



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023**

COURSE NAME : CIRCUIT THEORY
COURSE CODE : DAE11103
PROGRAMME CODE : DAE
EXAMINATION DATE : FEBRUARY 2023
DURATION : 3 HOURS
INSTRUCTION : 1. ANSWER ALL QUESTIONS.
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY OTHER EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

- Q1** (a) **Table Q1 (a)** shows the current through and the voltage across a device from 0 to 4s. Prove that the total energy absorbed by the device is 916.67 mJ. (10 marks)
- (b) Identify all Kirchhoff's current law (KCL) equations for the circuit in **Figure Q1 (b)**. (5 marks)
- (c) By referring to **Figure Q1 (c)**, determine:
- (i) Currents I and I_6 . (4 marks)
- (ii) Voltages V_1 and V_5 . (4 marks)
- (iii) Power delivered to the 3 k Ω resistor. (2 marks)
- Q2** (a) Find voltage V_a in **Figure Q2 (a)** by using nodal analysis. (12 marks)
- (b) Find current I_x in **Figure Q2 (b)**. Hint: use supernode analysis. (7 marks)
- (c) By applying Thevenin's theorem, calculate the R_{TH} and V_{TH} for circuit in **Figure Q2 (c)**. (6 marks)
- Q3** (a) Find the equivalent capacitance between terminals x and y for **Figure Q3 (a)**. (5 marks)
- (b) By referring to **Figure Q3 (b)**, determine i_0 for $t > 0$. (10 marks)
- (c) Find the amplitude, phase, period and frequency of the sinusoidal voltage.
- $$v(t) = 12 \cos(50t + 10^\circ)$$
- (5 marks)
- (d) Calculate the instantaneous voltage across a 2 μ F capacitor when the current through it is
- $$i = 4 \sin(10^6 t + 25^\circ) \text{ A}$$
- (5 marks)

Q4. (a) Given current source in a linear circuit, $i_s = 15 \cos(25\pi t + 25^\circ)$ A. Determine:

- (i) Amplitude of the current. (1 mark)
- (ii) Angular frequency. (2 marks)
- (iii) Frequency of the current. (2 marks)
- (iv) Current i_s at $t = 2$ ms. (5 marks)

(b) Calculate the complex numbers below and express results in rectangular form.

$$\frac{60 \angle 45^\circ}{7.5 - j10} + j2$$

(5 marks)

(c) By referring to **Figure Q4 (c)**, determine:

- (i) Total impedance Z_T . (4 marks)
- (ii) Voltage V_2 . (2 marks)
- (iii) Current I_L . (2 marks)
- (iv) Power factor (Fp) of the network. (2 marks)

- END OF QUESTIONS -

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Table Q1 (a)

$t(s)$	$i(mA)$	$v(V)$
0	0	0
1	25	10
2	50	10
3	25	10
4	0	0

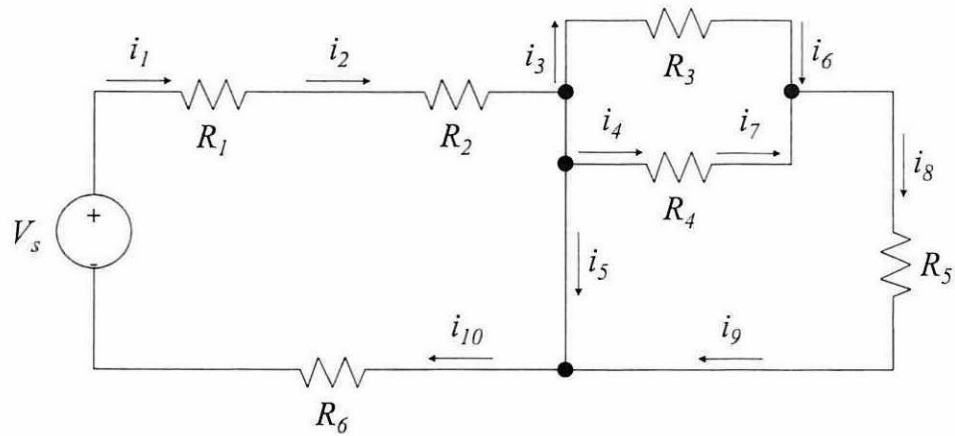


Figure Q1 (b)

