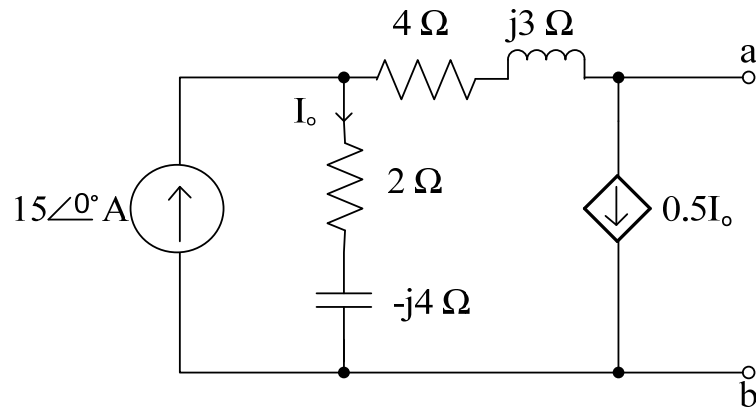


Figure 5(a)

- (b) Determine V_x in the circuit of Figure 5(b) using the method of source transformation.

(45 marks)

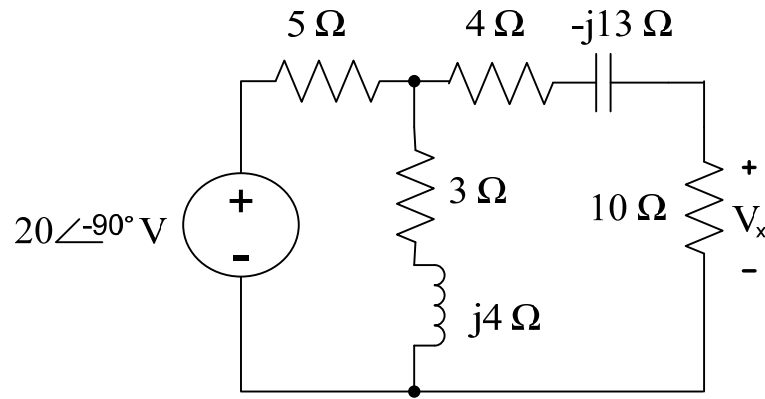
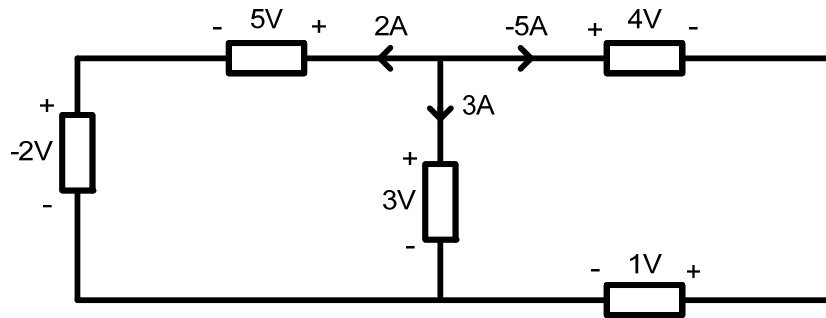


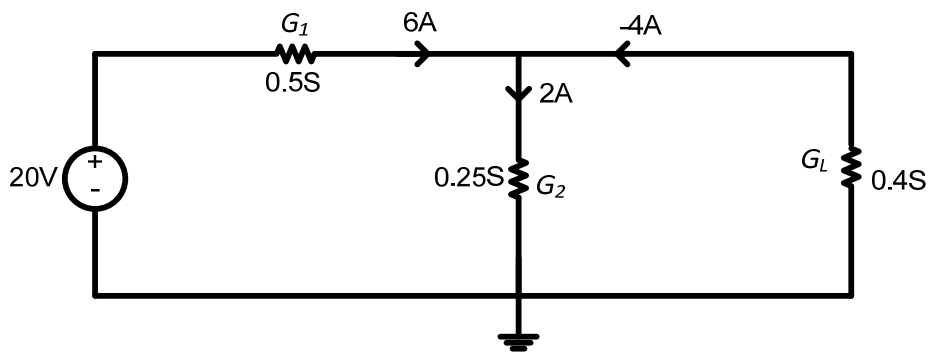
Figure 5(b)

VERSI BAHASA MELAYU :-

1. (a) Berdasarkan pengetahuan berkaitan hukum dan teorem dalam litar elektrik, kenalpasti litar yang ditunjukkan dalam Rajah 1(a)(i) dan 1(a)(ii) (jika ada) yang tidak mematuhi hukum dan/atau teorem tertentu. Jelaskan jawapan anda.



