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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	ELECTRIC CIRCUIT THEORY
COURSE CODE	:	BEX 10103
PROGRAMME	:	4 BEE
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

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Q1 (a) With the aid of appropriate circuit diagram, explain what is meant by supernode.
(4 marks)

(b) The pin diagram of a resistance array is shown in Figure **Q1(b)**. Find the equivalent resistance between the following.

(i) *a* and *b* (3 marks)

(ii) *c* and *d* (3 marks)

(c) Three devices with P_1 Watts, P_2 Watts and P_3 Watts, respectively, are connected in parallel to a common voltage source. Prove that the total power is equal to $P_T = P_1+P_2+P_3$.
(5 marks)

(d) Two devices are rated as shown in Figure **Q1(d)**. Calculate the value of the resistors R_1 and R_2 needed to power the device using a 20 V battery.
(5 marks)

Q2 (a) Determine v_0 in the circuit shown in Figure **Q2(a)** using the superposition principle.
(10 marks)

(b) Find the Thevenin equivalent circuit of the circuit shown in Figure **Q2(b)** to the left of the terminal *x-y*. and the current to R_L = 50 Ω. What is the maximum power transfer to the R_L and its value?
(10 marks)

Q3 (a) Using nodal analysis, determine V_o in the circuit in the circuit shown in Figure **Q3(a).**
(9 marks)

(b) Use mesh analysis to obtain i_o in the Figure **Q3(b).**
(11marks)

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

(i) the voltage across each capacitor

(ii) the energy stored in each capacitor

(10 marks)

(b) Show that the voltage division rule for two capacitors in series as in Figure **Q4(b)** is $v_1 = \frac{C_2}{C_1 + C_2} v_s$, and $v_2 = \frac{C_1}{C_1 + C_2} v_s$

(5 marks)

(c) Show that the current division rule for two capacitors in parallel as in Figure **Q4(c)** is $i_1 = \frac{C_1}{C_1 + C_2} i_s$, and $i_2 = \frac{C_2}{C_1 + C_2} i_s$

(5 marks)

Q5 (a) Find the current through a 10-H inductor if the voltage across it is

$$v(t) = \begin{cases} 35t^2, & t > 0 \\ 0, & t < 0 \end{cases}$$

Also, find the energy stored at $t = 6$ s. Assume $i(0) = 0$

(5 marks)

(b) A 4 mF capacitor has the current waveform shown in Figure **Q5(b)**. Assuming that $v(0) = 10$ V, sketch the voltage waveform $v(t)$.

(15 marks)

Q6 (a) Assuming that the switch in Figure **Q6(a)** has been in position *A* for a long time and is moved to position *B* at $t = 0$, find $v_o(t)$ for $t \geq 0$.

(5 marks)

(b) For the circuit in Figure **Q6(b)**, determine;

i) $i_R(0^+)$, $i_L(0^+)$, and $i_C(0^+)$,

(ii) $di_R(0^+)/dt$, $di_L(0^+)/dt$, and $di_C(0^+)/dt$,

(iii) $i_R(\infty)$, $i_L(\infty)$, and $i_C(\infty)$.

(15 marks)

Q7 (a) For the following pairs of sinusoids, determine which one leads and by how much.

(i) $v(t) = 10\cos(4t - 60°)$ and $i(t) = 4\sin(4t + 50°)$

(ii) $v_1(t) = 4\cos(377t + 10°)$ and $v_2(t) = -20\cos 377t$

(iii) $x(t) = 13\cos 2t + 5\sin 2t$ and $y(t) = 15\cos(2t - 11.8°)$

(9 marks)

(b) For the circuit in Figure **Q7(b)**, calculate Z_T and V_{ab}.

(11 marks)

- END OF QUESTION -

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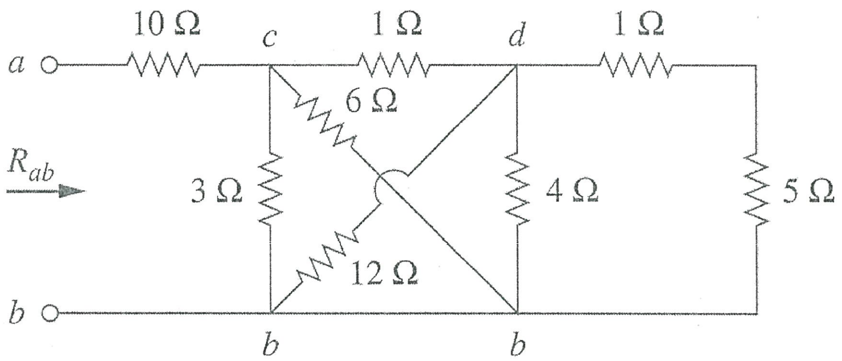