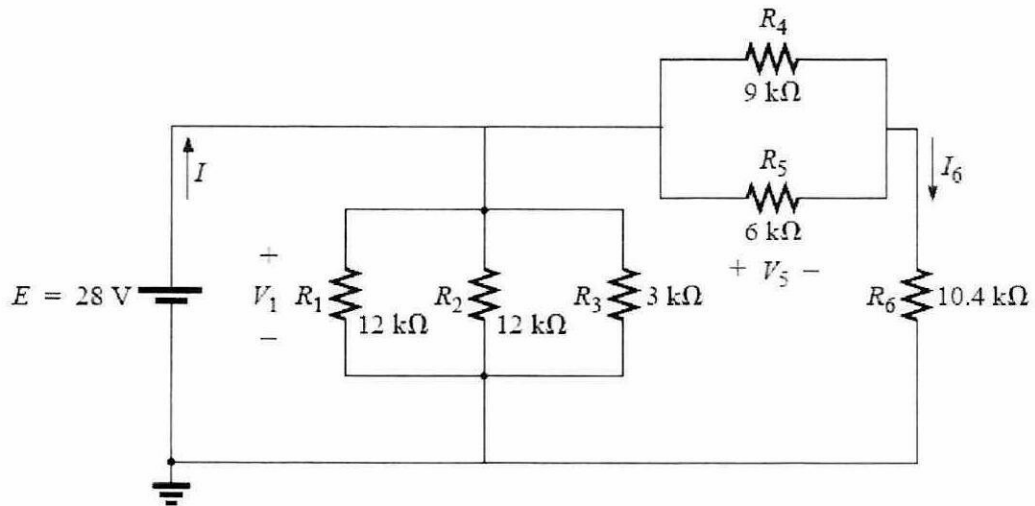


Figure Q1 (c)

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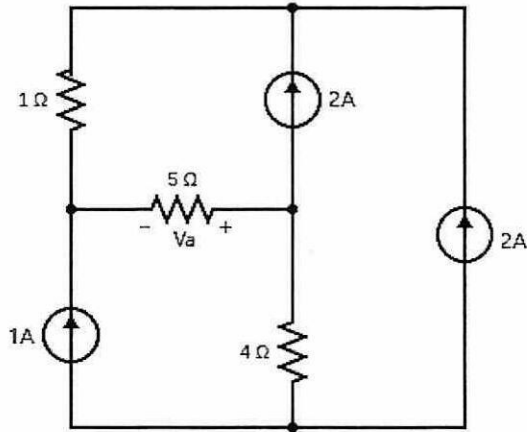


Figure Q2 (a)

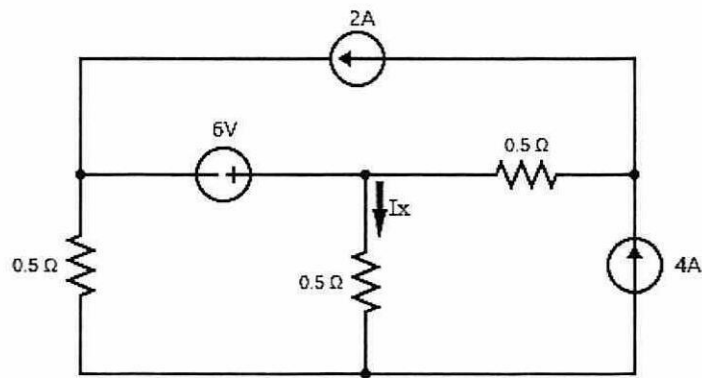


Figure Q2 (b)

