

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-invariant 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  $(R + \Delta R)$ .

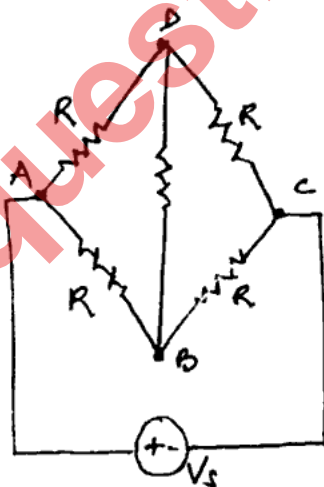


Figure 1.1



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

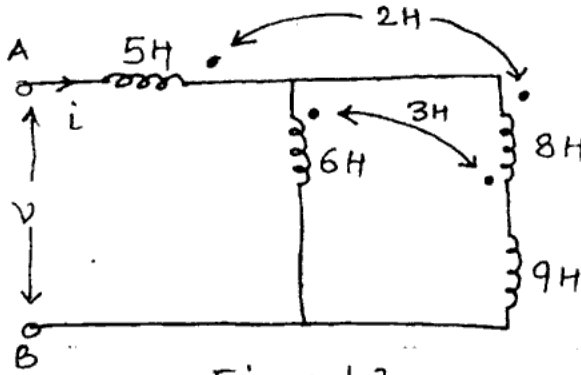


Figure 1.2

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OR

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

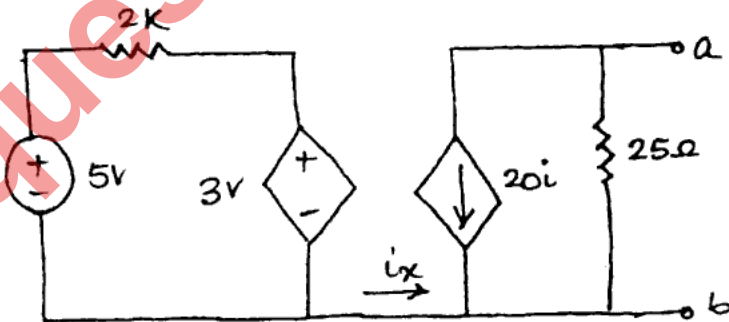


Figure 1.3

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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.

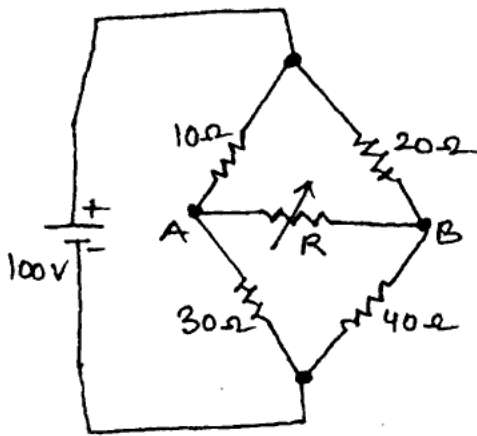


Figure 1.4

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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  $i_L(0) = 0$ .

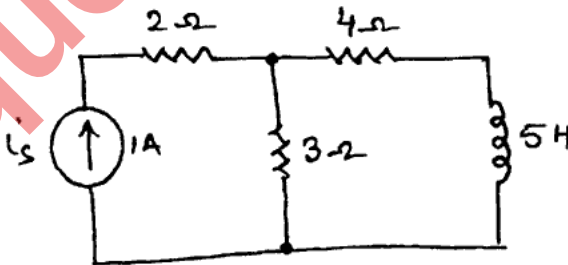


Figure 2.1

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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  $\phi=30^\circ$ , determine the current equation.

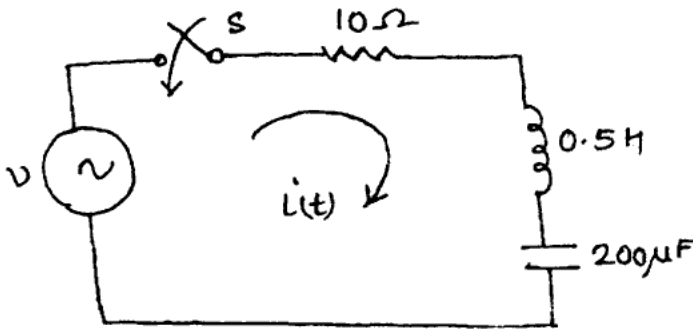


Figure 2.2

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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  $t > 0$ .

