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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	: ELECTRIC NETWORK ANALYSIS & SYNTHESIS
COURSE CODE	: BEE 3113 / BEX 31303
PROGRAMME	: BEE
EXAMINATION DATE	: JUNE 2013
DURATION	: 3 HOURS
INSTRUCTION	: ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

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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 part (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) Analyze the circuit to obtain $V_O(s)$, $i_L(t)$ and $v_O(t)$.

(8 marks)

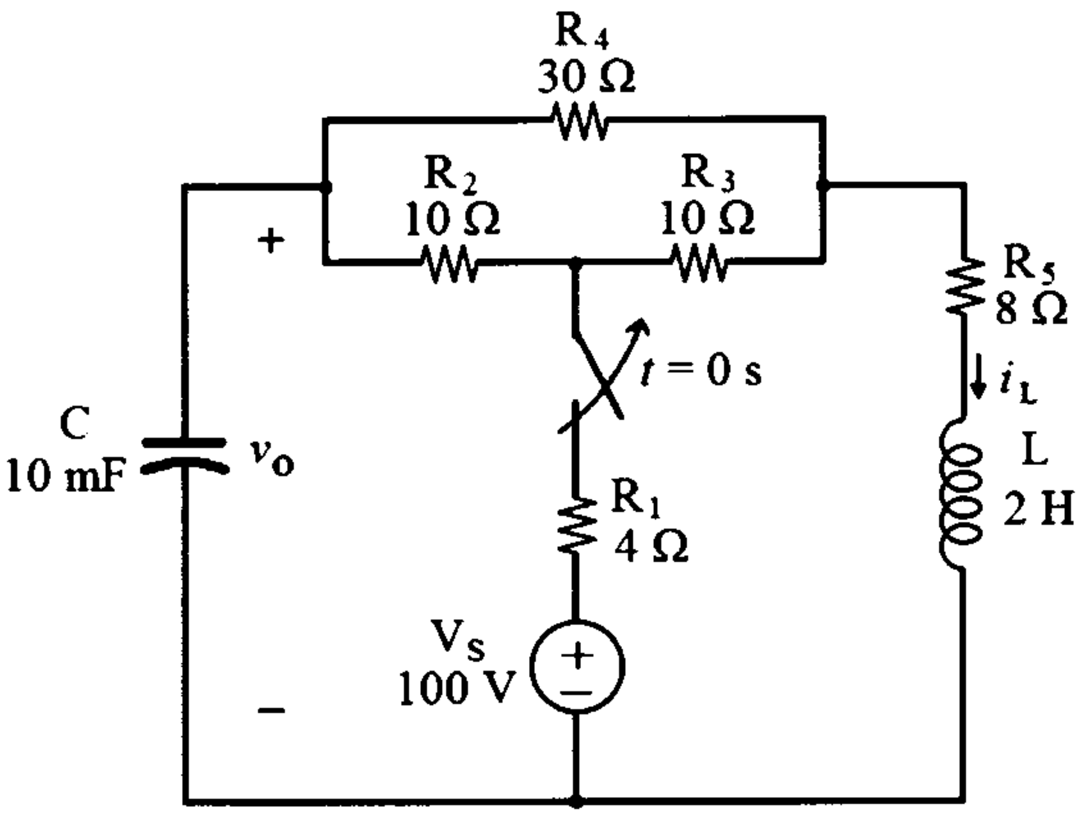

FIGURE Q2(b)

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)

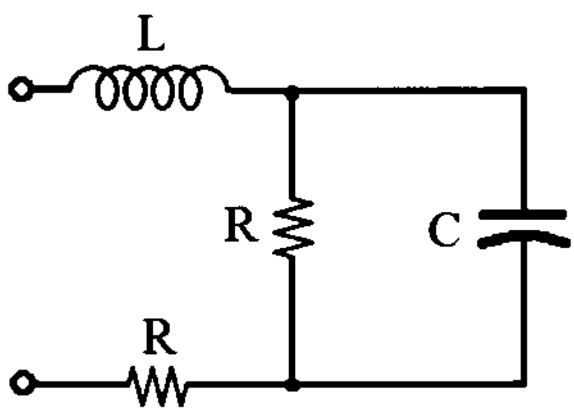

FIGURE Q3(b)

Q4 (a) Explain one advantage of using two-port network in circuit analysis.

