UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2010/2011

COURSE	:	ELECTRIC CIRCUIT ANALYSIS II
COURSE CODE	:	BEF 12503
PROGRAMME	:	1 BEF
EXAMINATION DATE	:	APRIL/MAY 2011
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS PAPER CONSIST OF ELEVEN (11) PAGES

Q1 (a) State the difference between capacitor and resistor in term of its energy characteristic.

(2 marks)

(b) In your own words, explain why the circuit given in **Figure Q1 (b) (i)** can be redrawn as **Figure Q1 (b) (ii)** when it is operating under dc condition. Also, describe how to calculate the energy stored in the inductor and capacitor in **Figure Q1 (b) (i)**.

(4 marks)

(c) Voltage waveform in **Figure Q1 (c) (i)** is applied across the terminal a–b in **Figure Q1 (c) (ii)**. Illustrate:

(i) the current waveform that flows into terminal a-b

(ii) the energy waveform of 100μF capacitor

(9 marks)

(d) If the voltage across a 4 H inductor is given by:

$$v(t) = \begin{cases} 40t^2 \text{ V} & t > 0\text{s} \\ 0 \text{ V} & t < 0\text{s} \end{cases}$$

(i) Calculate the current through the inductor when t = 2ms.

(ii) Calculate the energy stored by the inductor within $0 < t < 7$ s.

(iii) Formulate the equation for instantaneous power of the inductor.

(5 marks)

Q2 (a) List down two (2) ways of supplying energy to the first order circuit.

(2marks)

(b) Explain briefly on the time constant, τ of the first order circuit.

(4 marks)

(c) The switch in the circuit shown in **Figure Q2 (c)** has been closed for a long time and it is opened at t = 0 s. Solve for:

(i) the initial voltage, $v(0)$.

(ii) the initial energy stored in the capacitor.

(iii) the time constant for the circuit.

(iv) the expression of $v(t)$ for t > 0s.

(9 marks)

(d) The switch in the circuit shown in **Figure Q2 (d)** remained connected to the 40V source for a long time. At t = 0s the switch was moved to the 100V supply.

(i) Calculate the initial value $i(0^-)$ and final value $i(\infty)$ of the inductor current $i(t)$.

(ii) Propose the general expression of $i(t)$ in terms of time constant, τ for t > 0s.

(5 marks)

Q3 (a) Define the meaning of second order circuit.

(2 marks)

(b) Explain on the effect of resonant frequency and damping factor to the response of series RLC circuit.

(4 marks)

(c) For the circuit shown in **Figure Q3 (c)**, solve for $v(t)$ when $t > 0$ s.

(9 marks)

(d) For the parallel RLC Circuit shown in **Figure Q3 (d)**:

(i) Deduce its characteristic equation.

(ii) Design a parallel RLC circuit that will produce critically damped response when $R = 2.5\ k\Omega$.

(5 marks)

Q4 (a) Define the meaning of phasors.

(2 marks)

(b) Describe the relationship between the types of load and complex power triangle.

(4 marks)

(c) For the circuit shown in **Figure Q4 (c)**, use mesh analysis to find the mesh currents $i_1(t)$ and $i_2(t)$.Let $v_1(t) = 10\cos 4t$ V and $v_2(t) = 20\cos(4t - 30^\circ)$ V.

(9 marks)

(d) For the circuit shown in **Figure Q4 (d)**:

(i) Determine $i(t)$ by using superposition theorem.

(ii) Deduce the new $i(t)$ if dc voltage is doubled.

(5 marks)

Q5 (a) State the importance of locus diagram.

(2marks)

(b) Give one example of a locus diagram for the circuit given in **Figure Q5 (b)**.

(4 marks)

(c) A 12 Ω resistor is in parallel connection with series combination of a 12 Ω inductive reactance and a resistor which varies from 0 Ω to ∞ Ω. A $120\angle 0^\circ$ V supply is connected at the terminal of those parallel impedances. Illustrate the locus diagram for the total current and use it to solve for:

(i) Current at unity power factor.

(ii) Maximum current and its corresponding power factor.

(iii) Minimum power factor and its corresponding current.

(9 marks)

(d) The total current locus diagram of a parallel circuit that is connected to $120\angle 0^{\circ}$ V supply is shown in **Figure Q5 (d)**.

(i) Analyze the circuit and calculate all of the circuit components if $\omega = 1$ rad/s.

(ii) Propose the maximum real power that can be supplied to the circuit

(5 marks)

Q6 (a) Define the meaning of mutual inductance.

