3E1493

Roll No. : _____ Total Printed Pages : 8

3E1493

B. Tech. (Sem. III) (Main & Back) Examination, January - 2013
Electronics & Communication
3EC3 Circuit Analysis & Synthesis (Common for AI, EC & EI)

Time : **3** Hours] [Total Marks : **80**
[Min. Passing Marks : **24**

*Attempt any **five** questions. Selecting **one** question from each unit. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) What do you understand by the term compensation ? For a linear time-invarient network as given in **fig. 1.1**, deduce the change in the current, if the impedance of an uncoupled branch is changed. Find the voltage across BD, when the resistor in the branch BC is changed from R to $(R+\Delta R)$.

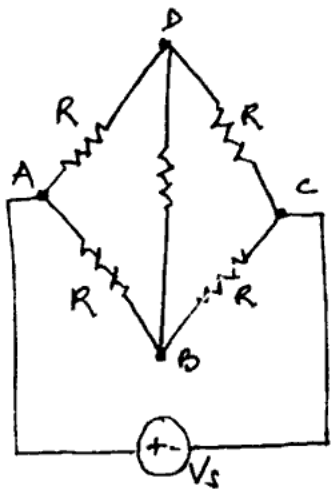

Figure 1.1

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(b) Calculate the effective inductance of the circuit given in **fig. 1.2** across AB.

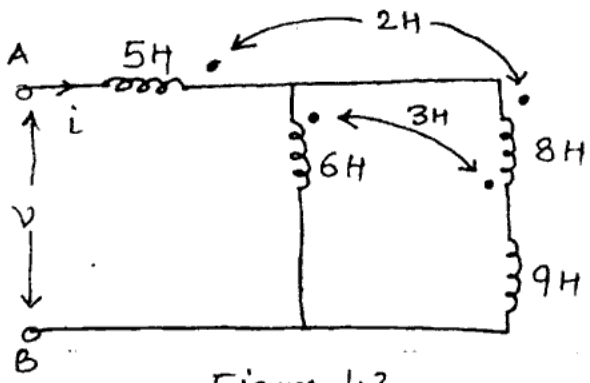

Figure 1.2

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OR

1 (a) Determine the Thevenin's equivalent of the circuit shown in **fig. 1.3**.

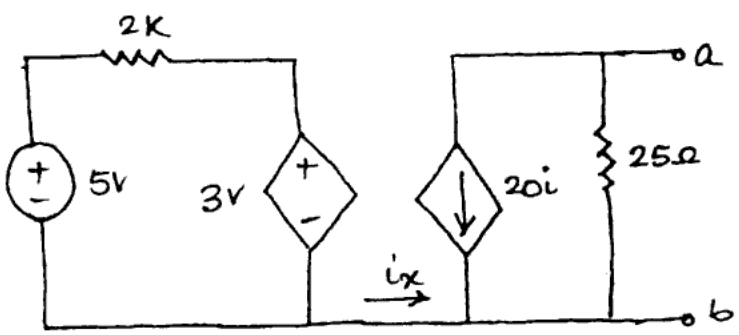

Figure 1.3

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(b) Determine the load resistance to receive maximum power from the source. Also, find the maximum power delivered to the load in the circuit given in **fig. 1.4.**

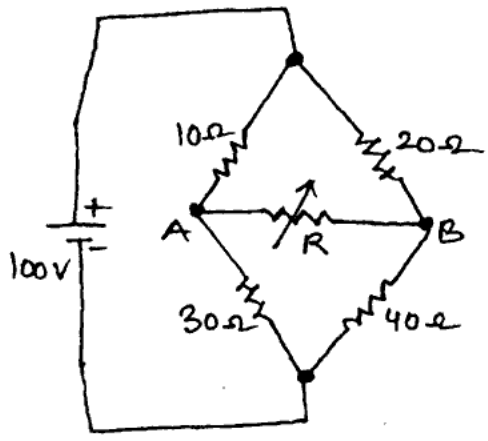

Figure 1.4

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UNIT - II

2 (a) Find out the unit step response for i_L in the network given in **fig. 2.1,** for a given condition that $i_L(0) = 0$.

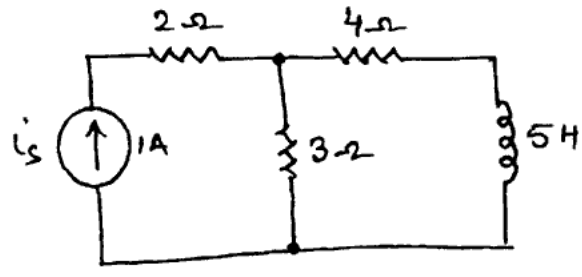

Figure 2.1

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(b) The circuit shown in **fig. 2.2,** consists of a series RLC circuit with $R = 10\Omega$, $L = 0.5H$, $C = 200\,\mu F$ has a sinusoidal voltage $v = 150\sin(200t + \phi)$. If the switch is closed at $\phi = 30^0$, determine the current equation.

