UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	ELECTRIC CIRCUITS / ELECTRIC CIRCUIT THEORY
COURSE CODE	:	BEL 10103/BEX 10103/BEE 1113
PROGRAMME	:	BED/ BEB/ BEH/ BEC/ BEU/ BEE
EXAMINATION DATE	:	JUNE 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 (a) Voltages are assigned polarities that indicate the direction of energy flow, while current is the time rate of flow of electrical charge through a conductor of circuit element. Define the following concepts.

(i) Ideal conductor

(2 marks)

(ii) Dependent voltage sources

(3 marks)

(iii) Dependent current sources

(3 marks)

(b) Find R_{eq} for the circuit shown in **Figure Q1 (b)**. Then solve for I_0.

(12 marks)

Q2 (a) Use the node-voltage method to find v_1, v_2 and v_3 in the circuit shown in **Figure Q2 (a)**.

(10 marks)

(b) A source transformation allows a voltage source in series with resistor to be replaced by a current source in parallel with the same resistor or vice versa. For the circuit shown in **Figure Q2 (b)**, show the source transformation technique in finding the value of power associated with the 6 V.

(10 marks)

Q3 (a) (i) For the circuit in **Figure Q3 (a)**, obtain the Thevenin equivalent at terminals *a-b*.

(6 marks)

(ii) Calculate the current in $R_L = 8\ \Omega$.

(3 marks)

(iii) Find R_L for maximum power deliverable to R_L and determine that the maximum power.

(4 marks)

(b) Obtain the Norton equivalent at terminal a-b of the circuit in **Figure Q3 (b)**.

(7 marks)

Q4 (a) The inductor in **Figure Q4 (a)** are initially charged and are connected to the black box at $t = 0$. If $i_1(0) = 4$ A, $i_2(0) = -2$ A, and $v(t) = 50e^{-200t}$ mV, $t \geq 0$, analyze:

(i) The initial energy stored in each inductor,

(4 marks)

(ii) The total energy delivered to the black box from $t = 0$ to $t = \infty$,

(2 marks)

(iii) $i_1(t)$ and $i_2(t)$, at $t \geq 0$,

(6 marks)

(b) Three capacitors, $C_1 = 10$ μF, $C_2 = 10$ μF and $C_3 = 20$ μF, are connected in parallel across a 150 V DC source. Determine:

(i) the total capacitance. (4 marks)

(ii) the charge on each capacitor. (4 marks)

Q5 (a) If $R = 10\ \Omega$, $L = 5$ H, and $C = 2$ mF in **Figure Q5 (a)**, find the damping factor, α, the resonant frequency, ω_o, and the characteristic roots, s_1, and s_2. What type of natural response will the circuit have?

(7 marks)

(b) For the circuit in **Figure Q5 (b)**, calculate the value of R needed to have a critically damped response.

(6 marks)

(c) The natural response of a series RLC circuit is

$$i(t) = 10e^{-500t} + 12e^{-800t}\ mA, \qquad t \geq 0.$$

If $R = 200\ \Omega$, find L and C. (7 marks)

-END OF QUESTION-

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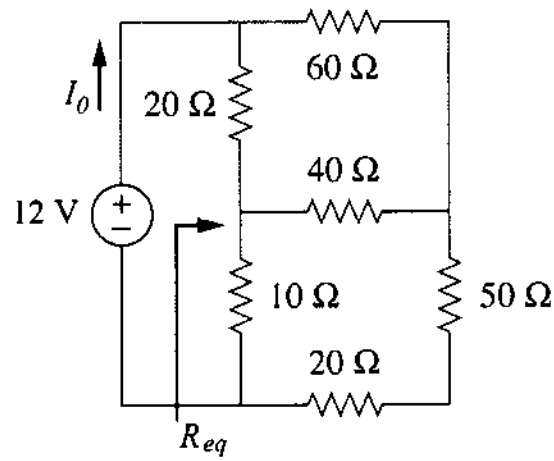

FIGURE Q1 (b)

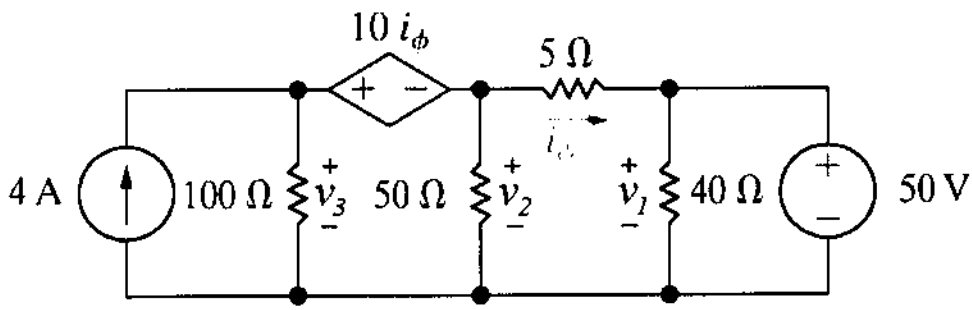

FIGURE Q2 (a)