(2 marks)

(b) Explain on how to determine mutual voltage polarity by using dot convention.

(4 marks)

(c) For the circuit given in **Figure Q6 (c)**, solve for the power absorbed by the 4 Ω and 5 Ω resistor.

(9 marks)

(d) For the coupled coils in **Figure Q6 (d)**:

(i) Calculate the total inductance

(ii) By using any two coils in **Figure Q6 (d)**, construct a coupled coils with series opposing condition.

(5 marks)

Q7 (a) State a difference between step up transformer and step down transformer.

(2 marks)

(b) Explain on any two (2) types of transformer losses.

(4 marks)

(c) The secondary winding of a step down transformer has a terminal voltage of $v_s(t) = 282.8 \sin 377t$ V. The turns ratio of the transformer is 100:200. If the secondary current of the transformer is $i_s(t) = 7.07 \sin (377t - 36.87^{\circ})$ A, illustrate the phasor diagram of the transformer. The impedances of this transformer referred to the primary side are

$R_{eq} = 0.20\ \Omega$ $\quad R_C = 300\ \Omega$

$X_{eq} = 0.75\ \Omega$ $\quad X_M = 80\ \Omega$

(9 marks)

(d) For the circuit in **Figure Q7 (d)**:

(i) Calculate the input impedance

(ii) Propose a suitable base voltage and base power at the input terminal such that the per unit input impedance is 0.256 +j0.112 pu

(5 marks)

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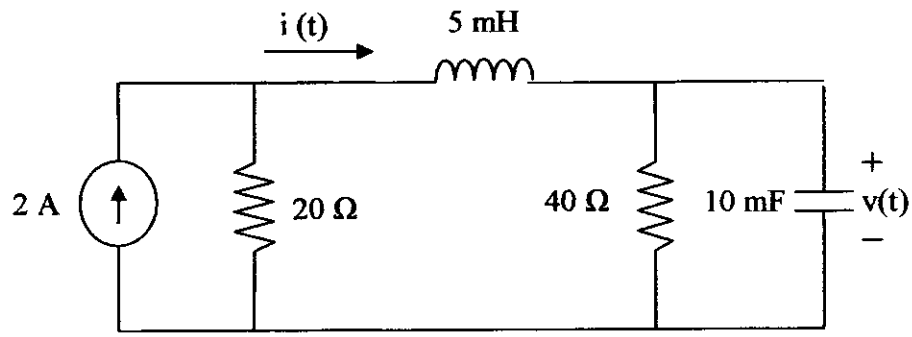

FIGURE Q1 (b) (i)

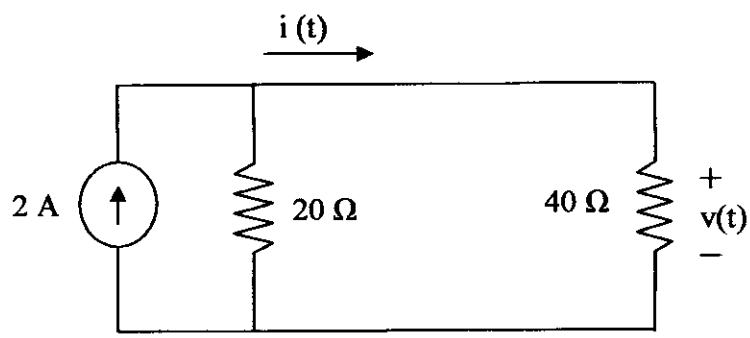

FIGURE Q1 (b) (ii)

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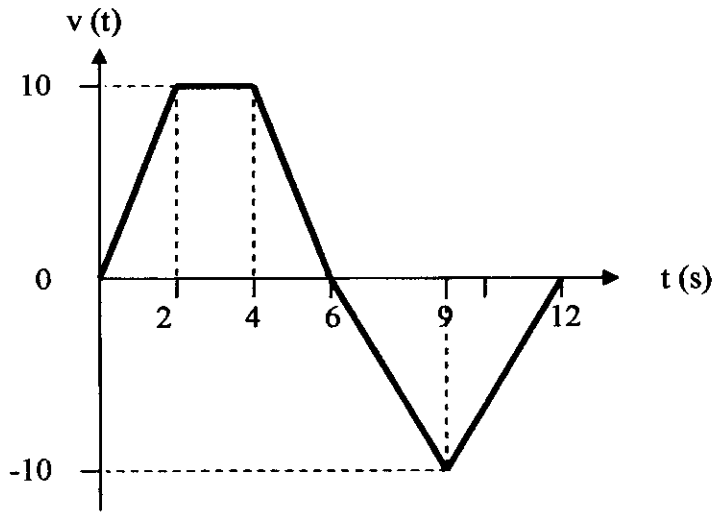

