Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	ELECTRIC CIRCUITS
COURSE CODE	:	BEL 10103
PROGRAMME	:	BACHELOR OF ELECTRONIC ENGINEERING WITH HONOURS
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

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

(3 marks)

(b) Two electric circuits, represented by boxes A and B, are connected as shown in **Figure Q1(b)**. The reference direction for the current i in the interconnection and the reference polarity for the voltage v across the interconnection are shown in the figure. For each of the following sets of numerical values, calculate the power in the interconnection and state whether the power is flowing for A to B or vice versa.

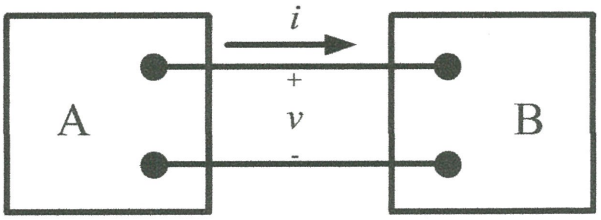

FIGURE Q1(b)

(i) $i = 15$ A, $v = 20$ V

(2 marks)

(ii) $i = -5$ A, $v = 100$ V

(2 marks)

(iii) $i = 4$ A, $v = -50$ V

(2 marks)

(iv) $i = -16$ A, $v = -25$ V

(2 marks)

(c) A house in countryside is supplied with 120 V, 100 A services. The following loads are to be operated at the same time, determine whether the house owner could safely operate these simultaneously.

5 hp motor
3000 W clothes dryer
2400 W electric range
1000 W steam iron
(Hint: 1 horsepower = 746 W)

(4 marks)

Q2 (a) Briefly explain the current divider concept by the aid of diagram.

(3 marks)

(b) Find equivalent R_{ab} of the circuit in **Figure Q2(b).**

(4 marks)

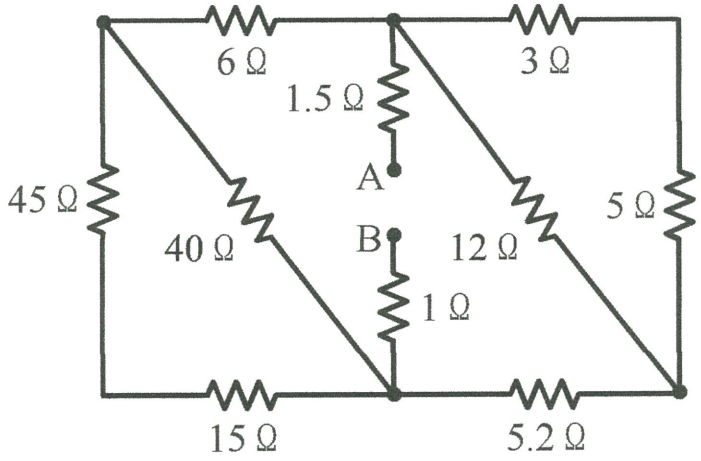

FIGURE Q2(b)

(c) The voltage V_0 across 10 Ω resistor in the circuit as shown in **Figure Q2(c)** is 1 V, calculate V_s.

(8 marks)

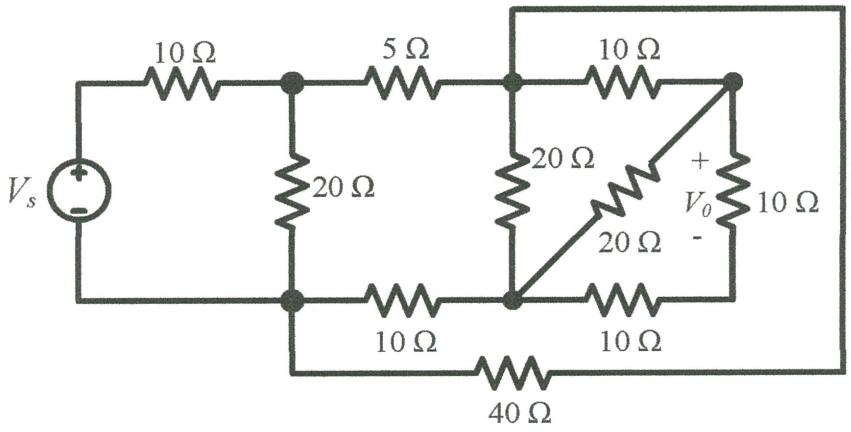

FIGURE Q2(c)

Q3 (a) Explain the concept of supernode in nodal analysis.

(2 marks)

(b) Find the mesh current i_1 and i_2 shown in **Figure Q3(b)**.

