UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	ELECTRIC CIRCUITS 1
COURSE CODE	:	BEJ 10303
PROGRAMME CODE	:	BEJ
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 EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES.

Q1 (a) For the circuit in **Figure Q1(a)**, find voltage, Vx and the power absorbed by the 12 Ω resistor.

(8 marks)

(b) Calculate the source current, I_S in the circuit of **Figure Q1(b)** by using delta-to-wye transformation. By aid of diagrams, show all related circuits involved during the transformation.

(7 marks)

(c) Referring to the circuit in **Figure Q1(c)**,

(i) Determine the value of voltages, v_1 and v_2, using nodal analysis.

(7 marks)

(ii) Calculate the power dissipated in all the resistors in the circuit.

(3 marks)

Q2 (a) By using the mesh analysis, compute the value of i_B and v_O for the circuit shown in **Figure Q2(a)**.

(12 marks)

(b) Nodal and mesh analysis provide a systematic way of analyzing a complex network. Describe the difference between these two analyses.

(4 marks)

(c) Use superposition to find V_0 in the circuit of **Figure Q2(b)**.

(9 marks)

Q3 (a) By aid of the diagram, explain the Thevenin's theorem.

(3 marks)

(b) Refer to the circuit in **Figure Q3(a)**,

(i) Obtain the Thevenin equivalent at terminals a-b.

(11 marks)

(ii) Determine the Norton current, I_N and draw its Norton equivalent circuit.

(3 marks)

(c) The variable resistor, R in **Figure Q3(b)** is adjusted until it absorbs the maximum power from the circuit.

(i) Calculate the value of R for maximum power.

(3 marks)

(ii) Determine the maximum power, P_{max} absorbed by R.

(5 marks)

Q4 (a) Given that, $v(t) = 120\cos(377t + 45°)$ V and $i(t) = 10\cos(377t - 10°)$ A.

(i) Find the instantaneous power and average power absorbed by the passive linear network.

(8 marks)

(ii) Explain what is instantaneous power and average power.

(4 marks)

(b) A current flowing through a 9Ω resistor has a periodic triangular waveform as shown in **Figure Q4(a)**.

(i) Find the rms value of the current waveform

(7 marks)

(ii) Find the average value of the current waveform.

(4 marks)

(iii) Calculate the power absorbed by the 9Ω resistor.

(2 marks)

-END OF QUESTIONS –

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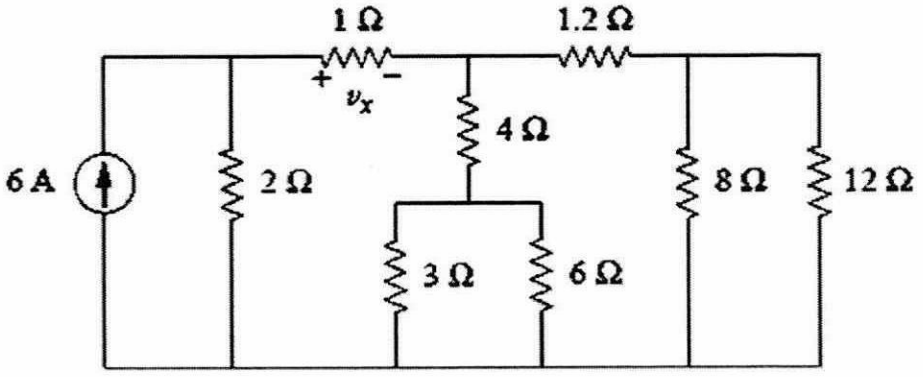

Figure Q1(a)

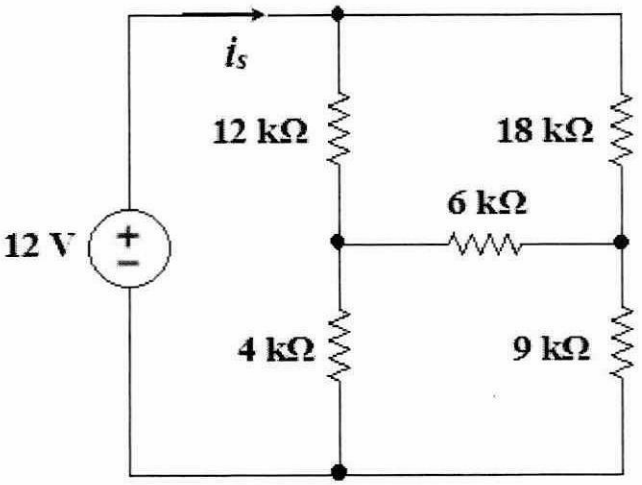

Figure Q1(b)

