Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2017/2018

COURSE NAME	:	ELECTRIC CIRCUITS
COURSE CODE	:	BEL 10103
PROGRAMMECODE	:	BEJ
EXAMINATION DATE	:	DECEMBER 2017/ JANUARY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS

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

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

(4 marks)

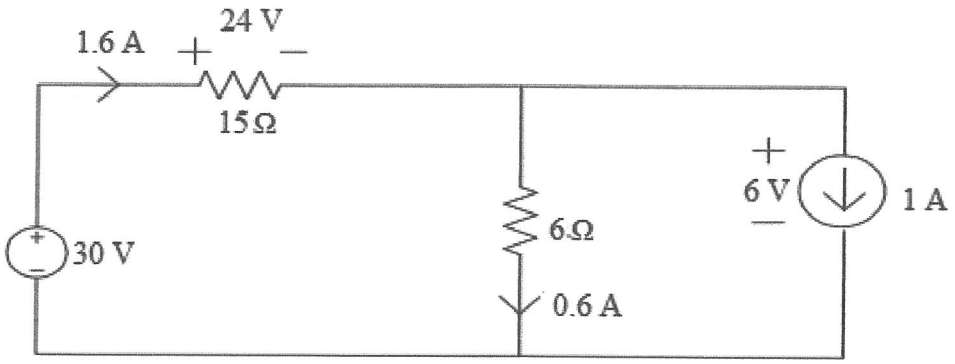

Figure Q1(a)

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

(2 marks)

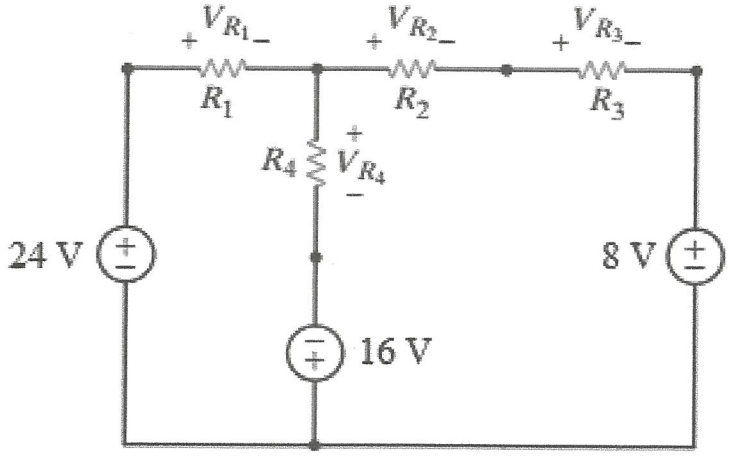

Figure Q1(b)

(c) If all resistors in **Figure Q1(b)** are given as 1 kΩ;

(i) Determine the voltage drop, V_{R3} across R_3.

(4 marks)

(ii) Find the total current flowing into R_4.

(2 marks)

(d) Referring to the circuit shown in **Figure Q1(d)**, calculate the total resistance of the network, R_T.

(3 marks)

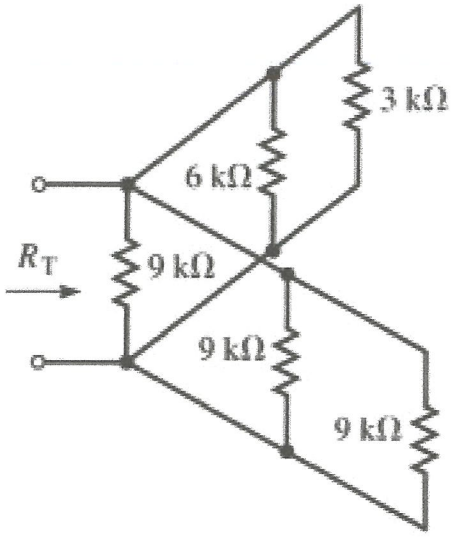

Figure Q1(d)

Q2 (a) State the difference between nodal and mesh analysis.

(2 marks)

(b) Based on the circuit in **Figure Q2(b)**, calculate the unknown currents, I_2 and I_3 by using nodal analysis.