(4 marks)

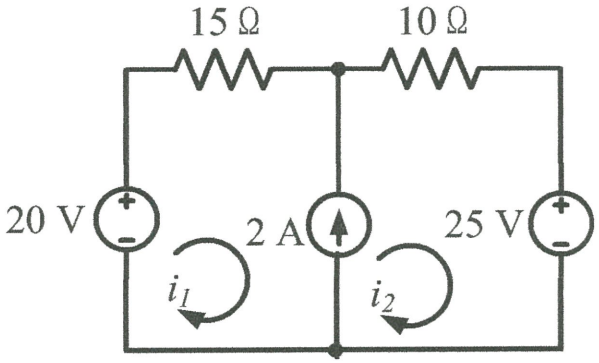

FIGURE Q3(b)

(c) Find the power dissipated in the 300 Ω resistor in the circuit shown in **Figure Q3(c)**.

(9 marks)

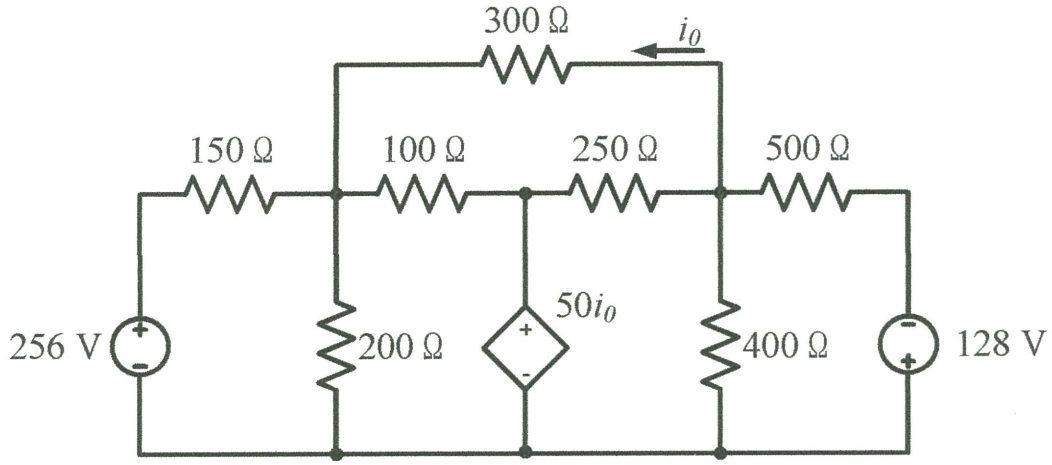

FIGURE Q3(c)

Q4 (a) Describe the type of response of RLC circuit in term of α and ω_0.

(3 marks)

(b) For the circuit in **Figure Q4(b)**, $v(0^+) = 12$ V, and $i_L(0^+) = 30$ mA,

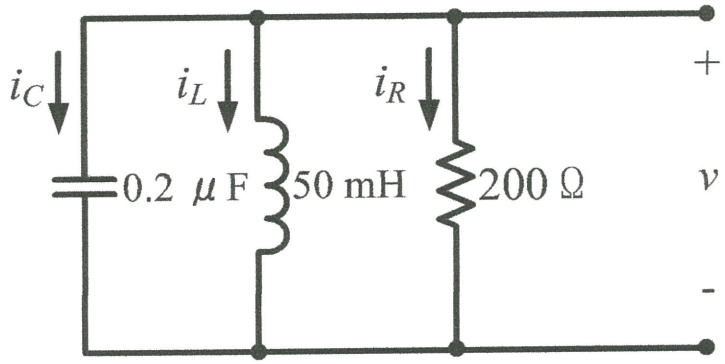

FIGURE Q4(b)

(i) Find the initial current in each branch of the circuit.

(3 marks)

(ii) Calculate the initial value of dv/dt.

(2 marks)

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

(6 marks)

(iv) State the type of response.

(1 mark)

Q5 (a) Explain the relationship between Thevenin Voltage V_{Th} and Norton Current I_N. (3 marks)

(b) For the circuit in **Figure Q5(b)**,

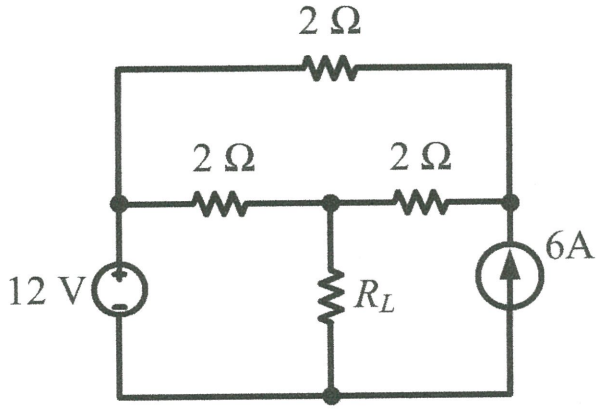

FIGURE Q5(b)

(i) Obtain the value of R_L for maximum power transfer to occur. (4 marks)

(ii) Calculate the P_{max}. (6 marks)

(c) Using a source transformation technique, calculate the current i_0 shown in **Figure Q5(c)**. (7 marks)

