Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	ELECTRIC CIRCUIT 1
COURSE CODE	:	BEV 10303
PROGRAMME CODE	:	BEV
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ 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 **SIX (6)** PAGES

Q1 (a) Refer to **Figure Q1.1**.

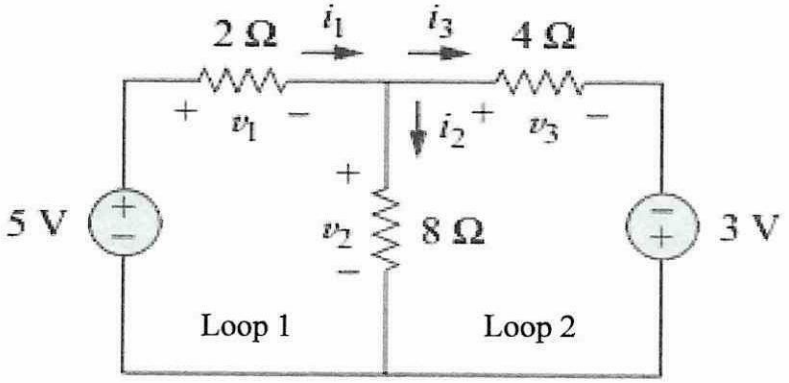

Figure Q1.1

(i) Based on Kirchhoff's Voltage Law (KVL), derive the equations representing loops 1 and 2.

(2 marks)

(ii) Based on Kirchhoff's Current Law (KCL), derive an equation related to the three branches of current, i_1, i_2, and i_3.

(1 mark)

(iii) Determine the value of current i_1, i_2, and i_3.

(10 marks)

(b) Two series resistors of R_1 and R_2 are connected to two parallel resistors of R_3 and R_4. This series-parallel combination is connected to a battery. Each resistor has a resistance of 10 Ω. A current of 2 A flows through the resistor R_1. Based on this statement,

(i) Draw the circuit diagram and label all the components clearly.

(3 marks)

(ii) Determine the voltage supplied by the battery.

(3 marks)

(iii) Calculate the power dissipated by a series resistor and parallel resistor.

(4 marks)

(iv) Calculate the power supplied by the battery.

(2 marks)

Q2 (a) Refer to the circuit in **Figure Q2.1**.

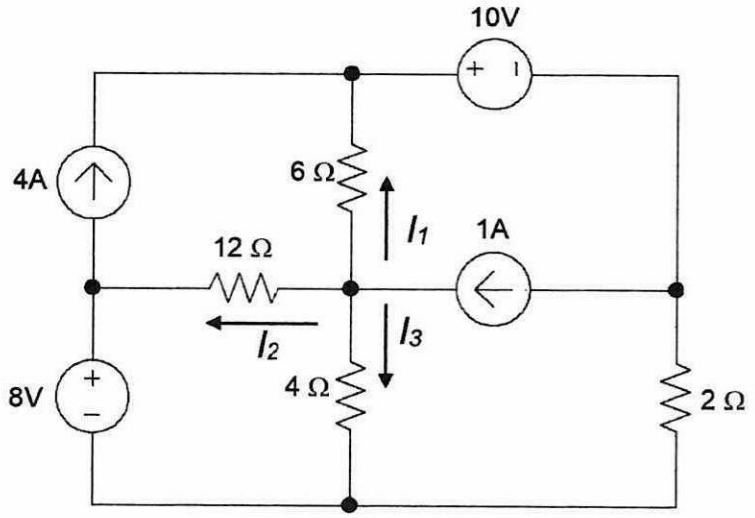

Figure Q2.1

(i) Determine the value of current I_1, I_2 and I_3, using mesh analysis.

(12 marks)

(ii) Calculate the power absorbed by 6 Ω and 4 Ω resistors.

(3 marks)

(b) Determine the voltage, V and current, i in **Figure Q2.2** using nodal analysis.

(10 marks)

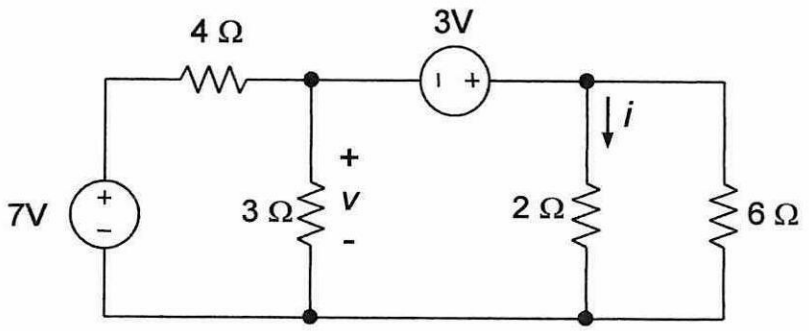

Figure Q2.2

Q3 (a) Given the circuit in **Figure Q3.1**, calculate the Norton current, I_N, and draw the Norton's equivalent circuit as viewed from terminal a-b.