(3 marks)

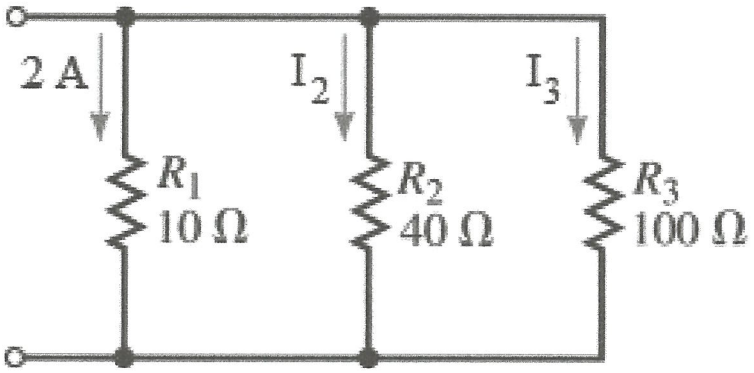

Figure Q2(b)

(c) Referring to the circuit shown in **Figure Q2(c)**;

(i) Express the Kirchoff Voltage Law (*KVL*) equations for the three meshes.

(3 marks)

(ii) Determine the current, i_o.

(7 marks)

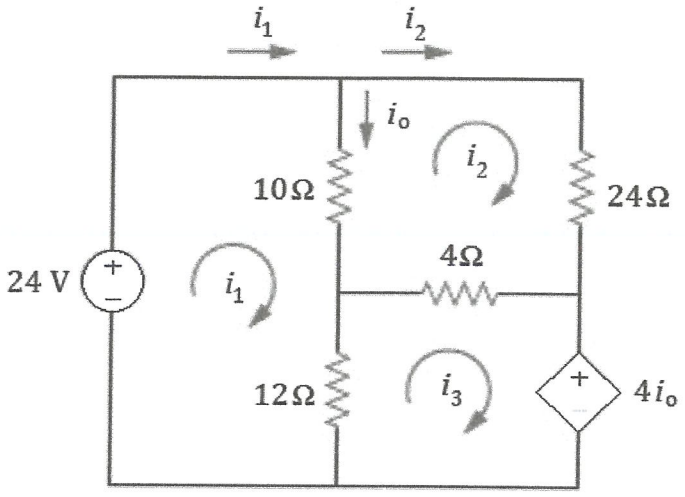

Figure Q2(c)

Q3 (a) Based on the circuit in **Figure Q3(a)**;

(i) By using the source transformation theorem, draw the equivalent circuit that has only one closed loop.

(4 marks)

(ii) Obtain the value of v_x.

(4 marks)

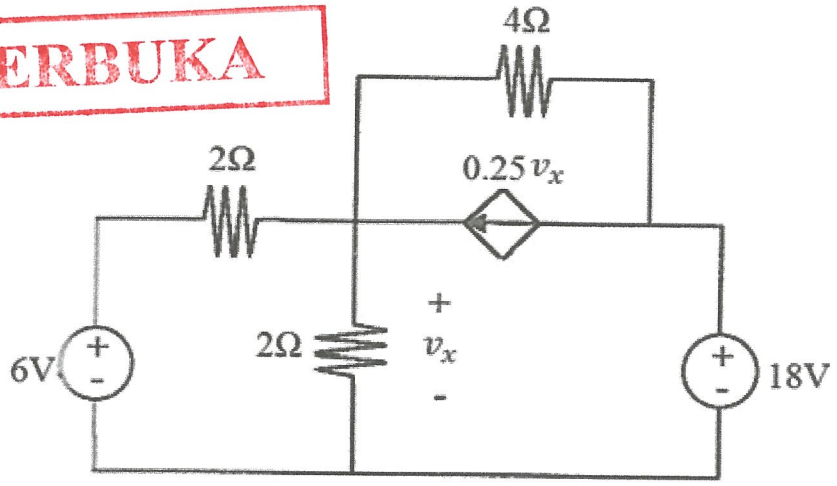

Figure Q3(a)

(b) For the circuit in **Figure Q3(b)**;

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

(4 marks)

(ii) Calculate the P_{max} .

(8 marks)

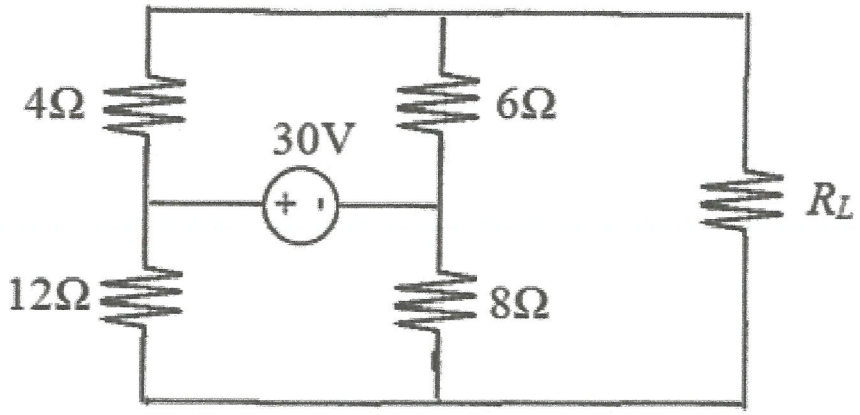

Figure Q3(b)

