UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	CIRCUIT THEORY
COURSE CODE	:	DAE 11103
PROGRAMME	:	1 DAE
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	PART A ANSWER **ALL** QUESTIONS PART B ANSWER **TWO (2)** QUESTIONS ONLY

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

PART A

Q1 (a) For the network shown in **Figure Q1(a)**, determine the supply current, I and the source voltage, E.

(10 marks)

(b) The current entering the positive terminal of a device is $i(t) = 6e^{-2t}$ mA and the voltage across the device is $v(t) = 10\frac{di}{dt}$ V.

(i) Find the charge delivered to the device between $t = 0$ and $t = 2\ s$.
(ii) Calculate the power absorbed.
(iii) Determine the energy absorbed in 3 s.

(10 marks)

Q2 Find the current i_o in the circuit shown in **Figure Q2** using

(a) Nodal analysis

(10 marks)

(b) Mesh analysis

(10 marks)

Q3 (a) Use a series of source transformations to find the voltage v in the circuit shown in **Figure Q3(a)**.

(6 marks)

(b) For the circuit shown in **Figure Q3(b)**,

(i) Use the principle of superposition to find the voltage v.
(ii) Find the power dissipated in the 10 Ω resistor.

(7 marks)

(c) For the circuit shown in **Figure Q3(c)**,

(i) Find the value of R_L that results in maximum power being transferred to R_L.
(ii) Calculate the maximum power that can be delivered to R_L.

(7 marks)

PART B

Q4 (a) Determine the equivalent inductance, L_{eq} seen from terminal *a-b* in **Figure Q4(a)**.

(4 marks)

(b) Under steady-state dc conditions, find i_L, v_C and the energy stored in the capacitor and inductor in the circuit in **Figure Q4(b)**.

(6 marks)

(c) The switch in the circuit shown in **Figure Q4(c)** has been in position ***a*** for a long time. At $t = 0$, the switch moves instantaneously to position ***b***.

(i) Find the numerical expression for $i_0(t)$ when $t \geq 0$
(ii) Find the numerical expression for $v_0(t)$ for $t \geq 0^+$

(10 marks)

Q5 (a) Use the concept of the phasor to combine the following sinusoidal functions into a single trigonometric expression:

(i) $y = 100\cos(300t + 45°) + 500\cos(300t - 60°)$
(ii) $y = 250\cos(377t + 30°) - 150\sin(377t + 140°)$

(6 marks)

(b) Determine the instantaneous voltage across a 2 μF capacitor when the current through it is, $i = 4\sin(10^6t + 25°)\ A$.

(4 marks)

(c) A 20 Ω resistor is connected in parallel with a 5 mH inductor. This parallel combination is connected in series with a 5 Ω resistor and a 25 μF capacitor. This interconnection is energized by a sinusoidal voltage source whose voltage is $v = 150\ cos\ 4000t\ V$.

(i) Calculate the impedance of this interconnection.
(ii) Find the steady-state expression of the current in the 5 mH inductor.

(10 marks)

Q6 (a) Given the circuit in **Figure Q6(a),** find the average power supplied or absorbed by each element.

(10 marks)

(b) A 110-V rms, 60-Hz source is applied to a load impedance Z. The apparent power entering the load is 120 VA at a power factor of 0.707 lagging.

(i) Calculate the complex power.
(ii) Find the rms current supplied to the load.
(iii) Determine Z.
(iv) Assuming that $Z = R + j\varpi L$, find the values of R and L.

(10 marks)

- END OF QUESTION -

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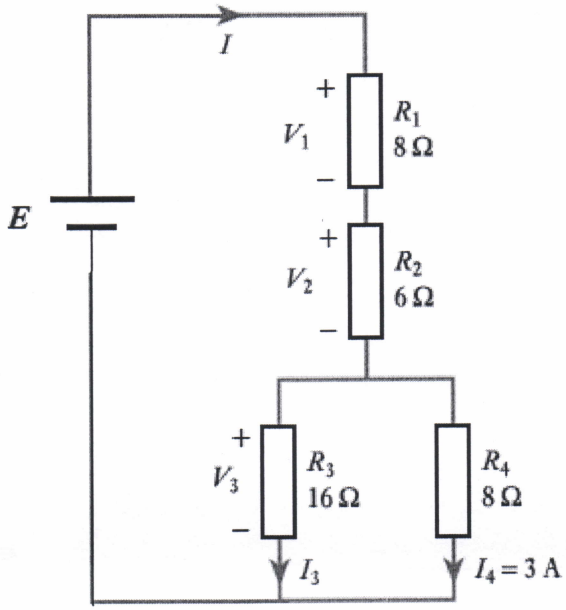

FIGURE Q1(a)