Rajah 1(a)(i)



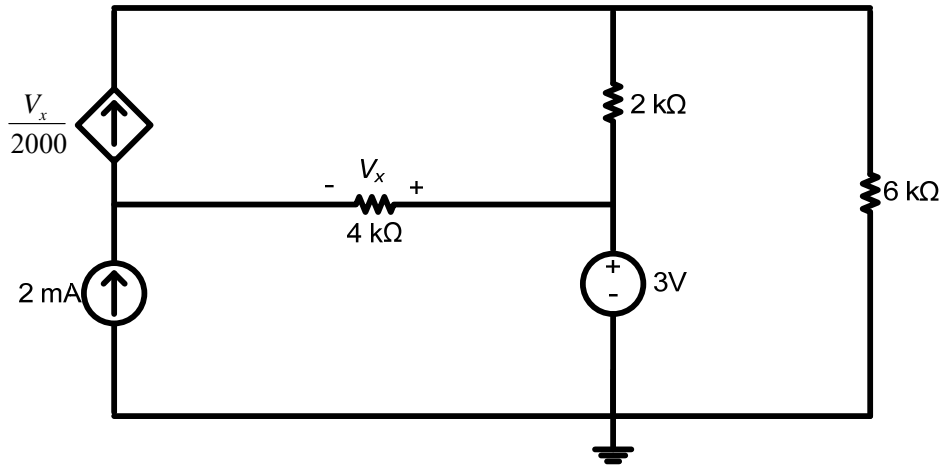
Rajah 1(a)(ii)

(50 markah)

(b) Jawab soalan-soalan berikut berdasarkan Rajah 1(b).

(i) Dengan menggunakan **analisa jaring**, dapatkan V_x dan semua voltan nod.

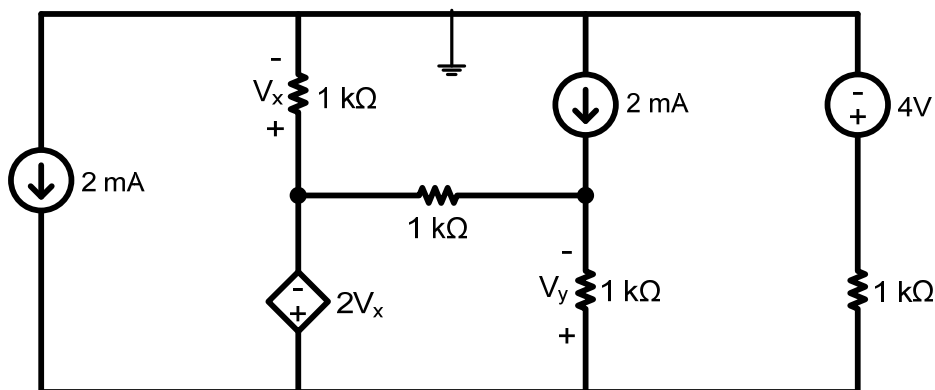
(ii) Kemudian, dapatkan kuasa yang dijana oleh sumber voltan, 3V.



Rajah 1(b)

(50 markah)