FIGURE Q1(b)

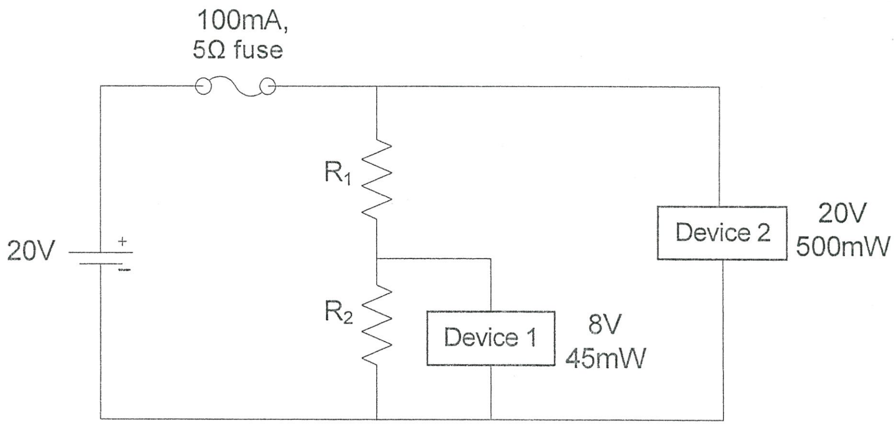

FIGURE Q1(d)

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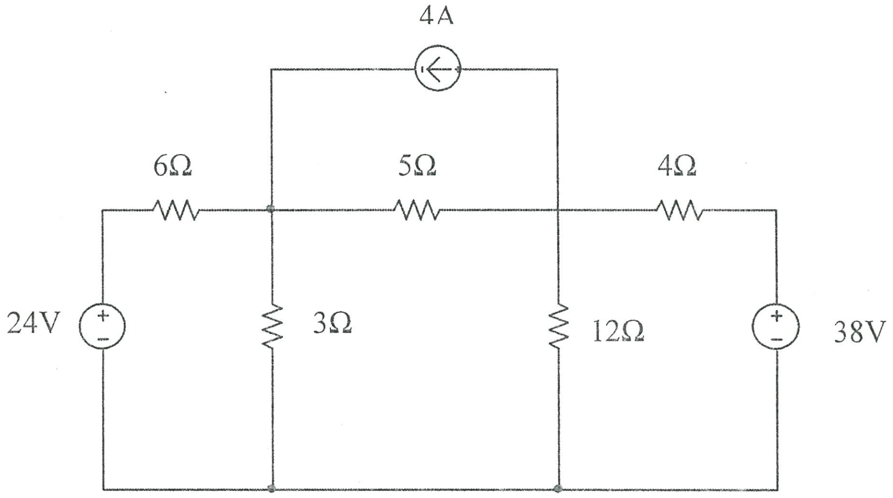

FIGURE Q2(a)

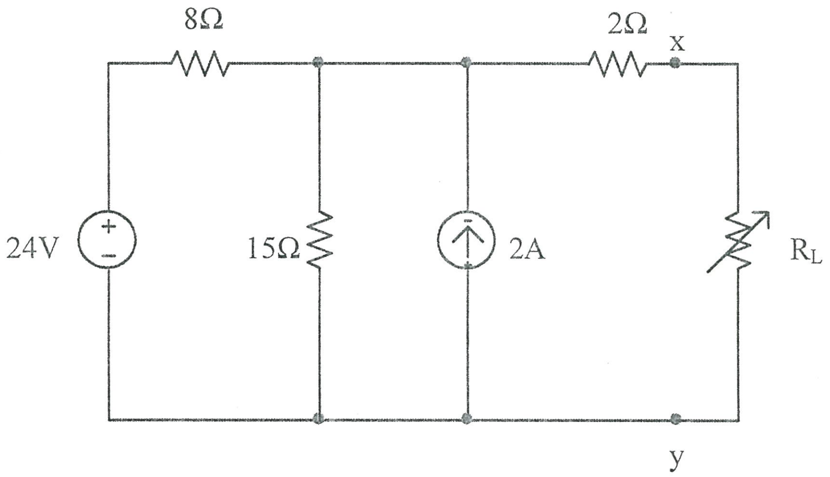

FIGURE Q2(b)

