UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2010/2011

COURSE NAME	:	CIRCUIT TEORY
COURSE CODE	:	DEE 1223
PROGRAMME	:	1 DEE/DET
EXAMINATION DATE	:	NOVEMBER/DECEMBER 2010
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS IN PART A AND **TWO (2)** QUESTIONS FROM PART B

THIS QUESTION PAPER CONSISTS OF ELEVEN (11) PAGES

PART A – (60 marks)

Q1 (a) Define the following circuit elements and give two examples each.

(i) Passive elements (3 marks)

(ii) Active elements (3 marks)

(b) Find V_o in the circuit of Figure Q1(b). (6 marks)

(c) Use Ohm's law and Kirchhoff's law to find the value of R in the circuit shown in Figure Q1(c).

(8 marks)

Q2 (a) Write the nodal equations for the network in Figure Q2(a) and solve for the nodal voltages.

(10 marks)

(b) Using the supermesh approach, find the current through each resistor of the network in Figure Q2(b).

(10 marks)

Q3 (a) Using the Principle of Superposition, find the current I_2 through the 12 kΩ resistor in Figure Q3(a).

(10 marks)

(b) (i) Find the Thevenin equivalent circuit for the network external to the resistor R for the network in Figure Q3(b).

(6 marks)

(ii) Find the power delivered to R when R is 2 Ω and 100 Ω.

(4 marks)

PART B – (40 marks)

Q4 (a) Find the total capacitance C_T for the circuit in Figure Q4(a).

(5 marks)

(b) Find the voltage across and the charge on capacitor C_1 in Figure Q4(b) after it has charged up to its final value.

(7 marks)

(c) The mutually coupled inductances in Figure Q4(c) have $L_1 = 1$ H, $L_2 = 2$ H and $M = 1$ H. Given $i_1(t) = \sin 10t$ and $i_2(t) = 0.5 \sin 10t$. Find the values for v_1 and v_2 at $t = 2$ ms.

(8 marks)

Q5 (a) The switch in the circuit shown in Figure Q5(a) had been closed for a long time and is opened at $t = 0$.

(i) Calculate the initial value of i.
(ii) Calculate the initial energy stored in the inductor.
(iii) What is the time constant of the circuit for $t > 0$?
(iv) What is the numerical expression for i(t) for $t \geq 0$?

(10 marks)

(b) The switch in the circuit seen in Figure Q5(b) had been in position **a** for a long time. At $t = 0$, the switch moves instantaneously to position **b**. Find $v_o(t)$ and $i_o(t)$ for $t \geq 0$.

(10 marks)

Q6 (a) Consider the sinusoidal voltage

$$v_s(t) = 20 \sin(120\pi t + 60^o) \text{ V}$$

(i) What is the angular frequency of the voltage?
(ii) What is the frequency of the source?
(iii) Find the period of the voltage.
(iv) Express v_s in cosine form.
(v) Determine v_s at $t = 2.5$ ms.

(6 marks)

(b) The circuit in Figure Q6(b) is operating in the sinusoidal steady state. Find the steady-state expression for $\upsilon_o(t)$ if $\upsilon_g = 64 \cos 8000t$ V.

(7 marks)

(c) Find i(t) and $\upsilon(t)$ in the circuit of Figure Q6(c).

(7 marks)

Q7 (a) A relay coil is connected to a 210 V, 50 Hz supply. If it has a resistance of 30 Ω and an inductance of 0.5 H, calculate the apparent power and the power factor.

(8 marks)

(b) For the entire circuit in Figure Q7(b), calculate :

(i) the average power delivered by the source
(ii) the reactive power
(iii) the apparent power
(iv) the complex power
(v) the power factor

(12 marks)