FIGURE Q1 (c) (i)

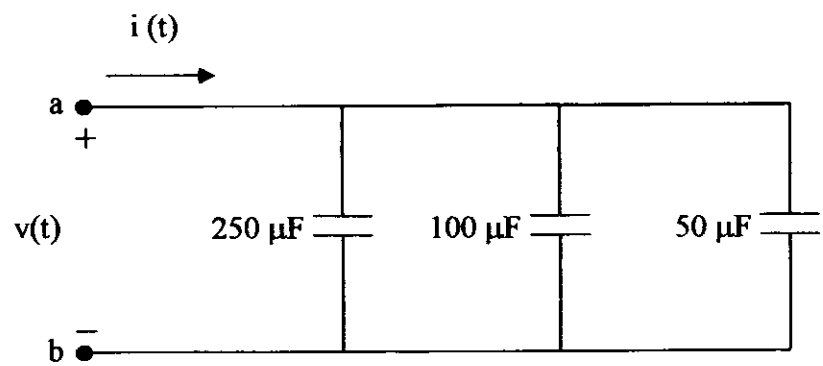

FIGURE Q1 (c) (ii)

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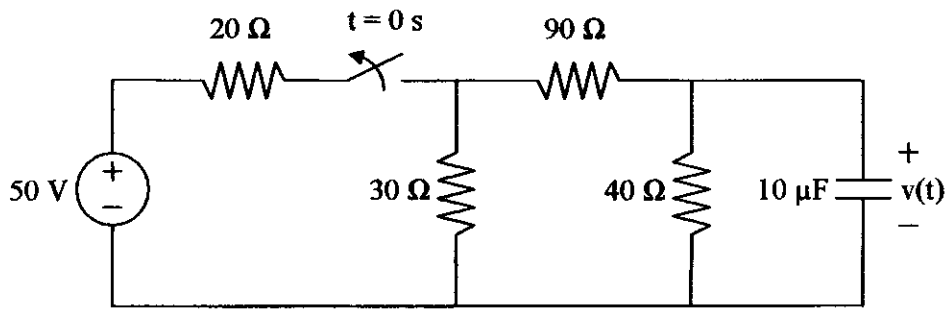

FIGURE Q2 (c)

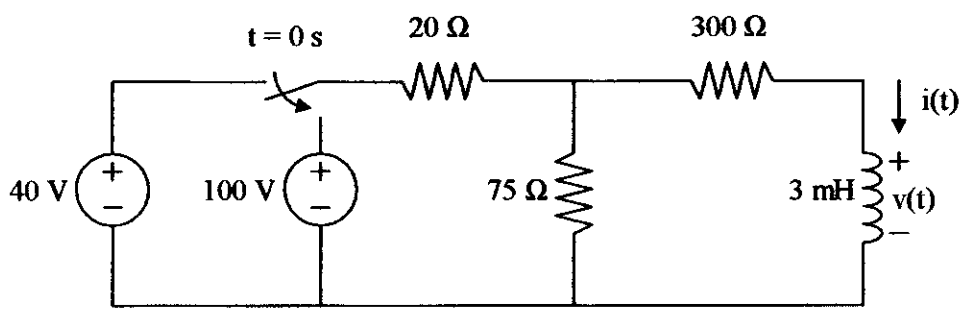

FIGURE Q2 (d)

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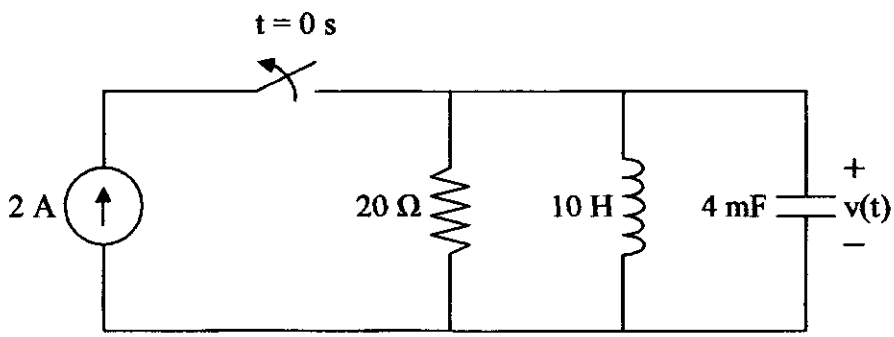