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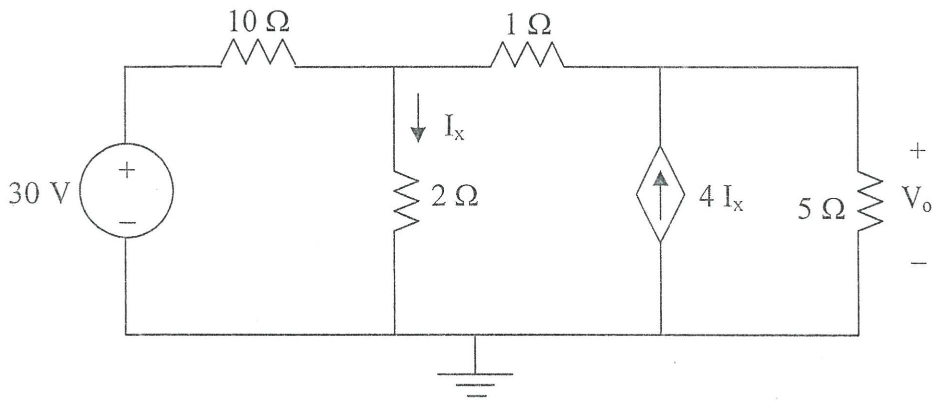

FIGURE Q3(a)

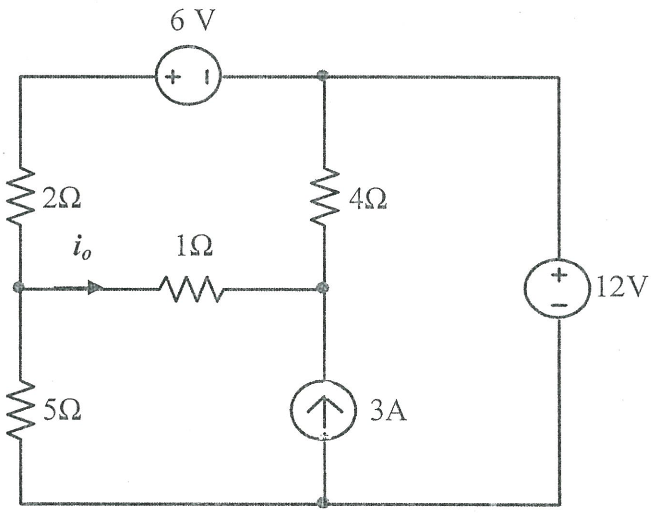

FIGURE Q3(b)

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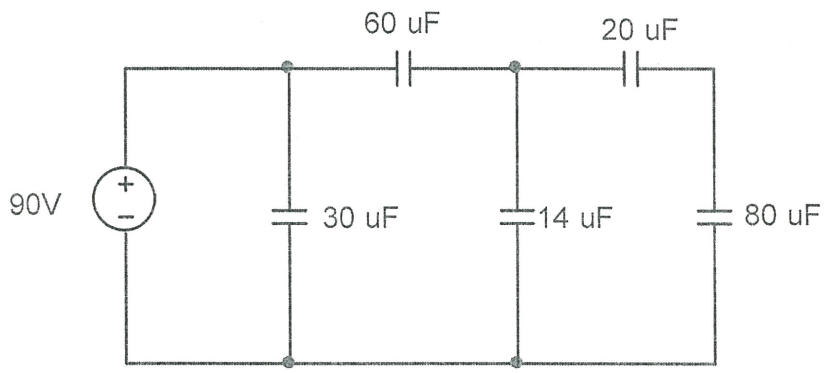

FIGURE Q4(a)

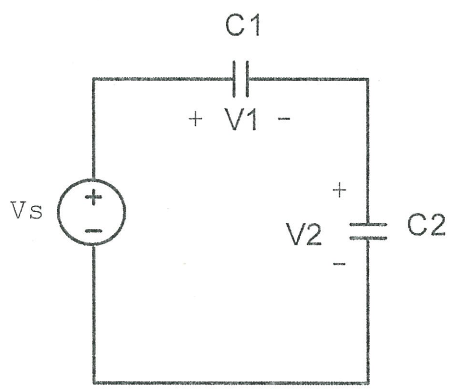

FIGURE Q4(b)

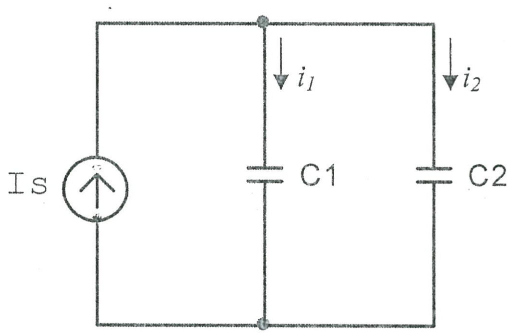

FIGURE Q4(c)