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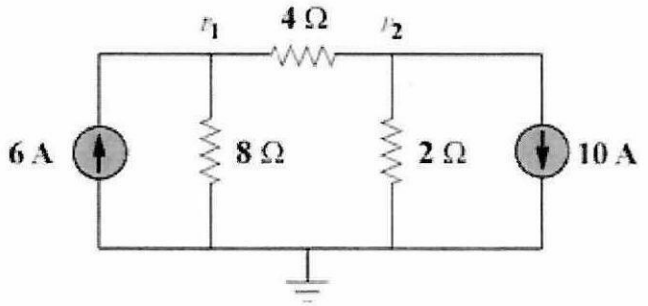

Figure Q1(c)

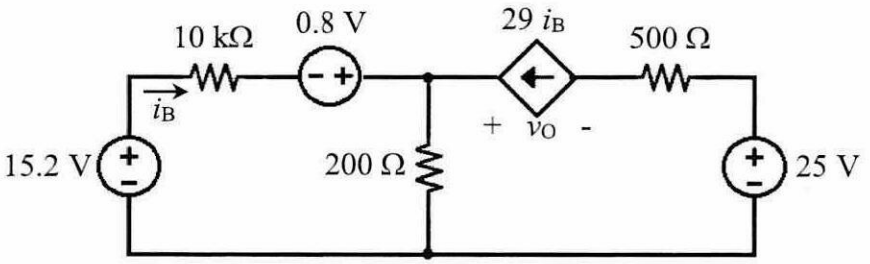

Figure Q2(a)

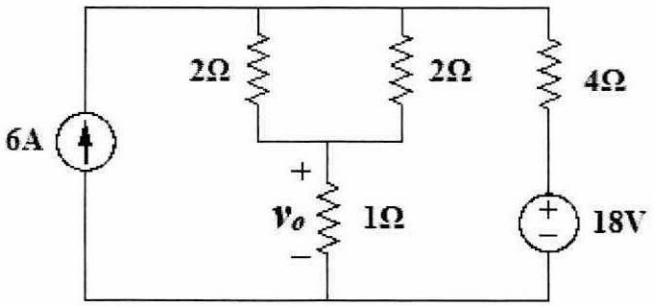

Figure Q2(b)

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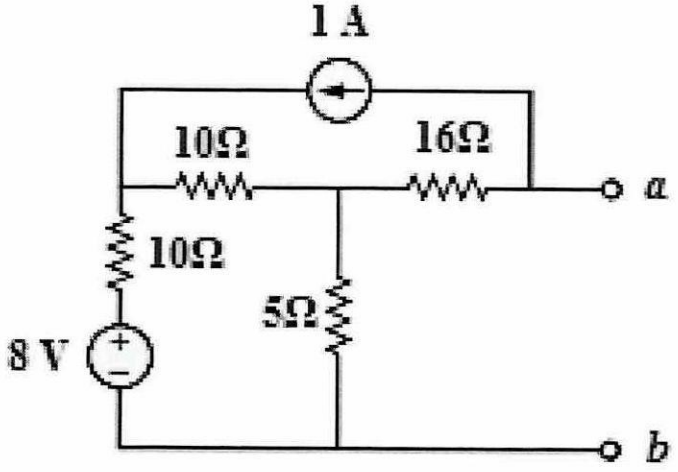

Figure Q3(a)

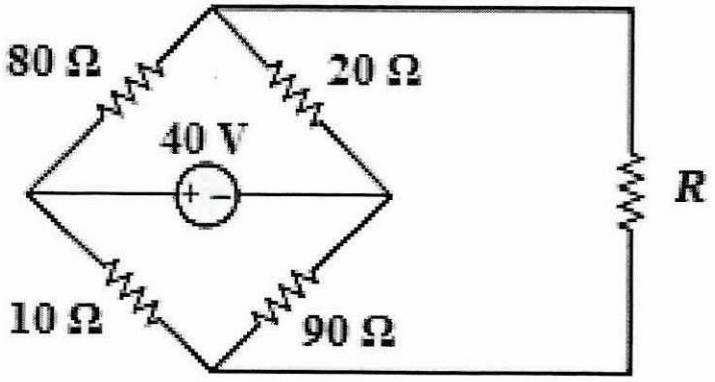

Figure Q3(b)