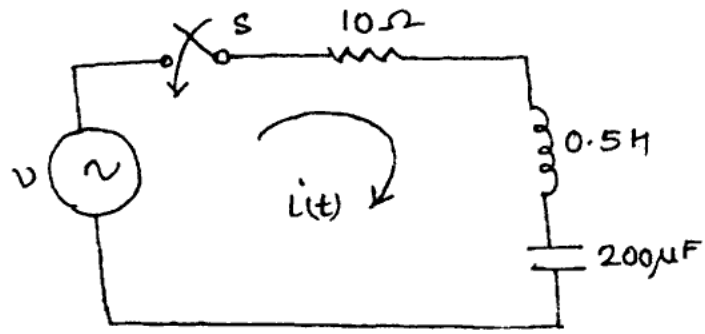

Figure 2.2

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OR

2 (a) In a series RL circuit shown in **fig. 2.3,** a sinusoidal voltage $v = V_m \sin\omega t$ is applied at $t = 0$ through the switch 'S'. The switch has been open for a long time. Use Laplace transformation method to determine $i_L(t)$ for $t > 0$.

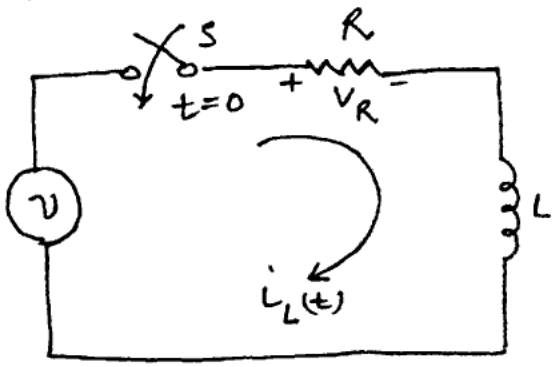

Figure 2.3

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(b) Determine the Fourier series expansion of the periodic waveform given in **fig. 2.4.**

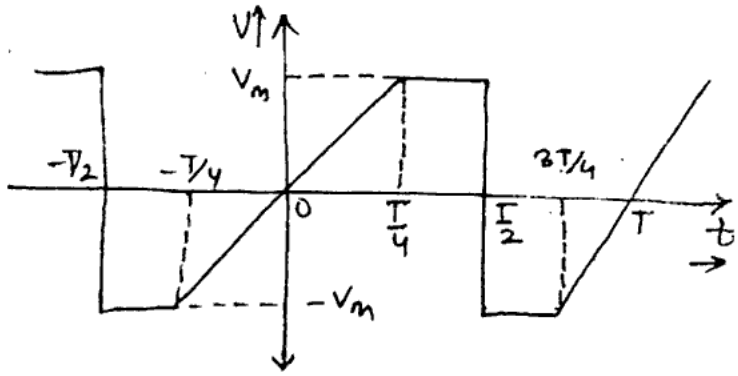

Figure 2.4

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UNIT - III

3 (a) In a two-port network, the voltage gain is given by :

$$\frac{V_2(s)}{V_1(s)} = \frac{s+2}{s^2+1}$$

Determine the output voltage, if the input is :

(i) a unit impulse

(ii) a unit step

(iii) e^{-t}

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(b) For the network shown in **fig. 3.1,** determine the transfer function $G_{21}(s)$ and $Z_{21}(s)$. Also, find the driving point impedance $Z_{11}(s)$.

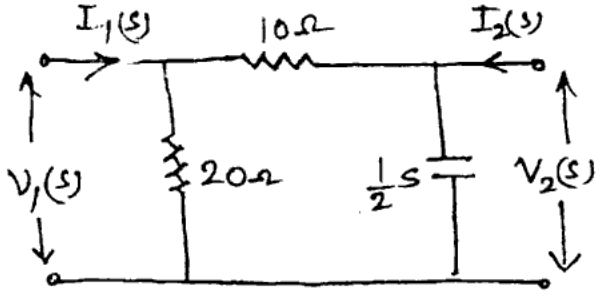

Figure 3.1

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OR

3 (a) For a given network function, draw the pole-zero diagram and hence deduce the time domain response $i(t)$:

$$I(s) = \frac{5s}{(s+1)\left(s^2+4s+8\right)}$$

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(b) How to determine the quality factors from the pole positions of a network function. For the given network function :

$$H(s) \frac{10s}{s^2+30s+10^6}$$

Determine the resonant frequency lower and upper half-power frequencies, and quality factor.