(2 marks)

(b) Two sets of measurements are taken from a two-port network. The first set is made with port 2 open-circuited, and the second set is made with port 2 short circuited. The results are indicated in **Table Q4**. Find the hybrid (h) parameter for this network.

(12 marks)

TABLE Q4

Set 1 **When Port 2 is open-circuited**	**Set 2** **When Port 2 is short-circuited**
$V_1 = 10$ mV	$V_1 = 24$ mV
$I_1 = 10\mu$A	$I_1 = 20\mu$A
$V_2 = -20$ V	$I_2 = 1$ mA

(c) Calculate the Admittance parameters represented by the network shown in **Figure Q4(c)**.

(6 marks)

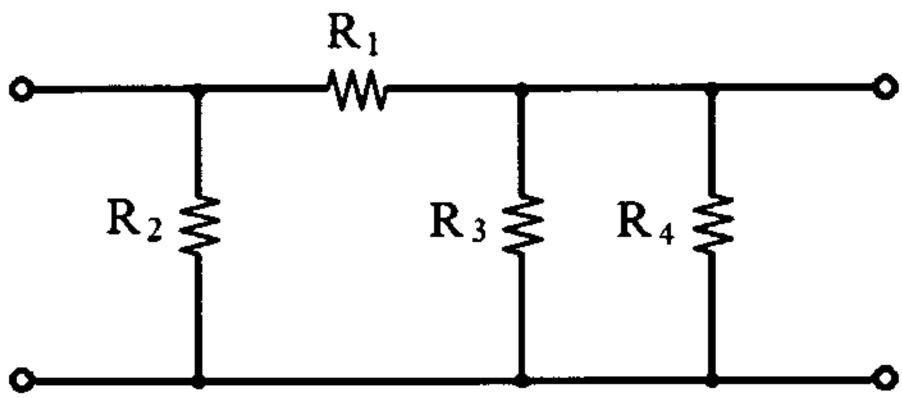

FIGURE Q4(c)

Q5 (a) Briefly explain 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)

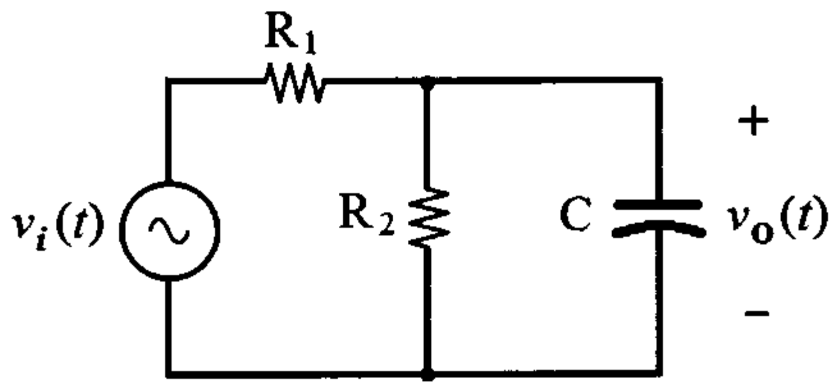

FIGURE Q5(b)

- END OF QUESTION -

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TABLE 1

No.	f(t)	F(s)
1.	$\delta(t)$	1
2.	u(t)	1/s
3.	tu(t)	$1/s^2$
4.	t^n u(t)	$(n!)/s^{n+1}$
5.	e^{-at} u(t)	1/(s+a)
6.	$\sin\omega t$ u(t)	$\omega/(s^2+\omega^2)$
7.	$\cos\omega(t)$ u(t)	$s/(s^2+\omega^2)$
8.	f(t-T)	$e^{-Ts}F(s)$
9.	e^{-at} f(t)	F(s+a)
10.	$e^{-at}\sin\omega t$ u(t)	$\omega/((s+a)^2+\omega^2)$
11.	$e^{-at}\cos\omega t$ u(t)	$(s+a)/((s+a)^2+\omega^2)$

TABLE 2

TYPE	$f(t)$	$F(\omega)$
Impulse	$\delta(t)$	1
Constant	A	$2\pi A\,\delta(\omega)$
Signum	$\mathrm{sgn}(t)$	$2/j\omega$
Step	$u(t)$	$\pi\,\delta(\omega)+1/j\omega$
Positive-time exponential	$e^{-at}u(t)$	$1/(a+j\omega), a>0$
Negative-time exponential	$e^{at}u(-t)$	$1/(a-j\omega), a>0$