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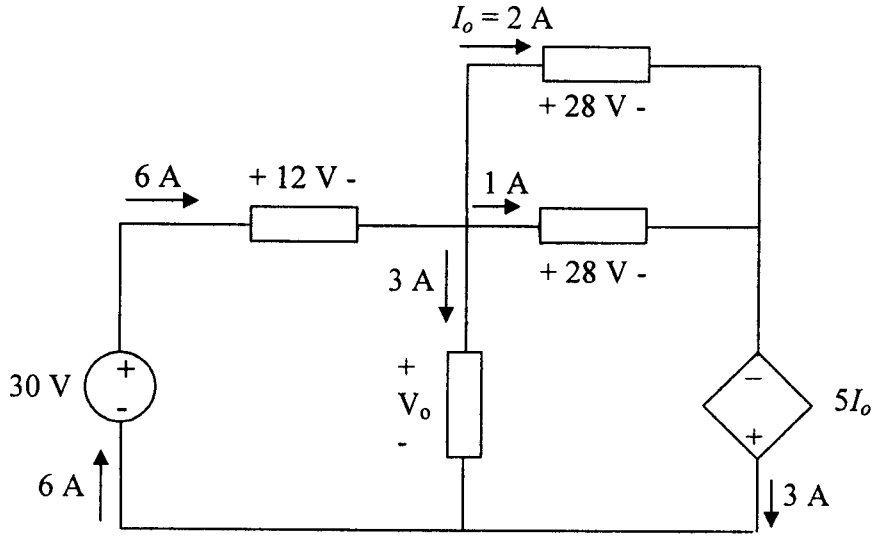

Figure Q1(b)

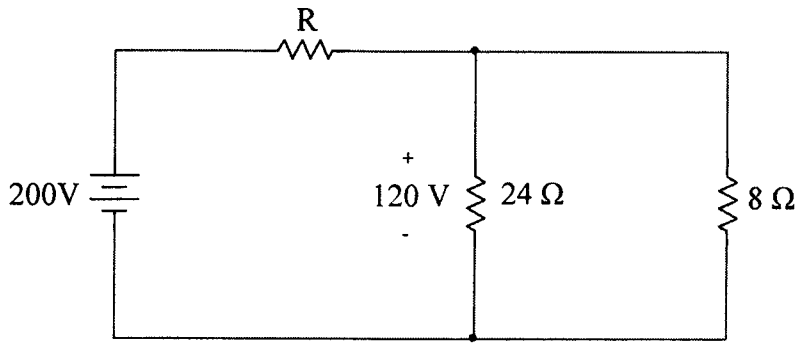

Figure Q1(c)

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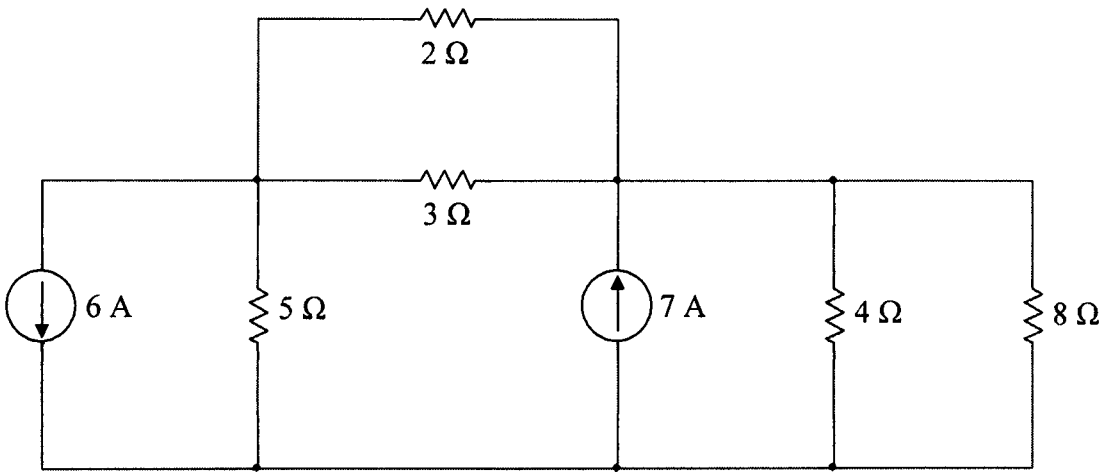

Figure Q2(a)