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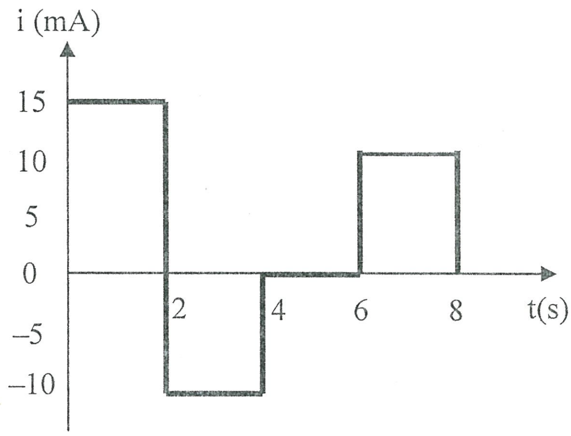

FIGURE Q5(b)

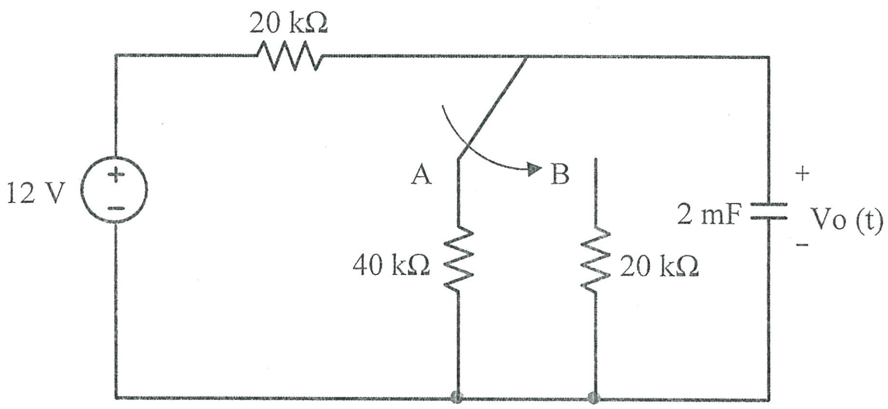

FIGURE Q6(a)

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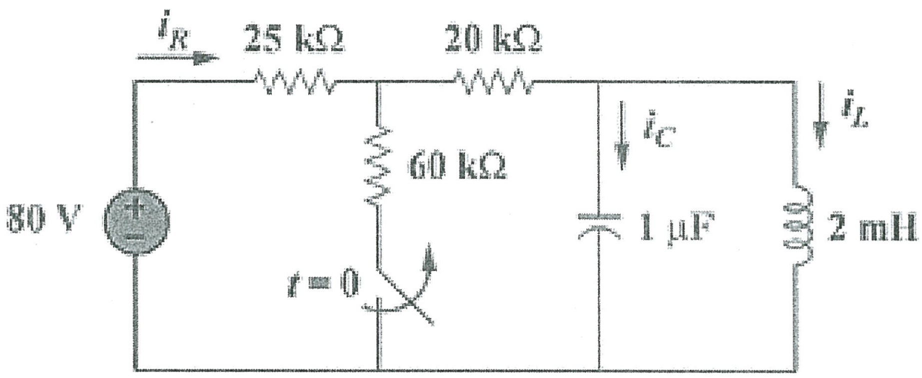

FIGURE Q6(b)

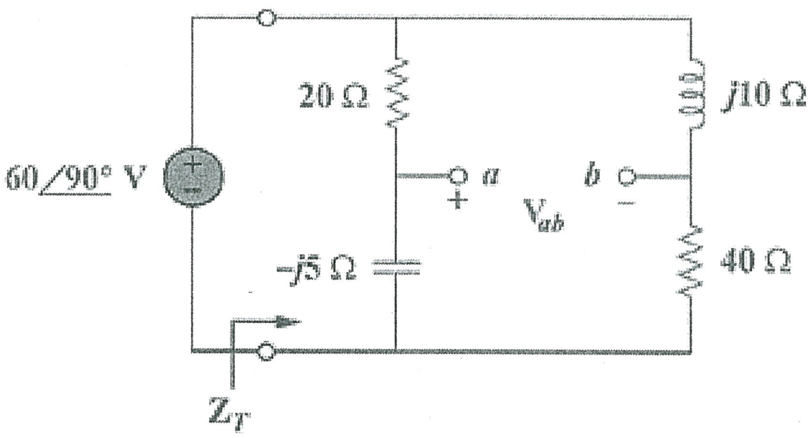

FIGURE Q7(b)

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CAPACITOR

$$v(t)=\frac{1}{C}\int_{-\infty}^{t} i(t)dt+v(t_0)$$

$$C=\frac{\varepsilon A}{d}$$

$$i=C\frac{dv}{dt}$$

$$w=\frac{1}{2}Cv^2$$

$$\tau=RC$$

INDUCTOR

$$i(t)=\frac{1}{L}\int_{t0}^{t} v(t)dt+i(t_0)$$

$$L=\frac{N^2\mu A}{l}$$

$$v=L\frac{di}{dt}$$

$$w=\frac{1}{2}Li^2$$

$$\tau=\frac{L}{R}$$