Q4 (a) Explain the concept of energy storage in an inductor, L and a capacitor, C. (4 marks)

(b) For the circuit shown in **Figure Q4(b)**;

(i) Find the equivalent inductance, L_{eq} at the terminals a-b. (3 marks)

(ii) Determine the voltage across 6 mH, v_1 in terms of v_o. (2 marks)

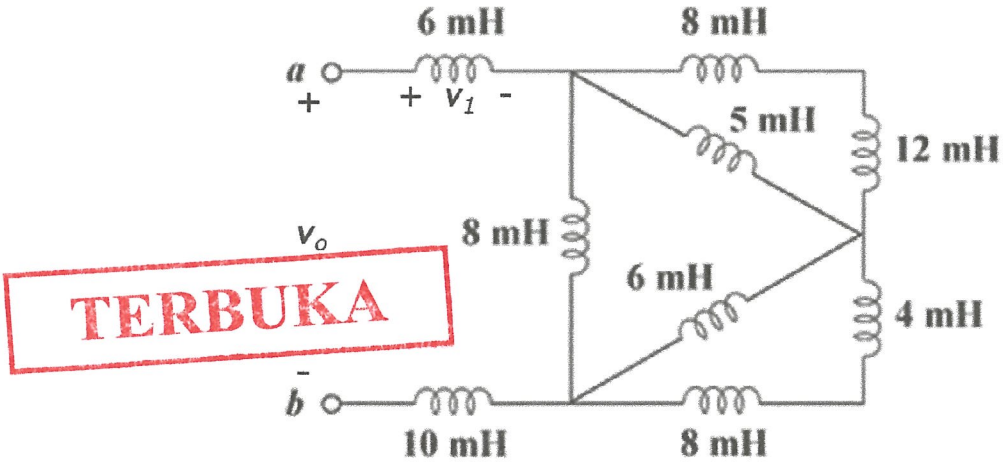

Figure Q4(b)

(c) Referring to the circuit in **Figure Q4(c)**;

(i) Calculate the equivalent capacitance, C_{eq} at the terminals a-b. (3 marks)

(ii) Determine the voltage across 40 μF, v_1 in terms of v_o. (2 marks)

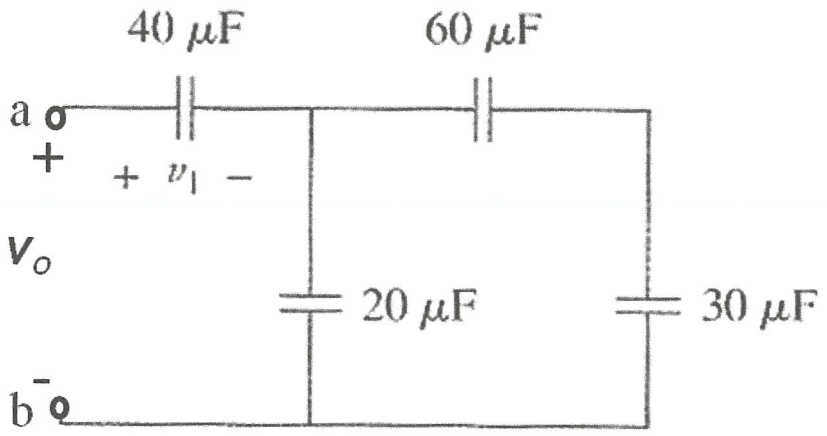

Figure Q4(c)

(d) Calculate the value of R in the circuit of **Figure Q4(d)** that will make the energy stored in the capacitor the same as that stored in the inductor, under *DC* condition.