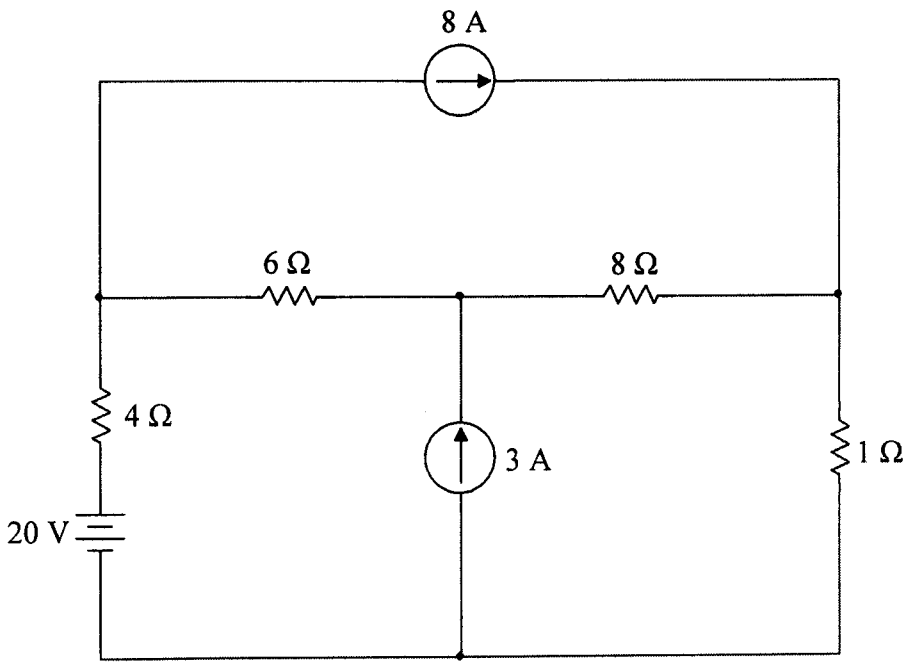

Figure Q2(b)

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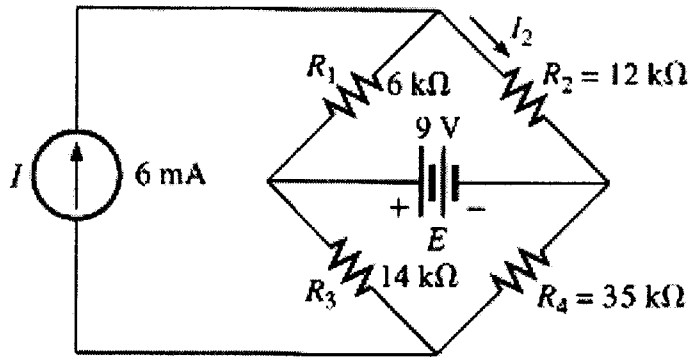

Figure Q3(a)

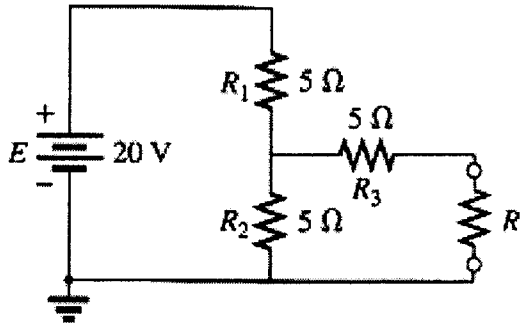

Figure Q3(b)

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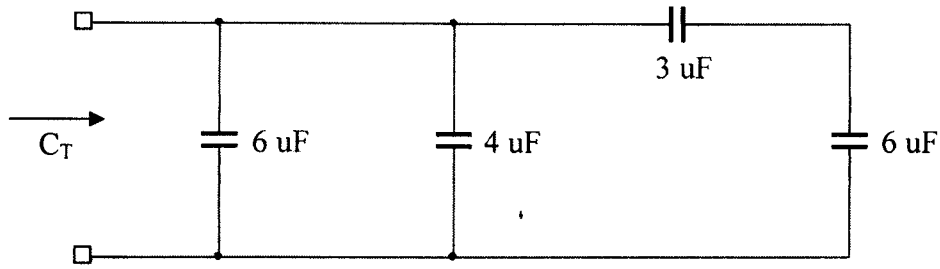

