Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	ELECTRIC NETWORK ANALYSIS & SYNTHESIS
COURSE CODE	:	BEE 3113
PROGRAMME	:	BEE
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Explain the term transfer function of any electric network. Briefly describe the meanings of pole and zero.

(4 marks)

(b) Given a function of a system is

$$h(t) = \frac{250}{3}(25e^{-100t} - e^{-4t})u(t)$$

(i) Find the transfer function, $H(s)$ of this system.

(4 marks)

(ii) Sketch a pole-zero map of the transfer function, $H(s)$.

(3 marks)

(iii) By using semilog graph paper, draw the magnitude response of $H(s)$.

(6 marks)

(iv) From the magnitude response plotted in Question **(b)(iii)**, identify the type of filter this system produced, maximum gain (in dB) and its operating frequency range.

(3 marks)

Q2 (a) Explain the difference between natural response and forced response of any electric network.

(4 marks)

(b) The switch in the circuit in Figure **Q2(b)** has been closed for a very long time before opening at $t = 0$ s.

(i) Show that the initial condition for capacitor, $v_o(0) = 70$ V.

(5 marks)

(ii) Construct the s-domain circuit for $t > 0$ s. Include all the initial conditions for energy storage elements if available. Name the type of response exists during this time.

(3 marks)

(iii) Analyse the circuit to obtain $V_O(s)$, $i_L(t)$ and $v_O(t)$.

(10 marks)

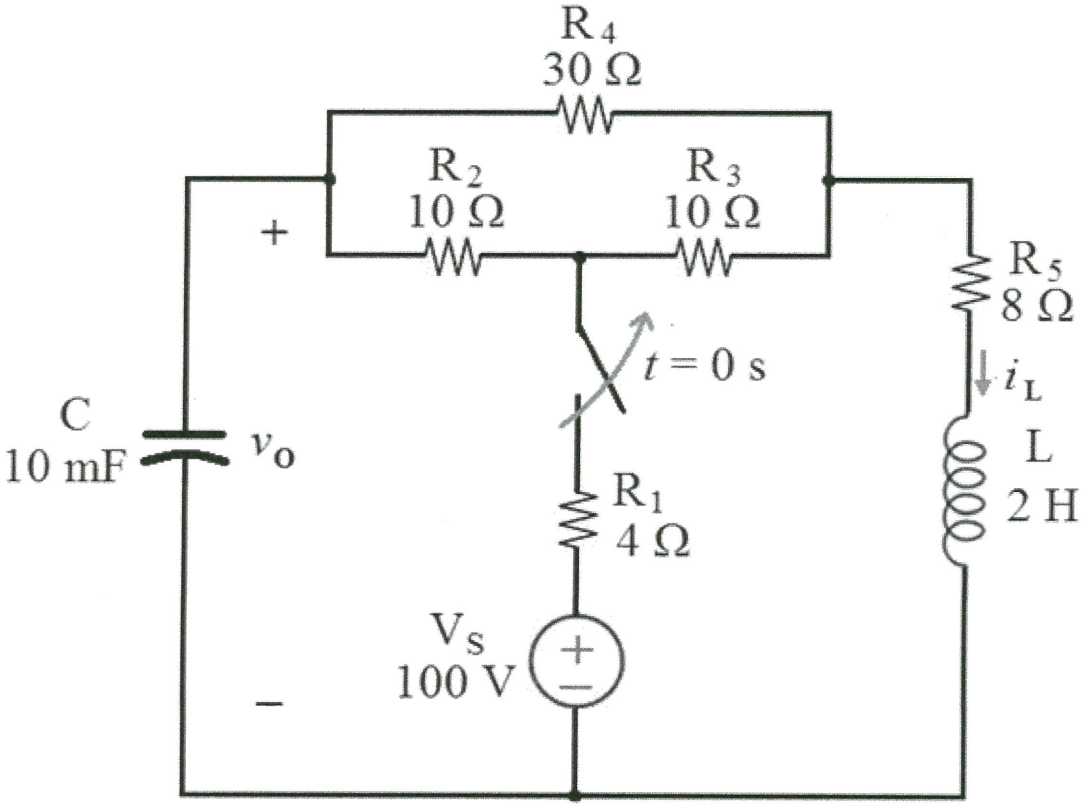

FIGURE Q2(b)

Q3 (a) Describe only **THREE (3)** out of four basic types of filter and sketch its frequency response.

(6 marks)

(b) The electric network in Figure **Q3(b)** behaves as filter for specified frequency range.

(i) Explain how the resonant phenomenon could be materialized in an electric network.

