Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	ELECTRIC CIRCUITS 1
COURSE CODE	:	BEJ 10303
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	DECEMBER 2019/JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) With the aid of a diagram, briefly explain the passive sign convention.

(3 marks)

(b) Based on your understanding, answer the following questions:

(i) Differentiate between passive and active element.

(2 marks)

(ii) Differentiate between independent and dependent sources.

(2 marks)

(c) An electric element, represented by box A. The direction for the current, i and the voltage, v across the element are shown in the **Figure Q1(c)**. For each of the following sets of numerical values, calculate the power for the element and state whether the power is being absorbed or supplied.

(i) $i = 1.5$ A, $v = 4$ V

(2 marks)

(ii) $i = -5$ A, $v = 25$ V

(2 marks)

(iii) $i = 10$ A, $v = -30$ V

(2 marks)

(iv) $i = -1$ A, $v = -30$ V

(2 marks)

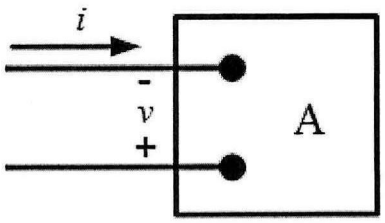

Figure Q1(c)

(d) Determine the equivalent resistance, R_{ab} for the circuits in **Figure Q1(d).**

(5 marks)

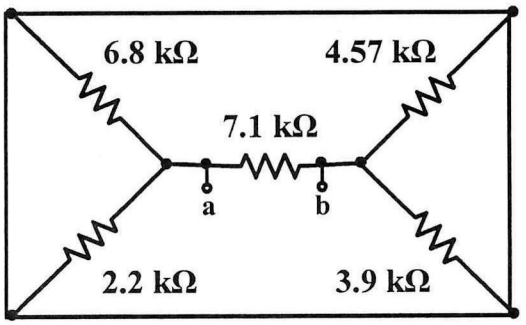

Figure Q1(d)

Q2 (a) Describe the voltage divider and current division rule concept by the aid of diagram. (5 marks)

(b) Referring to the circuit shown in **Figure Q2(b)**,

(i) calculate I_1, I_2 and I_3 (6 marks)

(ii) determine the voltage and power absorbed by resistor 1.5MΩ (4 marks)

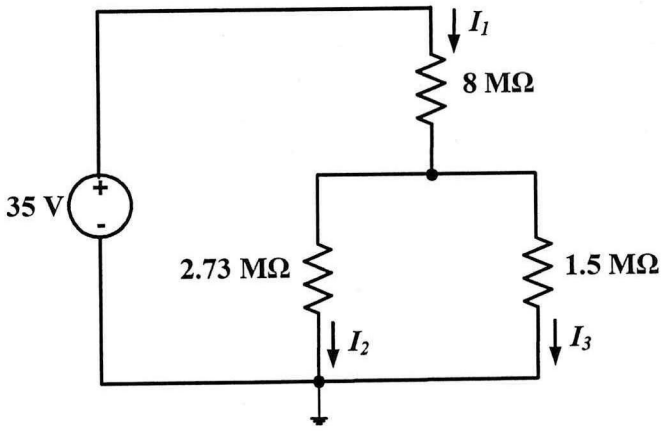

Figure Q2(b)

(c) Determine V_o in the circuit shown in **Figure Q2(c).** (5 marks)

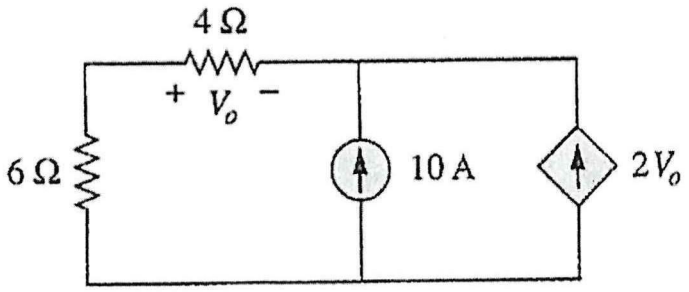

Figure Q2(c)

Q3 (a) Referring to the circuit in **Figure Q3(a)**,

(i) express Kirhhoff's Current Law (KCL) equations for node a and b in terms of V_a and V_b.

(4 marks)

(ii) determine the values of current, i_1 and i_2 by using nodal analysis.

(4 marks)

(iii) find the power dissipated at resistor 30Ω ,$P_{30\Omega}$.

(2 marks)

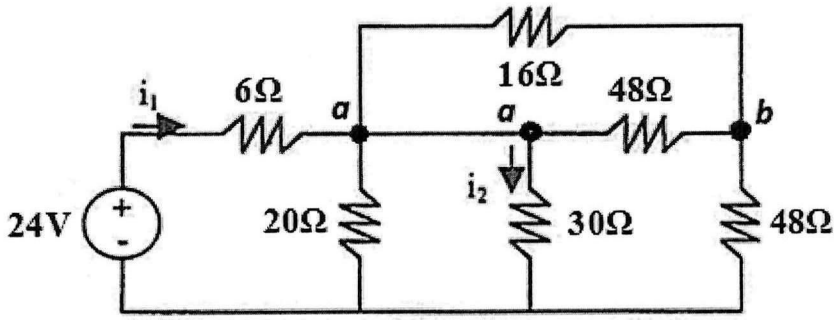

Figure Q3(a)

(b) Nodal and mesh analysis provide a systematic way of analyzing a complex network. Referring to the circuit in **Figure Q3(b)**, find the value of voltage v_o and current i_o by using either nodal or mesh analysis. Justify the chosen method.