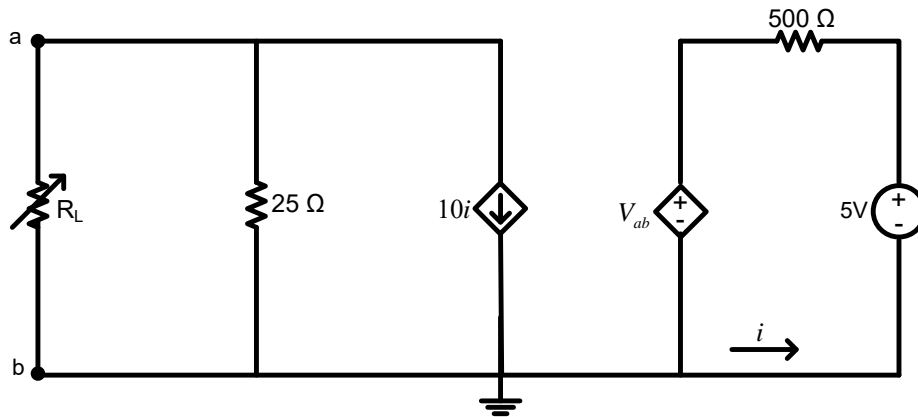
2. (a) Dengan menggunakan **analisa nod**, dapatkan V_x dan V_y dalam litar yang ditunjukkan dalam Rajah 2(a).



Rajah 2(a)

(50 markah)

(b) Jawab soalan-soalan berikut berdasarkan berdasarkan Rajah 2(b).

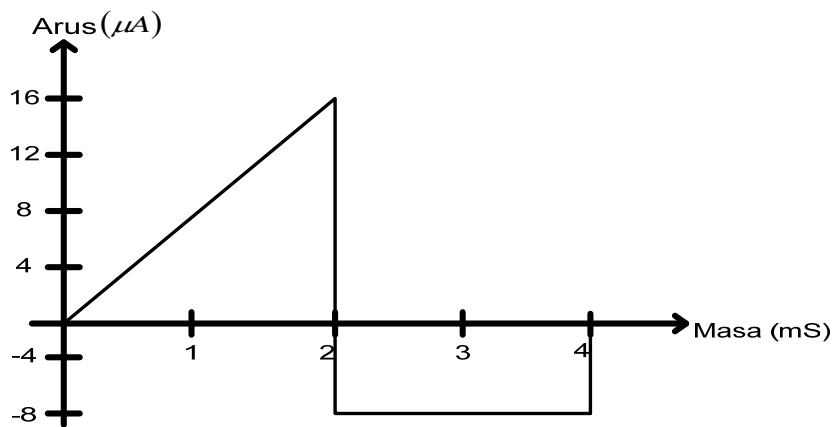


Rajah 2(b)

- (i) Dengan menggunakan **Teorem Thevenin**, dapatkan voltan Thevenin, V_{TH} pada terminal a-b.
- (ii) Dengan menggunakan **Teorem Norton**, dapatkan arus Norton, I_N pada terminal a-b.
- (iii) Daripada (i) dan (ii), dapatkan rintangan Thevenin, R_{TH} pada terminal a-b.
- (iv) Lakarkan litar setara Norton.

(50 markah)

3. (a) Arus yang mengalir melalui satu 4 kapasitor yang tidak dicas pada asalnya ditunjukkan dalam Rajah 3(a). Dapatkan persamaan untuk voltan merentasi kapasitor tersebut. Kemudian, dapatkan persamaan untuk kuasa yang diserap oleh kapasitor tersebut.



Rajah 3(a)

(50 markah)

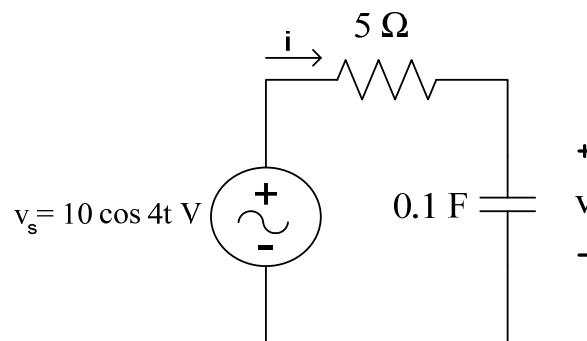
- (b) (i) Voltan, $v = 12 \cos (60t + 45^\circ)$, dikenakan kepada induktor 0.1 H . Tentukan arus keadaan mantap, $i(t)$, yang mengalir melalui induktor tersebut.

(15 markah)

- (ii) Jika voltan, $v = 6 \cos (100t - 30^\circ)$, dikenakan kepada satu kapasitor $50 \mu\text{F}$, kirakan arus melalui kapasitor.

