Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	ELECTRIC CIRCUITS
COURSE CODE	:	BEL10103
PROGRAMME	:	BEJ
EXAMINATION DATE	:	JUNE/JULY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. SHOW ALL CALCULATIOS

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

Q1 (a) Based on the circuit shown in **Figure Q1(a)**, show that the power conservation law is satisfied.

(6 marks)

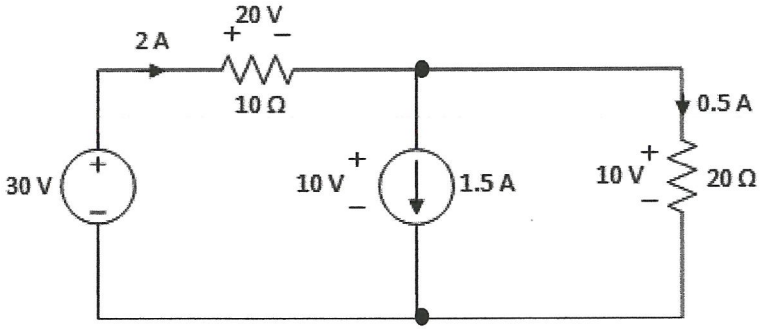

Figure Q1(a)

(b) Referring to the circuit in **Figure Q1(b)**;

(i) Express the Kirchoff Voltage Law (KVL) equation for circuit in **Figure Q1(b).**

(1 mark)

(ii) Determine the value of current, *I*.

(2 marks)

(iii) Find the voltage drop across resistor 3 Ω, V_1.

(2 marks)

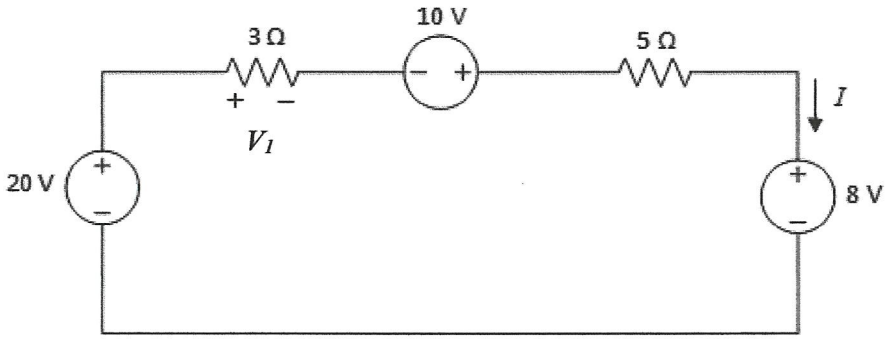

Figure Q1(b)

(c) Given equivalent resistor, R_{eq} of 20 Ω for the circuit in **Figure Q1(c)**.

(i) Analyze the value of resistor, R.

(5 marks)

(ii) Calculate the value of voltage, V_a, and V_b by applying the voltage division rule.

(4 marks)

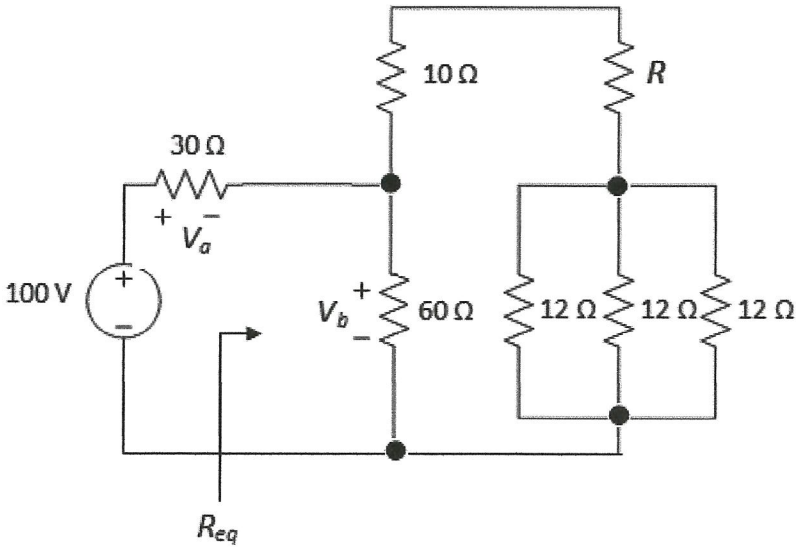

Figure Q1(c)

Q2 (a) Explain the concept of supernode and supermesh in an electric circuit.

(4 marks)

(b) Determine the mesh current i_1 and i_2 shown in **Figure Q2(b)**.