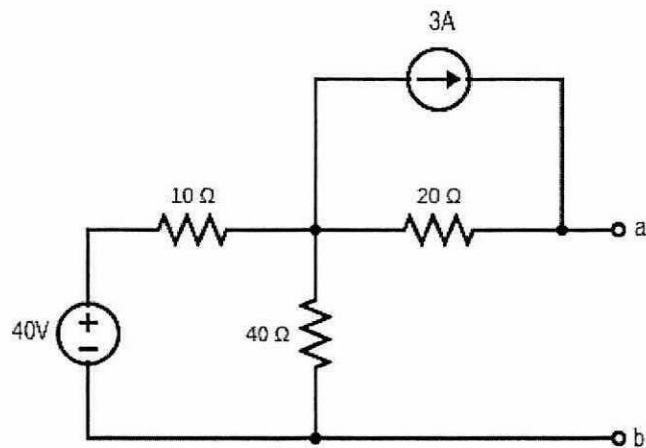


Figure Q2 (c)

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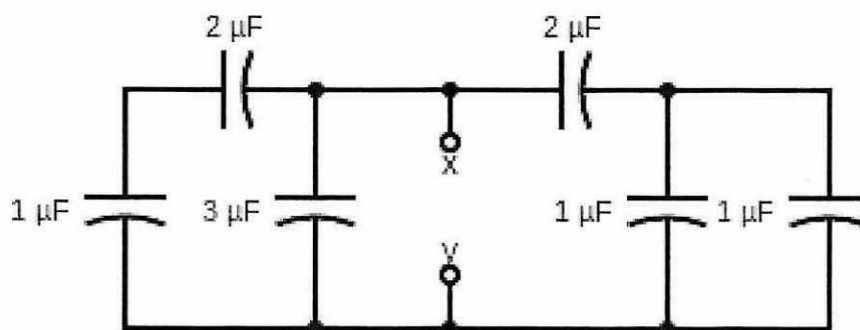


Figure Q3 (a)

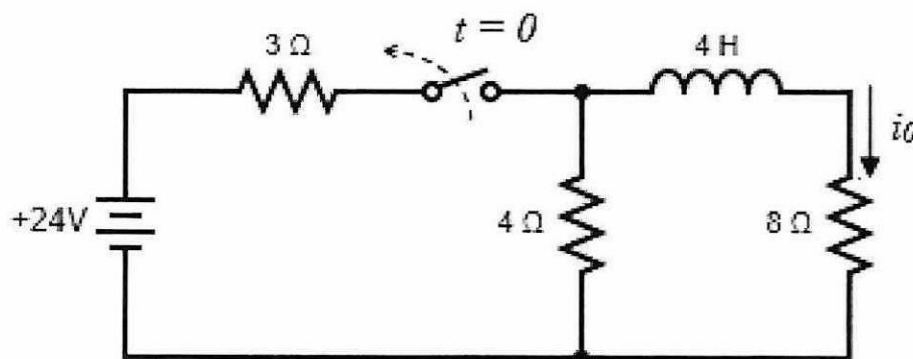


Figure Q3 (b)

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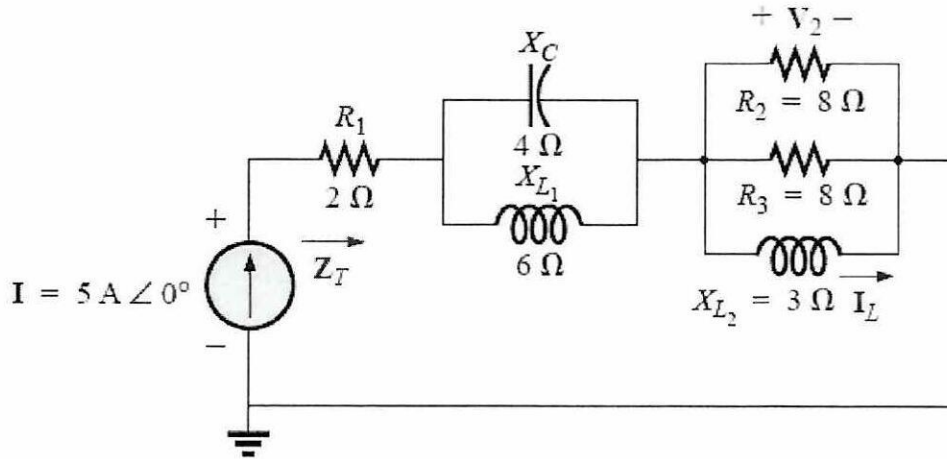


Figure Q4 (c)

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