(10 marks)

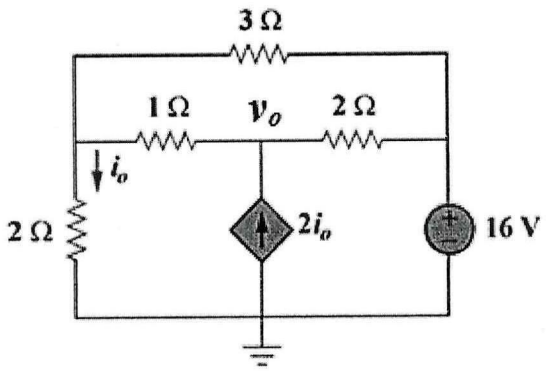

Figure Q3(b)

Q4 (a) For the circuit in **Figure Q4(a)**,

(i) obtain the Thevenin equivalent circuit at terminals *a* - *b*.

(8 marks)

(ii) find the Norton current, I_N from the Thevenin equivalent obtained in **Q4(a)(i)**.

(2 marks)

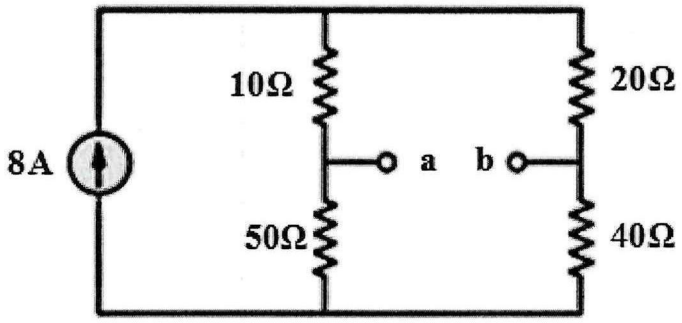

Figure Q4(a)

(b) For the circuit in **Figure Q4(b)**, the variable resistor, *R* is adjusted until it absorbs the maximum power from the circuit.

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

(4 marks)

(ii) Calculate the maximum power transfer, P_{max}

(6 marks)

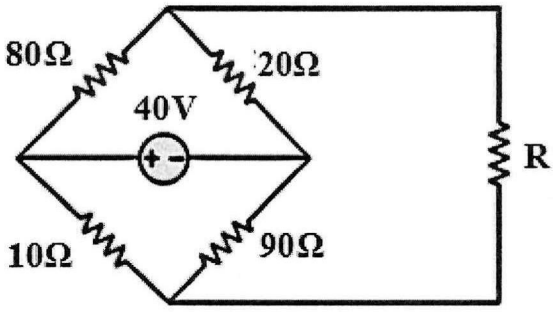

Figure Q4(b)

Q5 (a) By using an example of sine wave, describes the difference among the instantaneous value the average value, and the effective value of this voltage signal.

(4 marks)

(b) The circuit shown in **Figure Q5(b)(i)** is used to represent one part of the overall automatic watering system for a plantation in Batu Pahat. The input voltage, $v_s(t)$ that is periodic in nature is depicted in **Figure Q5(b)(ii)**. The other parameters are given as the following: $R_A = 1.5\ k\Omega$ and $R_B = 1\ k\Omega$.

(i) Compute the instantaneous current flows through R_B over a period and sketch the waveform.

(8 marks)

(ii) Calculate the average and the effective current flows through R_B.

(4 marks)

(iii) If the resistor R_B is the total equivalent resistance of resistors as shown in **Figure Q5(b)(iii)**, determine the value of R_1.

(4 marks)

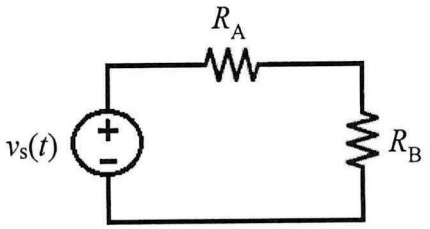

Figure Q5(b)(i)

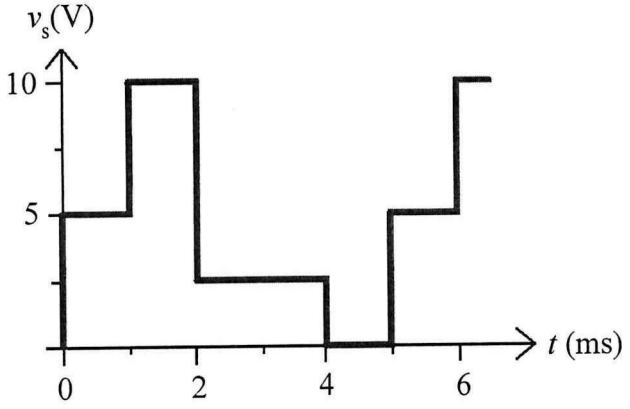

Figure Q5(b)(ii)

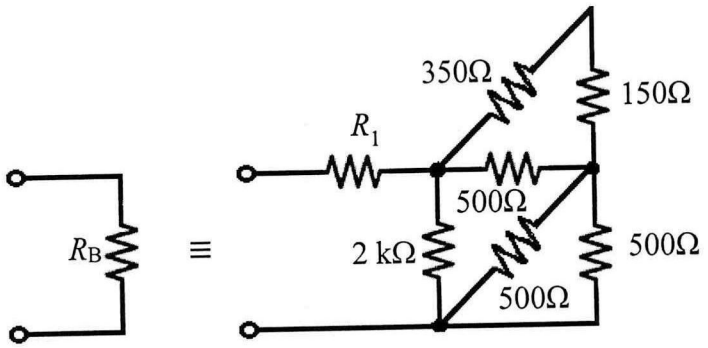

Figure Q5(b)(iii)

- END OF QUESTIONS-