(4 marks)

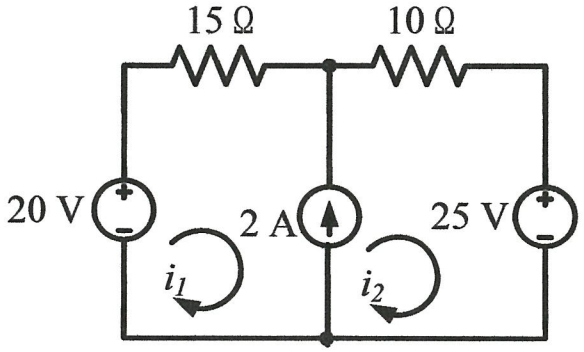

Figure Q2(b)

(c) **Figure Q2(c)** shows a circuit with combination of independent and dependent source.

(i) Determine which method is better or more efficient to analyze the circuit; nodal or mesh analysis and give your reason.

(2 marks)

(ii) Find the current, i_o across the 300 Ω resistor in the circuit shown in **Figure Q2(c)**.

(10 marks)

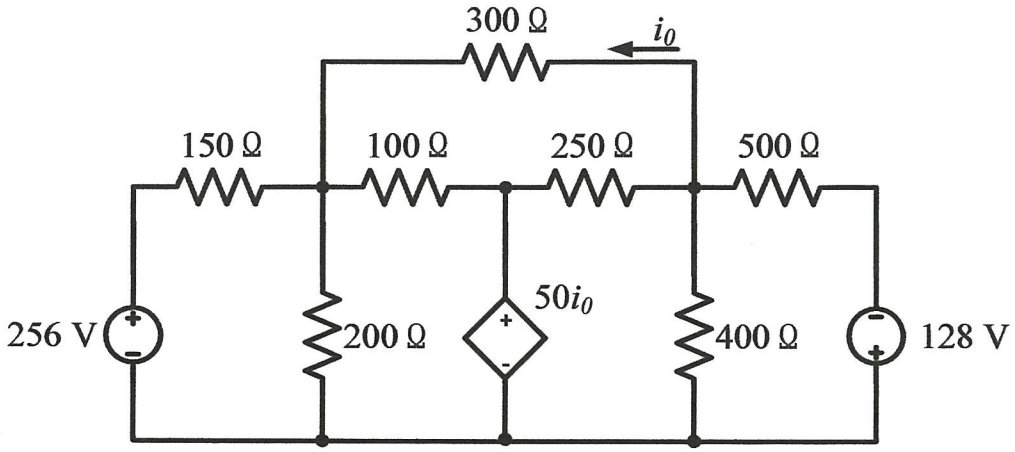

Figure Q2(c)

Q3 (a) Briefly explain the Thevenin theorem.

(3 marks)

(b) Based on the circuit in **Figure Q3(b)**, determine the Norton equivalent circuit at a-b terminals.

(12 marks)

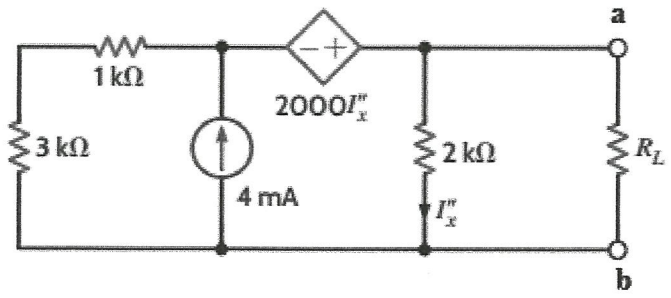

Figure Q3(b)

(c) A basic linear resistive circuit diagram is shown in **Figure Q(c)(i).** This circuit is found experimentally to have the i-v relationship plotted in **Figure Q(c)(ii).** Calculate the maximum power that can be absorbed by placing a load resistor across terminals a-b.

(5 marks)

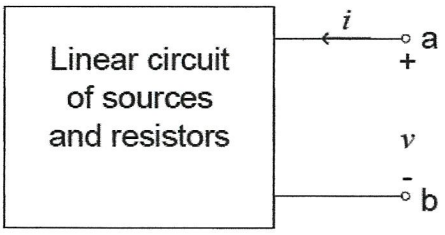

Figure Q3(c)(i)

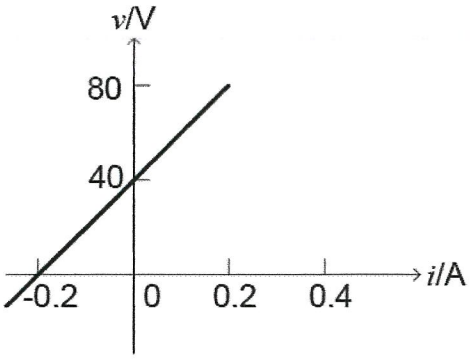

Figure Q3(c)(ii)

Q4 (a) Explain the concept of energy storage in inductor.

(2 marks)

(b) The current flowing through a 2mH inductor is, $i(t) = 2 \sin (377)t$ A. Determine the voltage across the inductor and the energy stored in the inductor.