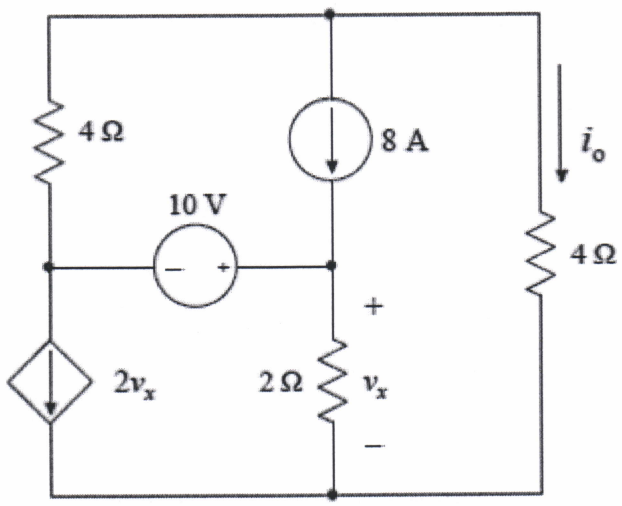

FIGURE Q2

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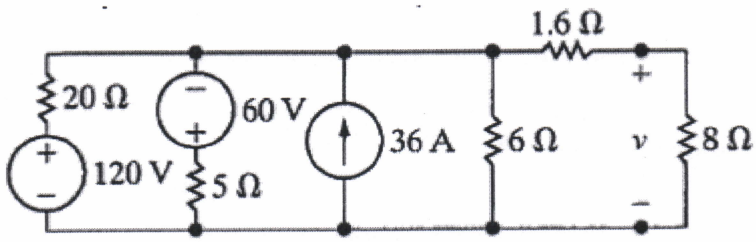

FIGURE Q3(a)

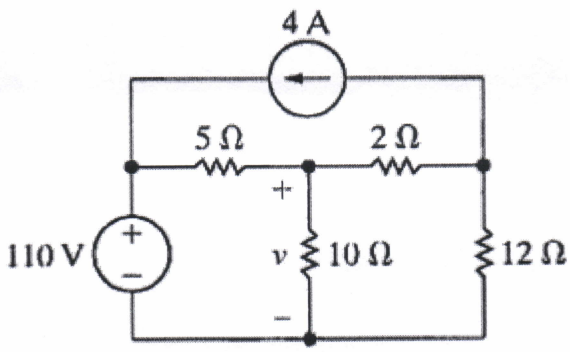

FIGURE Q3(b)

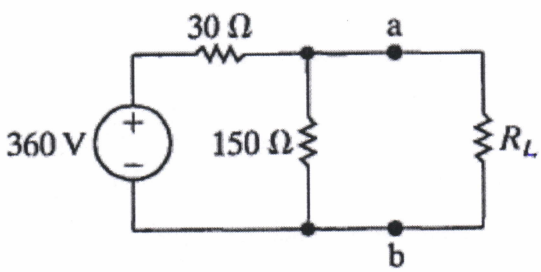

FIGURE Q3(c)

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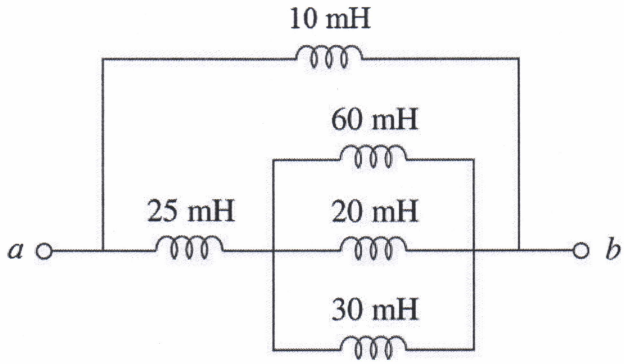

FIGURE Q4(a)

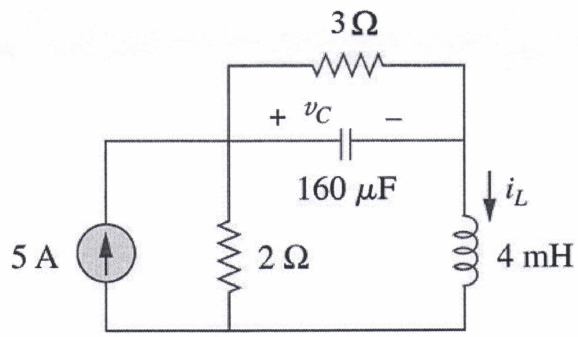

FIGURE Q4(b)

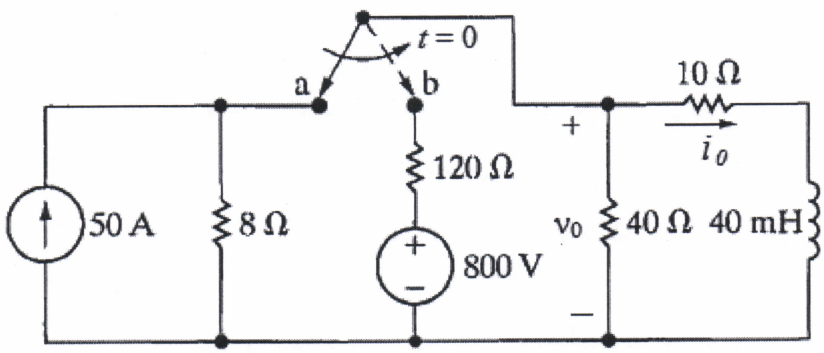

FIGURE Q4(c)

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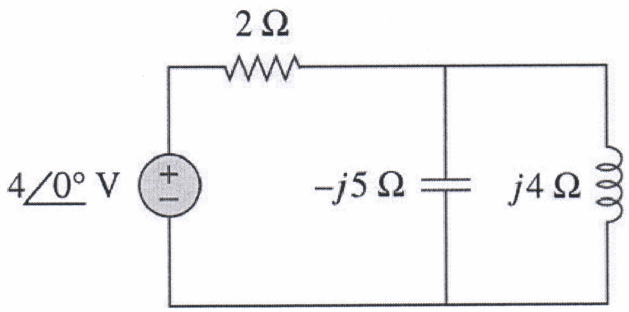

FIGURE Q6(a)