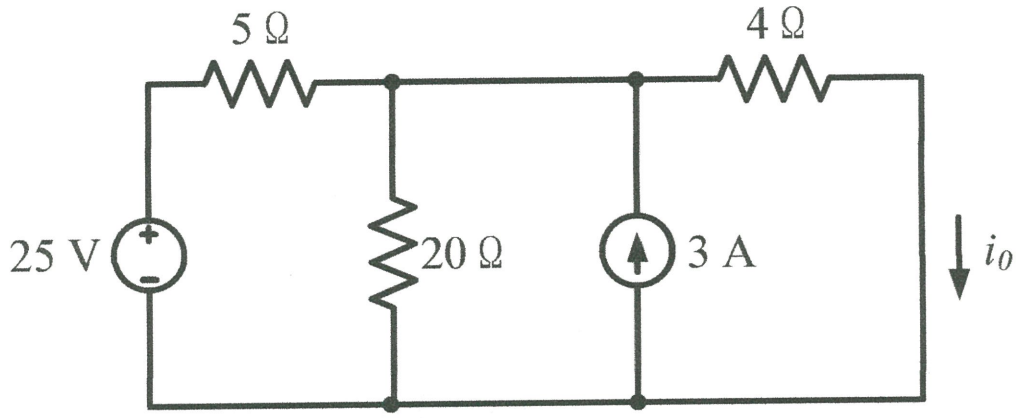

FIGURE Q5(c)

Q6 (a) Explain how the energy is stored in an inductor and a capacitor.

(4 marks)

(b) Consider the circuit shown in **Figure Q6(b)**,

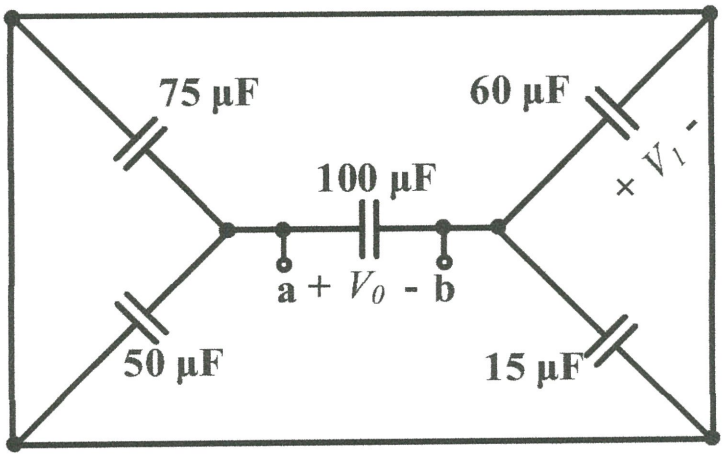

FIGURE 6(b)

(i) Find the equivalent capacitance C_{eq} for terminals **a-b**.

(3 marks)

(ii) Determine the voltage across 60 µF, V_1 in terms of V_0.

(4 marks)

(c) The switch in the circuit show in **Figure Q6(c)** has been in position **a** for a long time. At $t = 0$, the switch moves from position **a** to position **b**. The switch is a make-before-break type; that is, the connection at position **b** is established before the connection at position **a** is broken, so there is no interruption of current through the inductor.

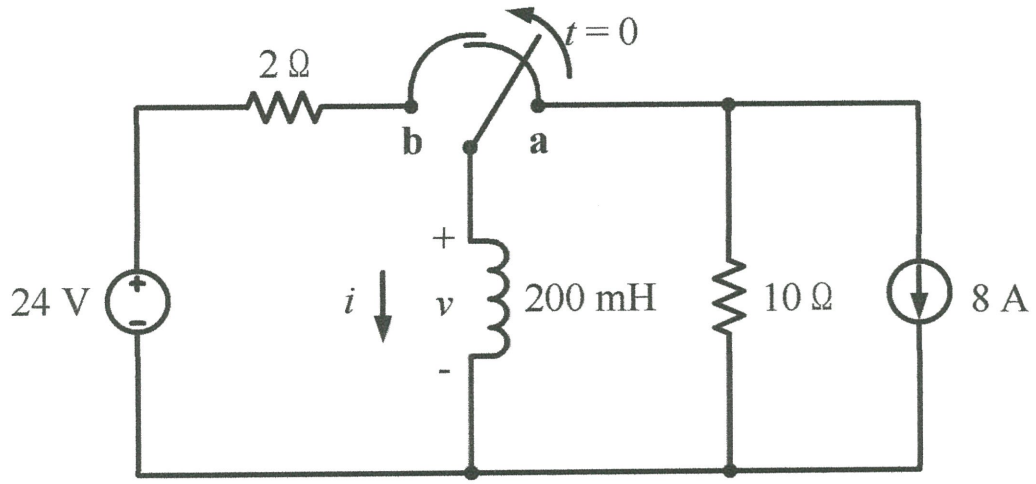

FIGURE Q6(c)

(i) Analyze the expression for $i(t)$ for $t \geq 0$.

(5 marks)

(ii) Calculate the initial voltage across the inductor just after the switch has been moved to position **b**.

(4 marks)

- END OF QUESTION -