(15 markah)

- (iii) Tentukan arus $i(t)$ dalam litar yang ditunjukkan dalam Rajah 3(b).



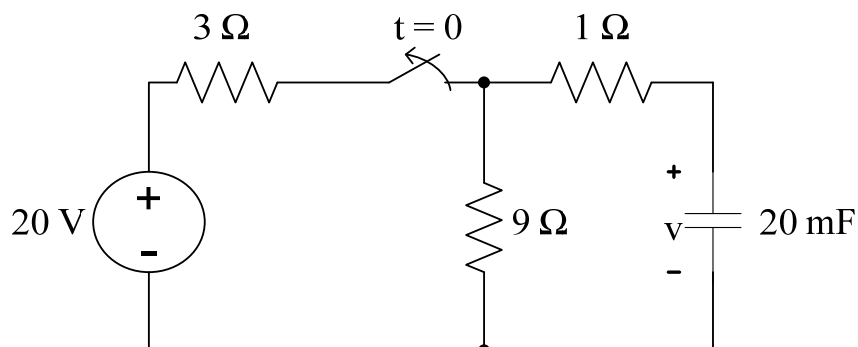
Rajah 3(b)

(20 markah)

4. (a) Suis dalam litar yang ditunjukkan oleh Rajah 4(a) telah tertutup bagi jangka masa yang panjang, dan dibuka pada $t=0$.

- (i) Tentukan $v(t)$ bagi $t > 0$.
- (ii) Kirakan tenaga awal yang disimpan dalam kapasitor.

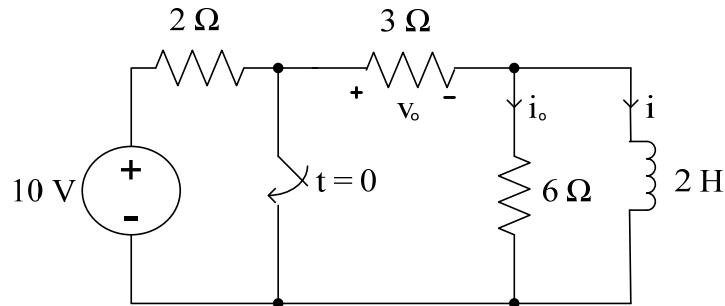
(40 markah)



Rajah 4(a)

- (b) Bagi litar dalam Rajah 4(b), tentukan i_o , v_o , dan i bagi semua masa, dengan anggapan bahawa suis adalah terbuka bagi jangka masa yang lama untuk .

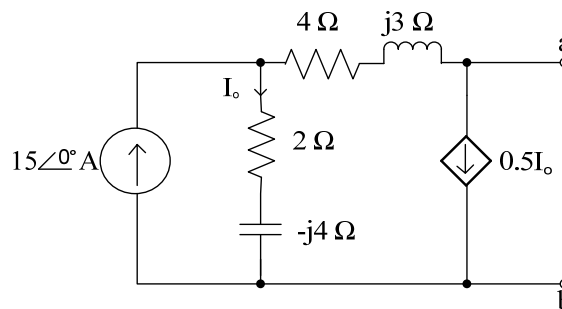
(60 markah)



Rajah 4(b)

5. (a) Tentukan dan lukis litar setara Thevenin bagi litar yang ditunjukkan dalam Rajah 5(a) yang dilihat pada terminal a-b.

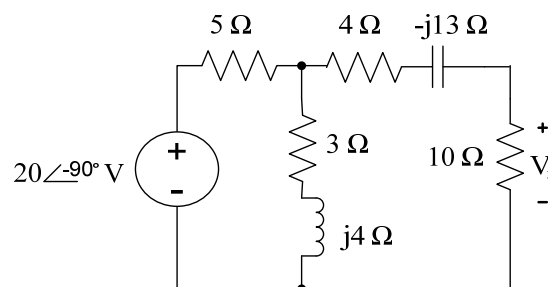
(55 markah)



Rajah 5(a)

- (b) Tentukan V_x dalam litar yang ditunjukkan oleh Rajah 5(b) menggunakan kaedah penjelmaan punca.

(45 markah)



Rajah 5(b)

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