FIGURE Q3 (c)

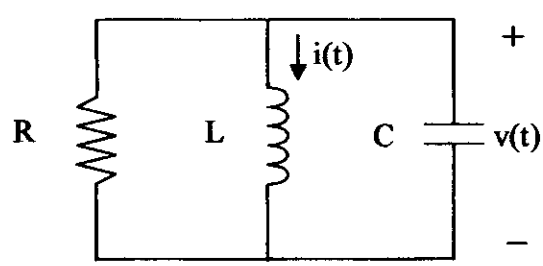

FIGURE Q3 (d)

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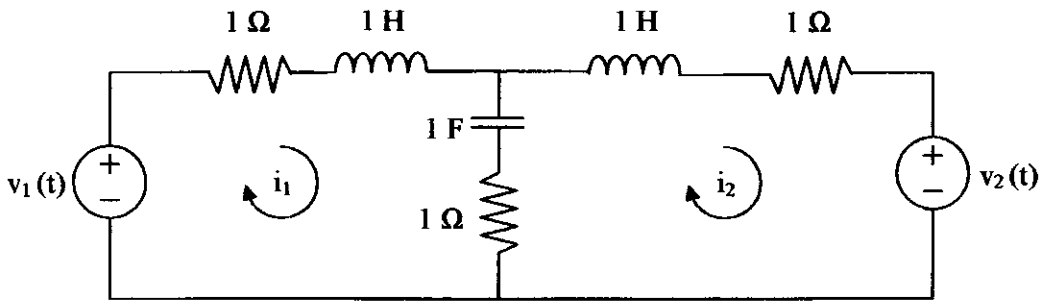

FIGURE Q4 (c)

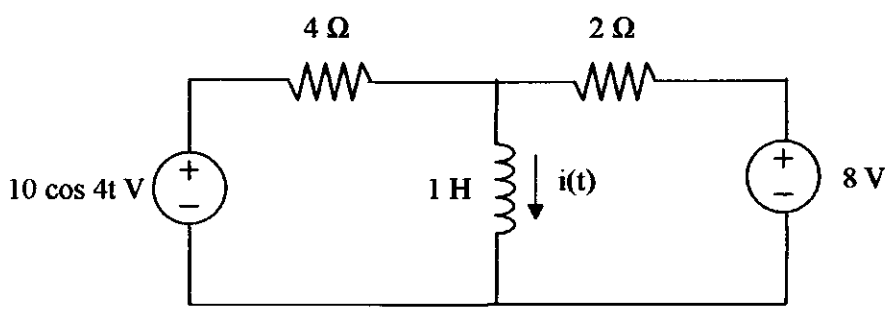

FIGURE Q4 (d)

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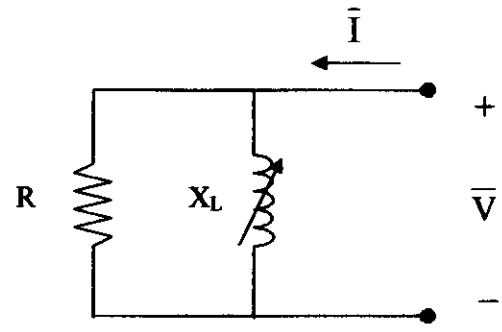

FIGURE Q5 (b)

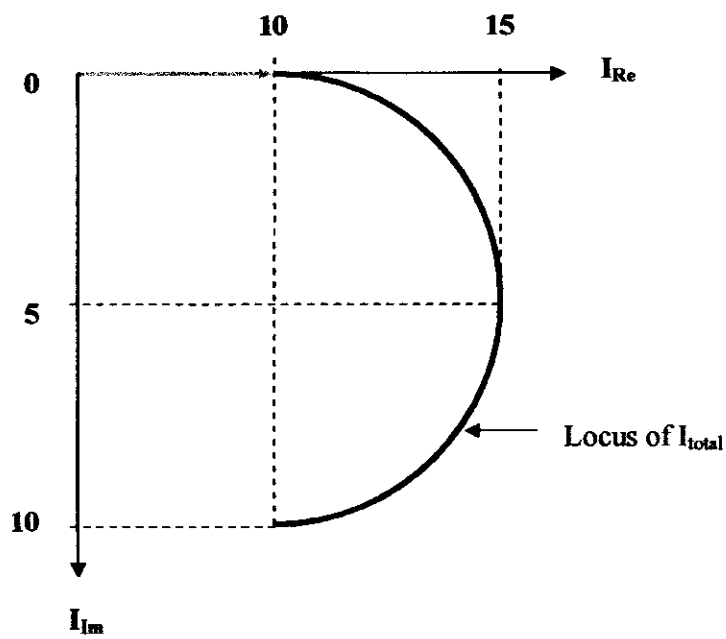

FIGURE Q5 (d)