(12 marks)

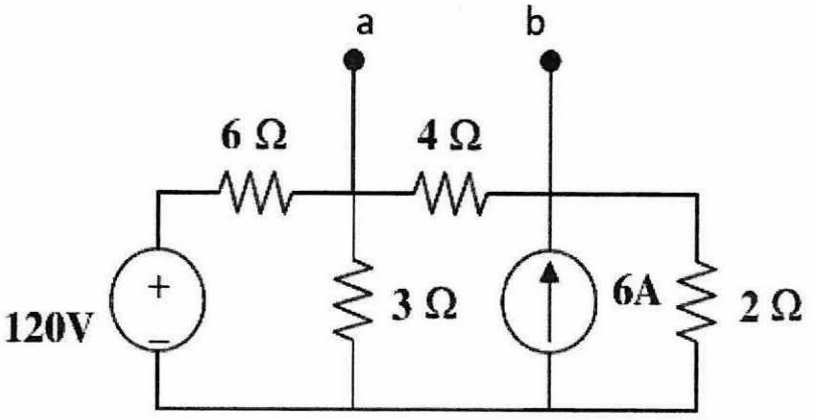

Figure Q3.1

(b) The variable resistor, R, in **Figure Q3.2** is adjusted until it absorbs the maximum power from the circuit.

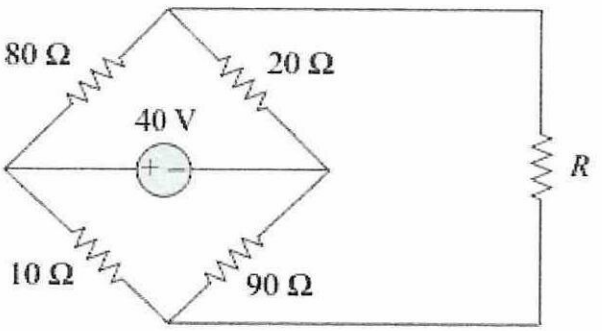

Figure Q3.2

(i) Calculate the value of R for the maximum power transfer, P_{max} to occur.

(3 marks)

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

(10 marks)

Q4 (a) The voltage supplied, v_s to the circuit in **Figure Q4.1** is 15 sin (4t + π/8) V.

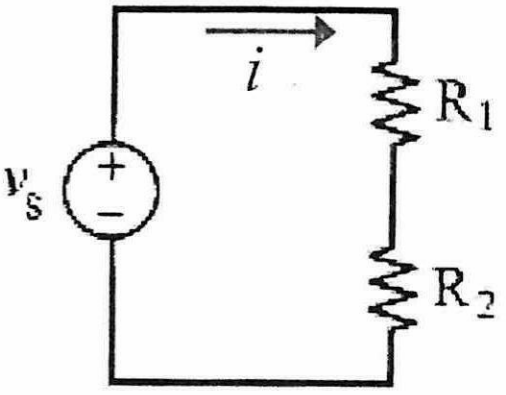

Figure Q4.1

(i) Explain the instantaneous power and average power.

(4 marks)

(ii) Find the voltage across R_2 if R_1 is 200 Ω and R_2 is 400 Ω.

(2 marks)

(iii) Obtain the instantaneous power absorbed by R_2 at time, t = 0.2 seconds.

(3 marks)

(iv) Determine the average power dissipated in R_2.

(4 marks)

(b) A current flowing through a 9 Ω resistor has a periodic triangular waveform as shown in **Figure Q4.2**.

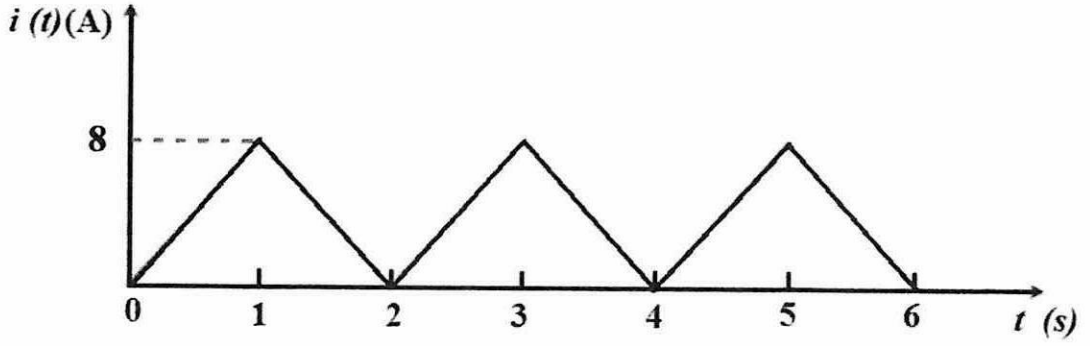

Figure Q4.2

(i) Find the root mean square (RMS) value of the current waveform.

(6 marks)

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

(4 marks)

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

(2 marks)

- END OF QUESTIONS -