(4 marks)

(c) Find the equivalent inductance of the following circuit across a-b terminals in **Figure Q4(c).**

(4 marks)

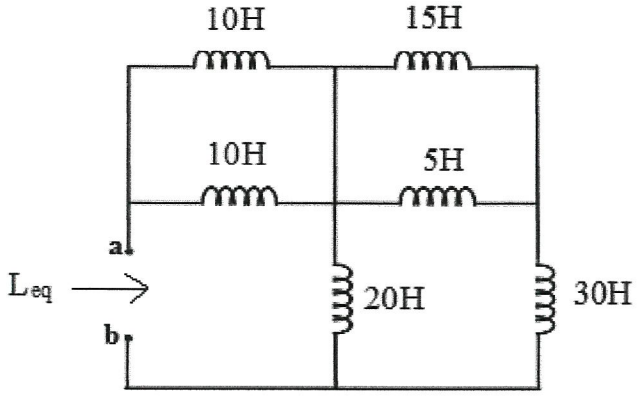

Figure Q4(c)

(d) The switch in the circuit in **Figure 4(d)** has been closed for a long time. It is opened at $t = 0$. Find the capacitor voltage, $v(t)$ for $t > 0$.

(i) Determine the value of time constant, τ.

(2 marks)

(ii) Find the value of $v(t)$ for $t < 0s$.

(3 marks)

(iii) Analyze the expression of $v(t)$ for $t > 0s$ by drawing the voltage response for this RC circuit.

(5 marks)

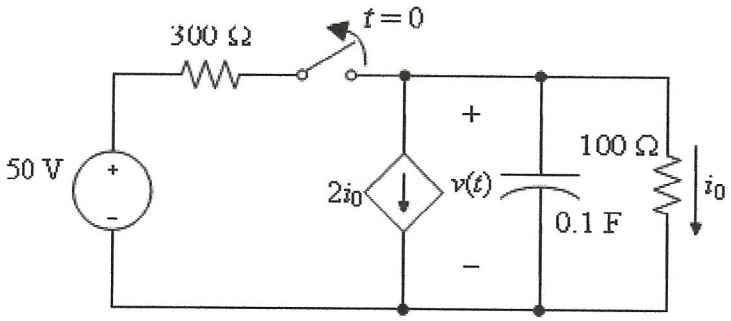

Figure 4(d)

Q5 (a) Distinguish between the transient state and steady state with the help of diagrams.

(3 marks)

(b) The switch of an RL circuit in **Figure Q5(b)(i)** has been in position A for a long time. At t = 0, the switch moves to B. Graph in **Figure Q5(b)(ii)** shows the response of circuit in **Figure Q5(b)(ii)** at t > 0.

(i) Based on graph in **Figure Q5(b)(ii)**, determine the value of resistor, R_2 in the circuit.

(2 marks)

(ii) Obtain the current expression of *i(t)* for t > 0.

(5 marks)

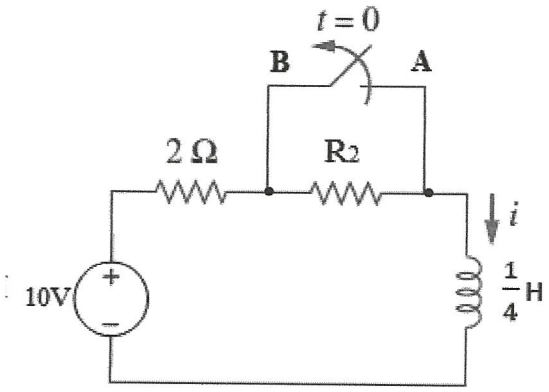

Figure Q5(b)(i)

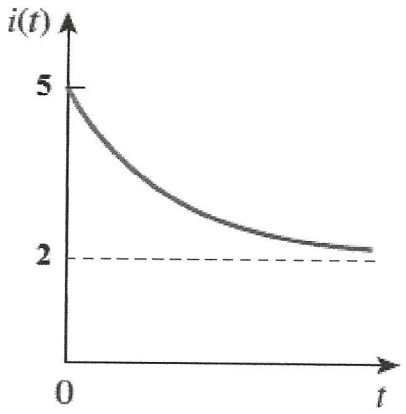

Figure Q5(b)(ii)

(c) For the circuit in **Figure Q5(c)**;

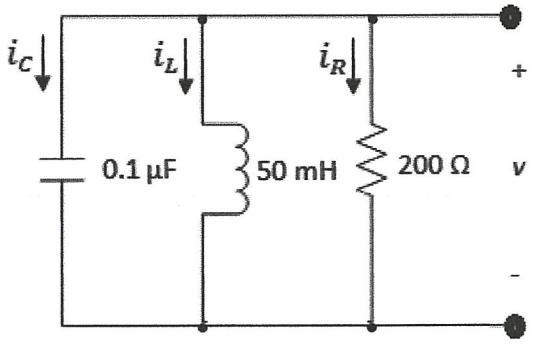

Figure Q5(c)

(i) Obtain the root of the characteristic s_1 and s_2.

(4 marks)

(ii) State the type of network response.

(2 marks)

(iii) Determine the value of resistor, R needed to have a critically damped response of the network.

(4 marks)

- END OF QUESTIONS -