Figure Q4(a)

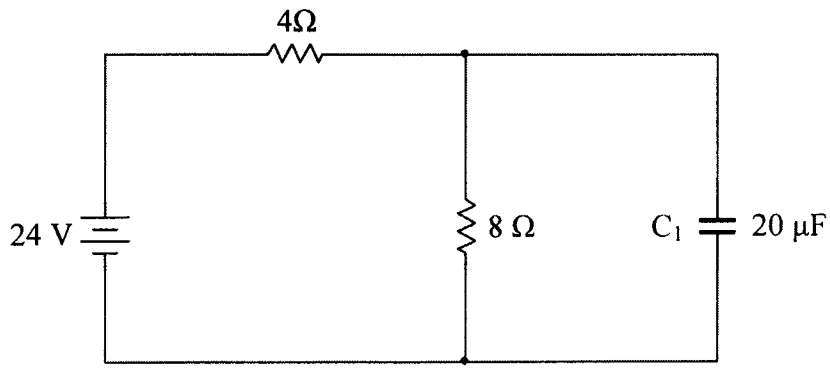

Figure Q4(b)

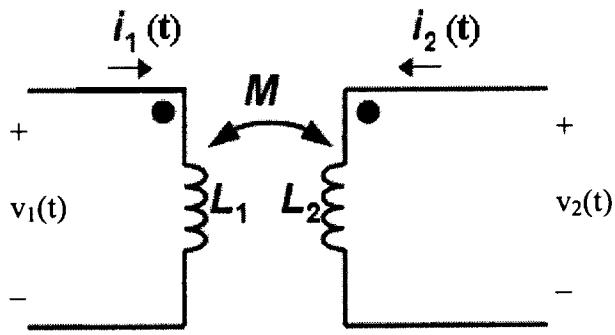

Figure Q4(c)

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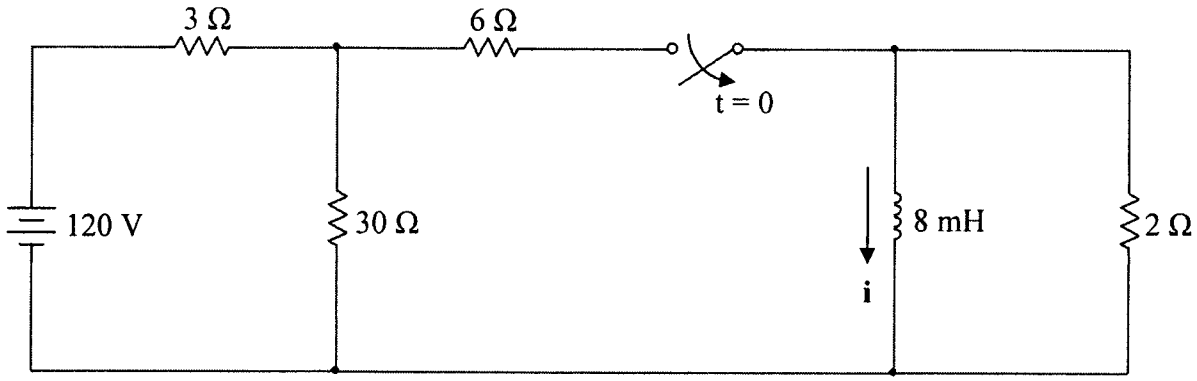

Figure Q5(a)