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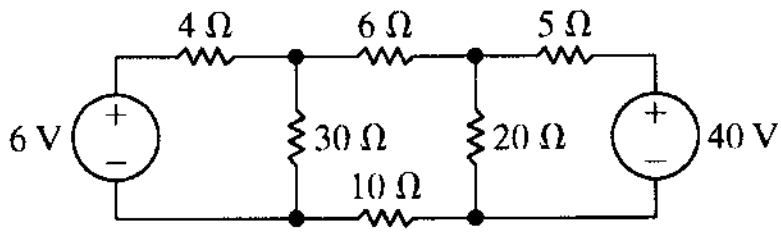

FIGURE Q2 (b)

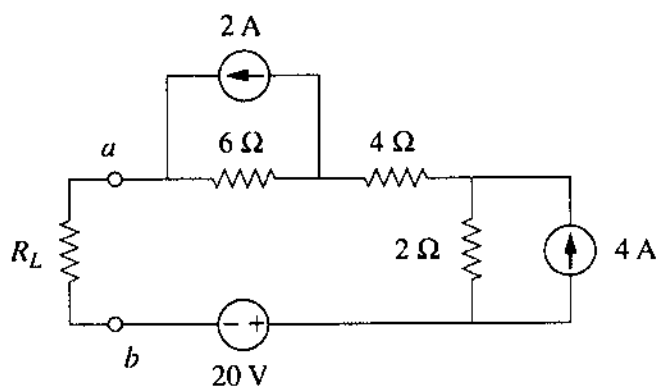

FIGURE Q3 (a)

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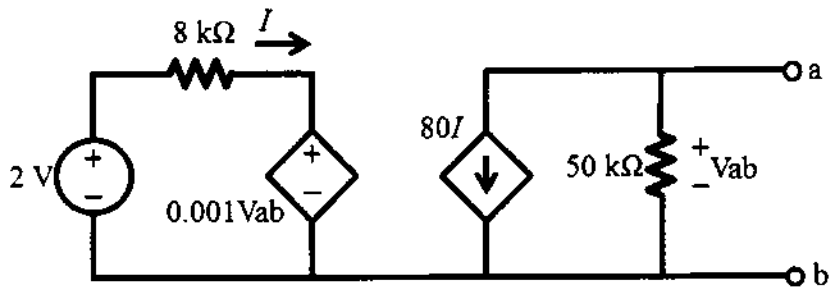

FIGURE Q3 (b)

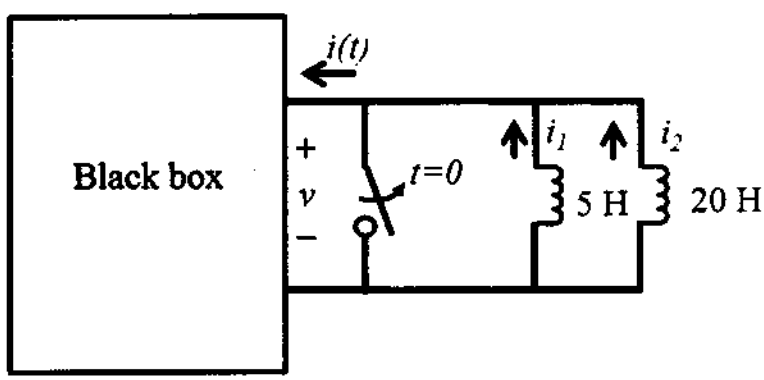

FIGURE Q4 (a)

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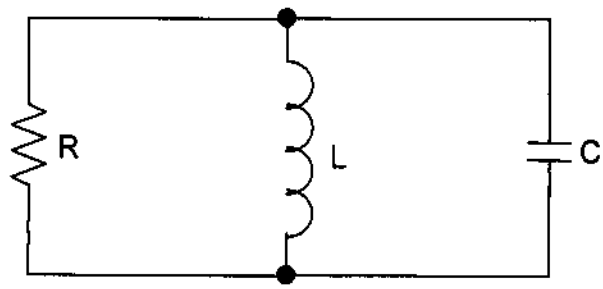

FIGURE Q5 (a)

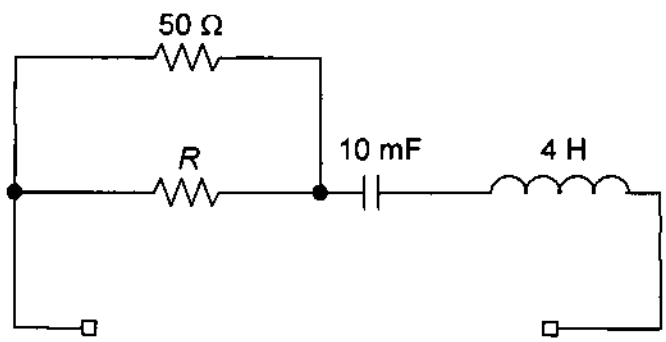

FIGURE Q5 (b)