(6 marks)

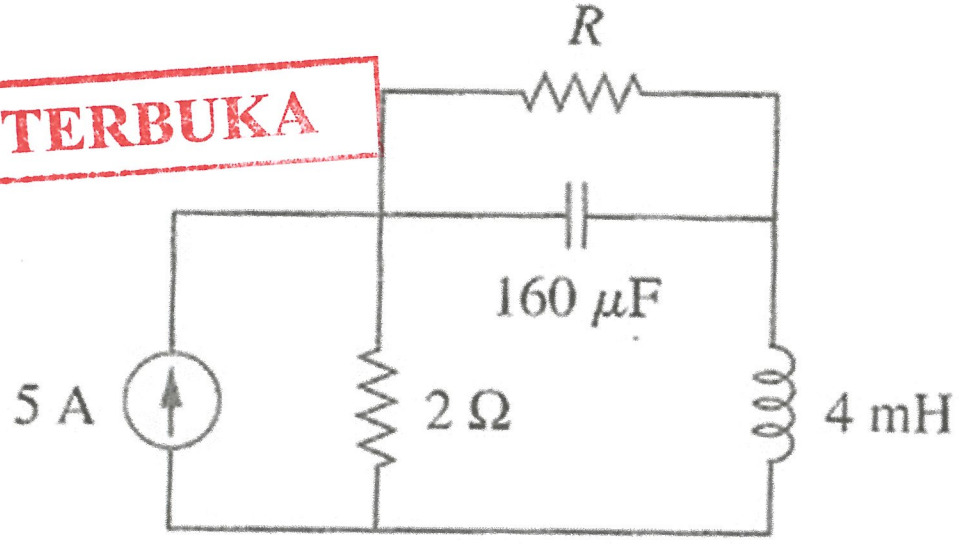

Figure Q4(d)

Q5 (a) Compare between transient response and steady-state response.

(3 marks)

(b) The switch in **Figure Q5(b)** has been in position A for a long time. At $t = 0$, the switch moves to B.

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

(2 marks)

(ii) Analyse the expression of $v(t)$ for $t > 0$.

(5 marks)

(iii) Calculate the value of v at $t = 4$s.

(2 marks)

(iv) Obtain the expression of $i(t)$ for $t > 0$.

(3 marks)

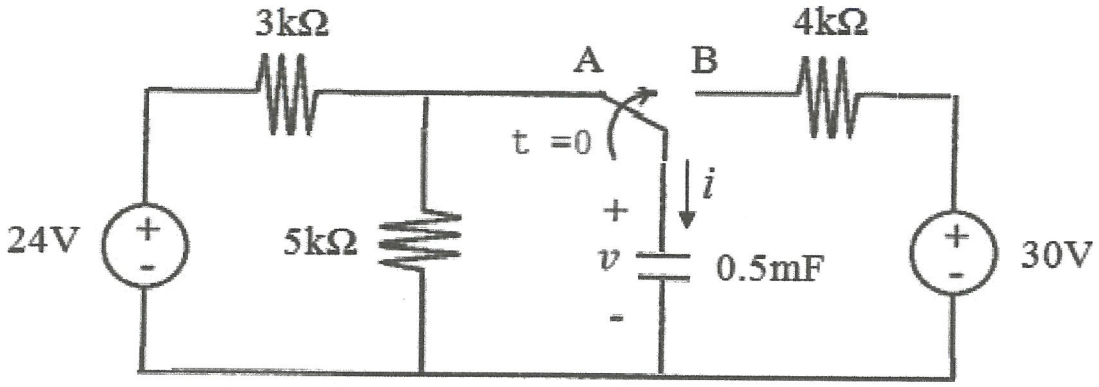

Figure Q5(b)

Q6 (a) Describe the type of response of *RLC* circuit in terms of α and ω.

(3 marks)

(b) Referring to the circuit in **Figure Q6(b)**;

(i) Calculate the roots of the characteristic, s_1 and s_2.

(6 marks)

(ii) State the type of the network response.

(2 marks)

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

(4 marks)

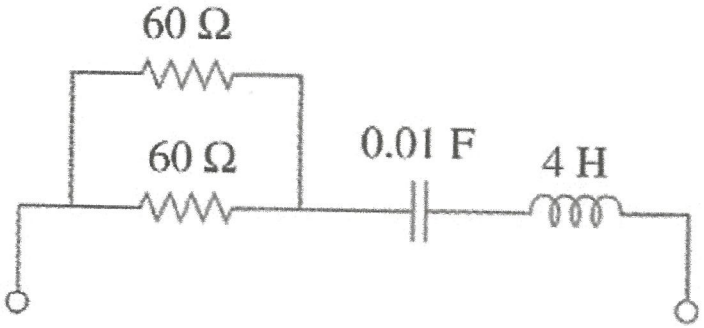

Figure Q6(b)

-END OF QUESTIONS -