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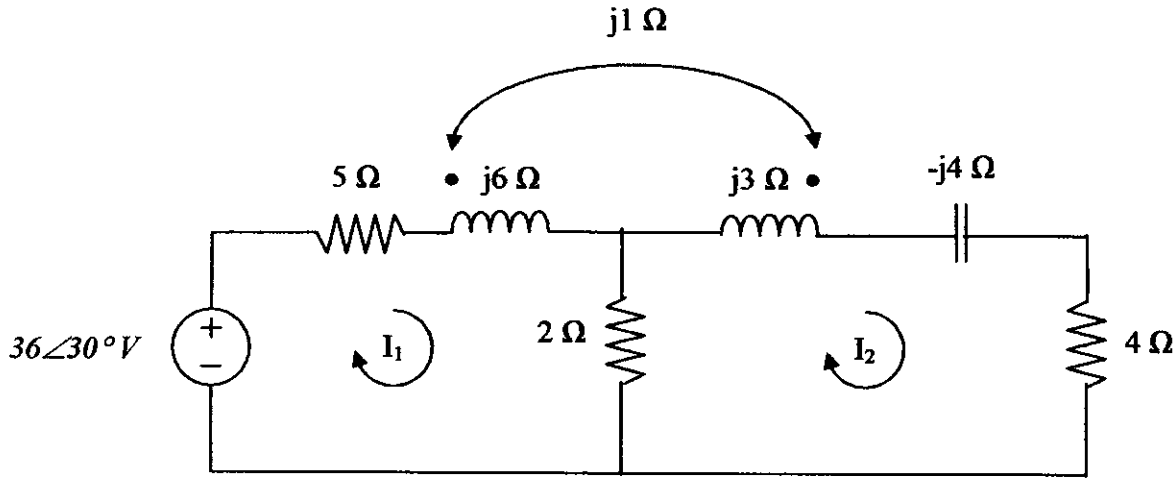

FIGURE Q6 (c)

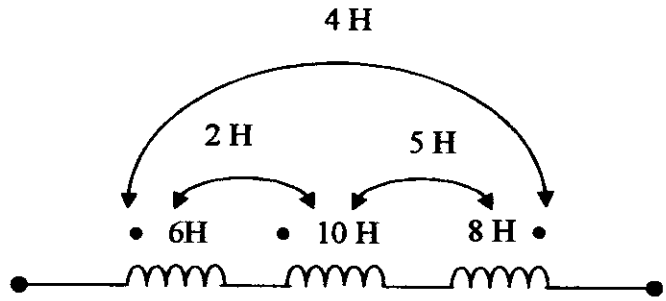

FIGURE Q6 (d)

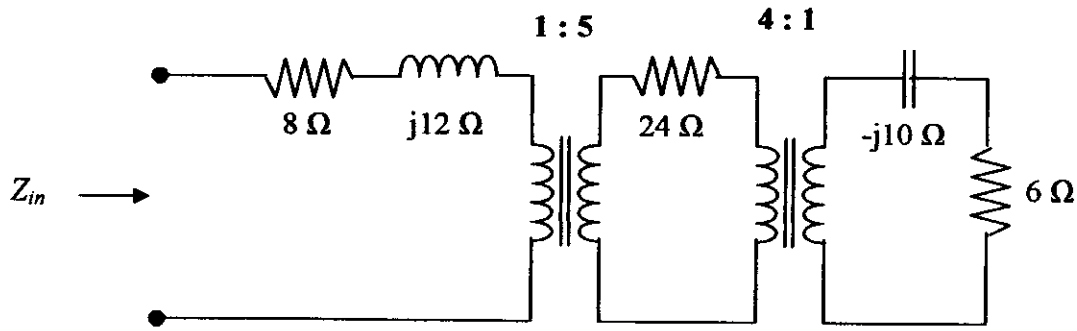

FIGURE Q7 (d)