(2 marks)

(ii) Prove that its resonant frequency, ω_0 is

$$\omega_0 = \frac{1}{\sqrt{CL}}\sqrt{1 - \frac{L}{CR^2}}$$

(6 marks)

(iii) Given that the resistor, R is 1 Ω and the capacitance is twice of inductance, calculate the value of L and C to produce the resonant frequency of 100 rad/s.

(4 marks)

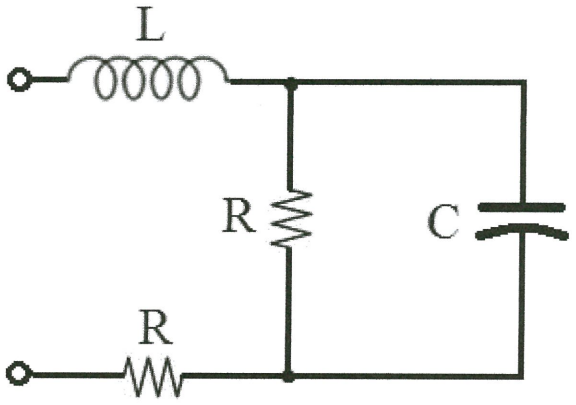

FIGURE Q3(b)

Q4 (a) Explain **ONE (1)** advantage of using two-port network in circuit analysis.
(2 marks)

(b) In an experiment on a two-port network, the following observations are recorded:

- with port 1 open-circuited and $V_2 = 10$ V, it is found that $V_1 = 25$ mV and $I_2 = 5$ mA
- with port 2 short-circuited and $V_1 = 20$ V, it is found that $I_1 = 10$ mA and $I_2 = 1$ A.

Obtain the Y-parameter of the two-port network. Determine whether this is a reciprocal network.
(10 marks)

(c) The hybrid parameter model of the circuit shown in Figure **Q4(c)** is

$$\begin{bmatrix} A\,\Omega & 0.1 \\ B & 0.6\,S \end{bmatrix}$$

Determine A and B.
(8 marks)

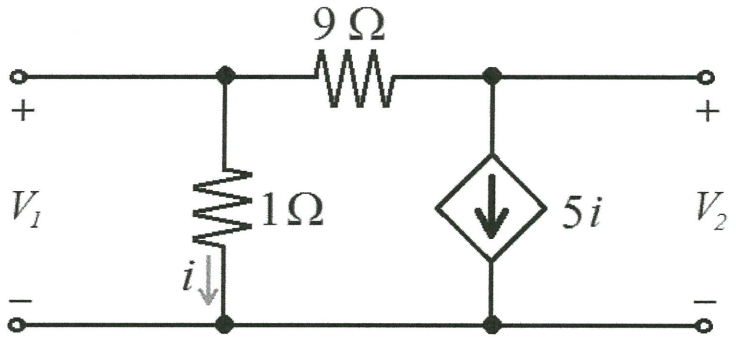

FIGURE Q4(c)

Q5 (a) Explain briefly the importance of Fourier Transform over Fourier series.
(2 marks)

(b) The input voltage in the circuit in Figure **Q5(b)** is $v_i(t) = 30e^{-|t|}$ V.

(i) Sketch the input signal, $v_i(t)$. By using the definition of Fourier Transform, determine the Fourier Transform of $v_i(t)$.
(6 marks)

(ii) Express the transfer function of the circuit in terms of R_1, R_2 and C. What can be concluded from this transfer function in terms of circuit's behaviour as the frequency of the input signal is varied?
(6 marks)

(iii) Determine $v_0(t)$ if the values of resistors R_1 and R_2 are 20 Ω and 80 Ω respectively, while the value of capacitor C is 0.125 F.
(6 marks)

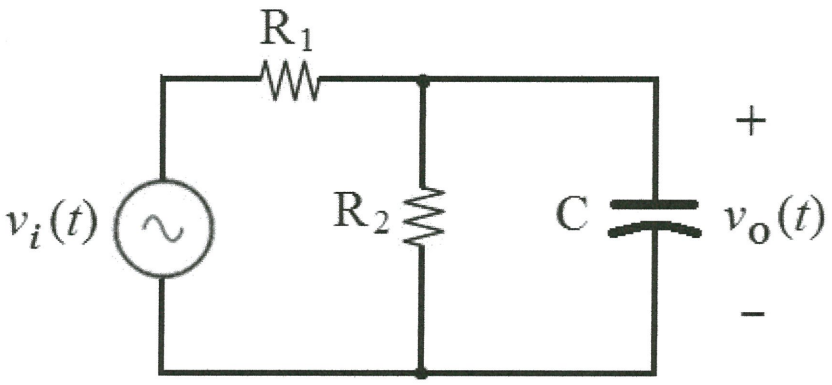

FIGURE Q5(b)

- END OF QUESTION -