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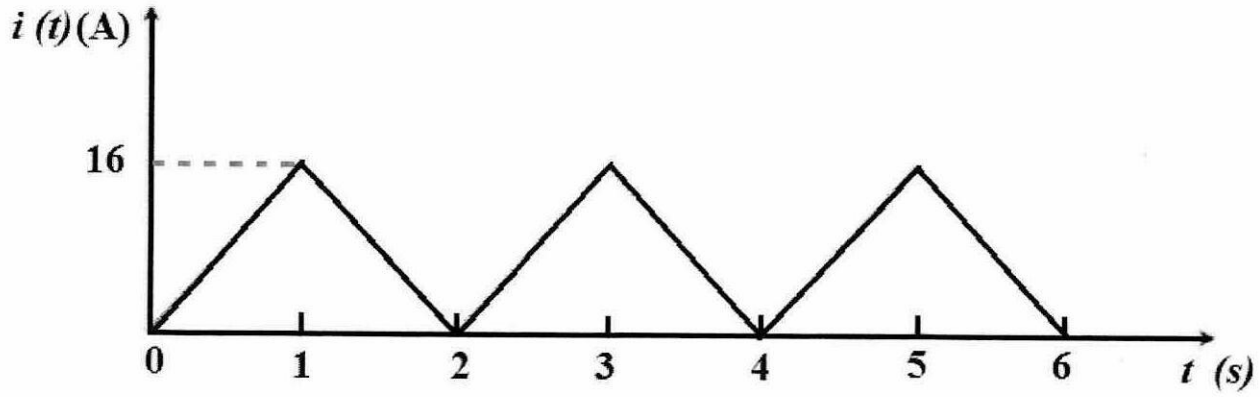

Figure Q4(a)

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APPENDIX A

TRIGONOMETRIC EQUATIONS

$$sin\ sin\ (x) = -\ sin\ sin\ (x)$$
$$cos(-x) = cos\ cos\ (x)$$
$$tan\ tan\ (-x) = -tan(x)$$
$$sec\ sec\ x = \frac{1}{cos\ cos\ x}, \qquad csc\ csc\ x = \frac{1}{sin\ sin\ x}$$
$$tan\ tan\ x = \frac{sin\ sin\ x}{cos\ cos\ x}, \qquad cot\ cot\ x = \frac{1}{tan\ tan\ x}$$
$$sin\ sin\ 2x + cos\ cos\ 2x = 1$$
$$sin\ sin\ (2x) = 2\ sin\ sin\ x\ \ cos\ cos\ x$$
$$cos\ cos\ (2x) = cos\ cos\ 2x - sin\ sin\ 2x$$
$$cos\ cos\ (2x) = 2\ cos\ cos\ 2x - 1 = 1 - 2\ sin\ sin\ 2x$$
$$sin(x \pm 90°) = \pm\ cos\ cos\ x$$
$$cos(x \pm 90°) = \mp\ sin\ sin\ x$$
$$sin(x \pm 180°) = \mp sin$$
$$cos(x \pm 180°) = \mp\ cos\ cos\ x$$

$$cos^2\ x + sin^2\ x = 1$$
$$sin\ sin\ (x \pm y) = sin\ sin\ x\ cos\ y \pm cos\ cos\ x\ sin\ y$$
$$cos\ cos\ (x \pm y) = cos\ cos\ x\ cos\ y \mp sin\ sin\ x\ sin\ y$$
$$tan\ tan\ (x \pm y) =$$
$$2\ sin\ sin\ x\ sin\ sin\ y = cos\ cos\ (x - y) - cos\ cos\ (x + y)$$
$$2\ sin\ sin\ x\ cos\ cos\ y = sin\ sin\ (x + y) + sin(x - y)$$
$$2x\ cos\ cos\ y = cos\ cos\ (x + y) + cos(x - y)$$
$$x\ cos\ cos\ y = \frac{1}{2}[cos\ cos\ (x + y) + cos(x - y)]$$