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UNIT - IV

4 (a) Find the impedance parameters of following RC ladder network given in **fig. 4.1.**

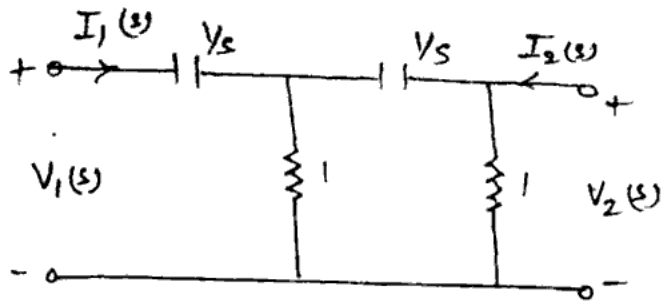

Figure 4.1

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(b) For the network shown in **fig. 4.2**, find Y-parameters.

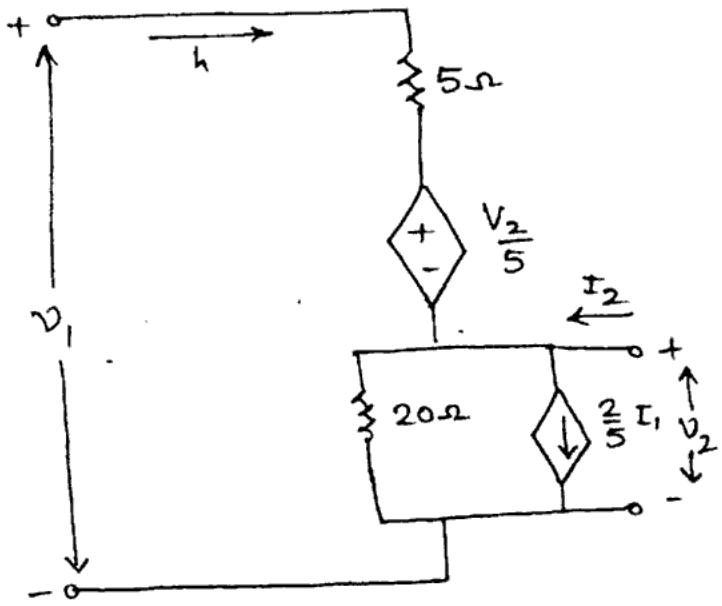

Figure 4.2

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OR

4 (a) Determine Y_i for 3-terminal network given in **fig. 4.3**.

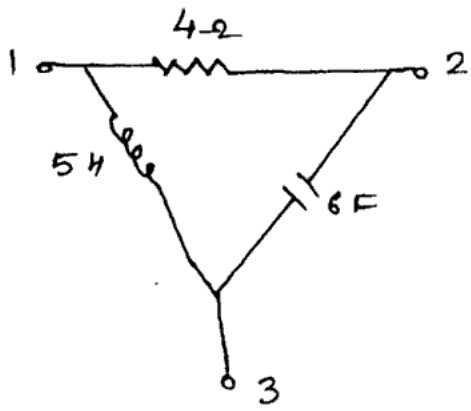

Figure 4.3

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(b) For the network given in **fig. 4.4**, determine the h-parameters at $\omega = 10^8$ rad/sec.

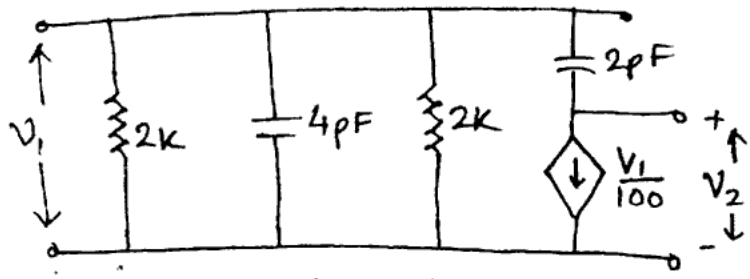

Figure 4.4

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UNIT - V

5 (a) Show that the function $\frac{s(3s+8)}{(s+1)(s+3)}$ represents an RL immitance. Also, realize the impedance in Foster form. 6

(b) Find the Foster's I and II form and Cauer's I and II form of the RC driving point impedance :

$$Z_{RC}(s) = \frac{(s+2)(s+5)}{(s+1)(s+3)}$$

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OR

5 (a) Check the following function for positive reality :

(i) $Z(s) = \frac{(s^2+2s+25)}{(s+4)}$

(ii) $F(s) = \frac{(s^4+4s^3+3s^2+1)}{(s^4+2s^2+1)}$

3×2

(b) An impedance function is given by :

$$Z(s) = \frac{(s+1)(s+4)}{s(s+2)(s+5)}$$

Find the RC representation of :
(i) Second Foster form
(ii) Second Cauer form.

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