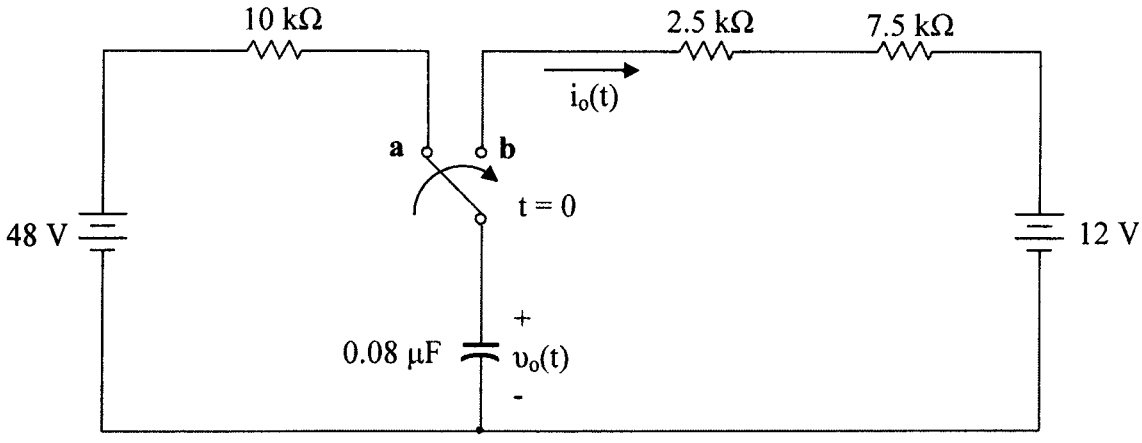

Figure Q5(b)

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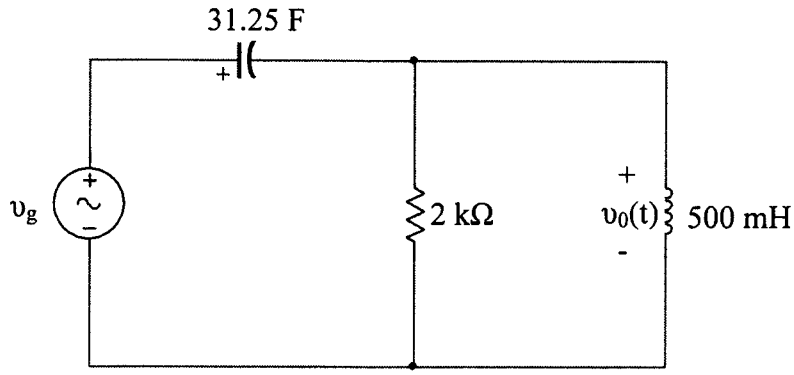

Figure Q6(b)

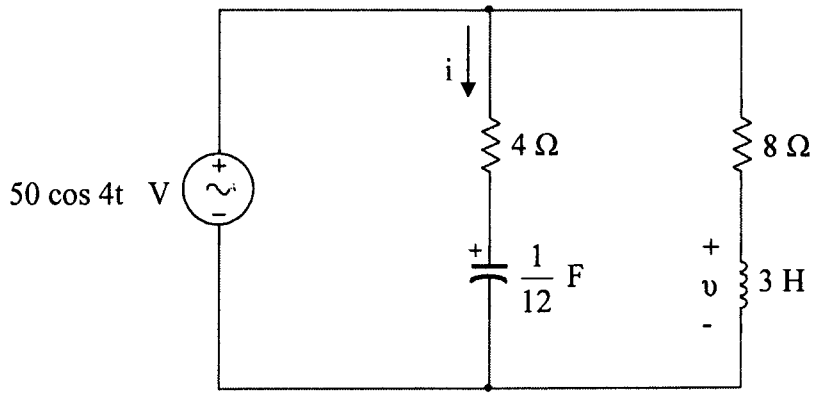

Figure Q6(c)

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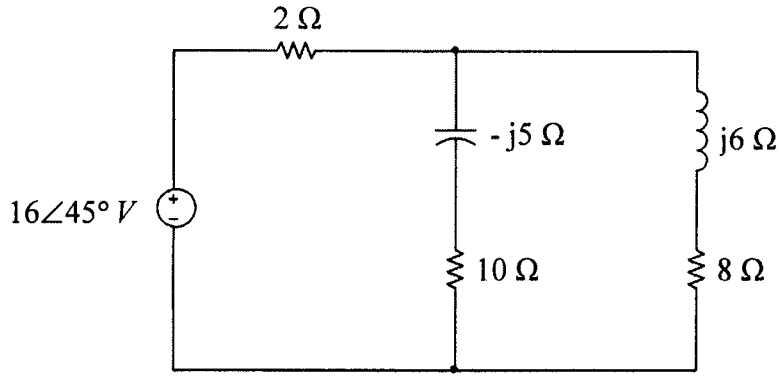

Figure Q7(b)