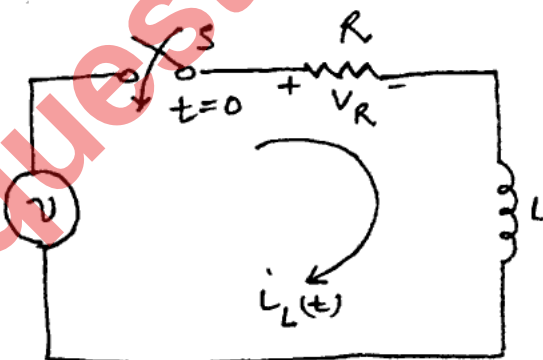


Figure 2.3

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

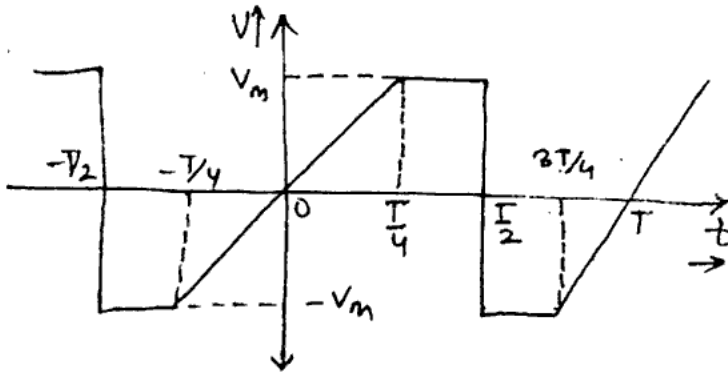


Figure 2.4

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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 :

- a unit impulse
- a unit step
- $e^{-t}$

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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  $Z_{11}(s)$ .

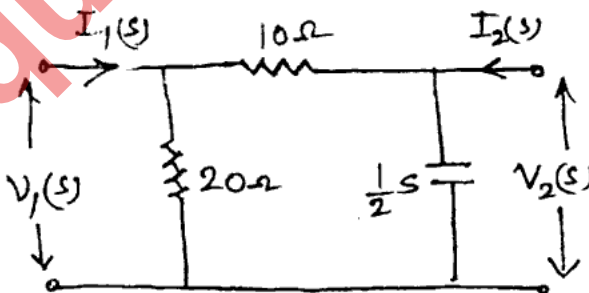


Figure 3.1

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OR



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

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

- (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. [rtuonline.com](http://rtuonline.com)

#### UNIT - IV

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

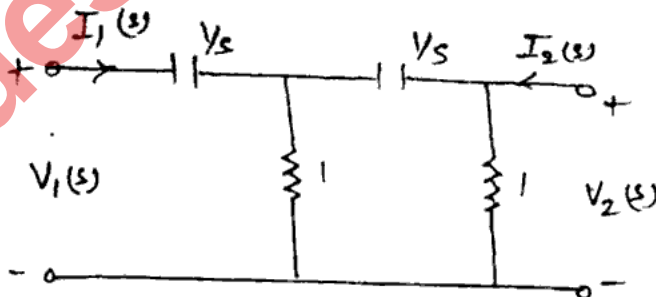


Figure 4.1



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

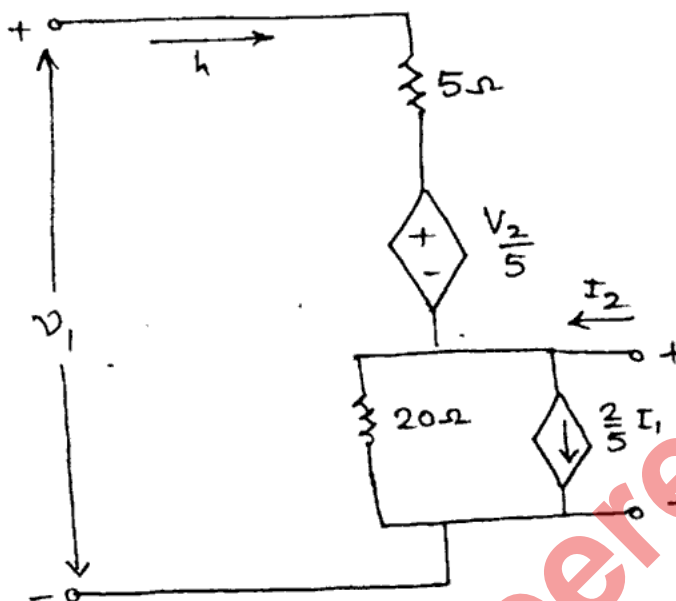


Figure 4.2

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OR

4 (a) Determine  $Y_1$  for 3-terminal network given in fig. 4.3.

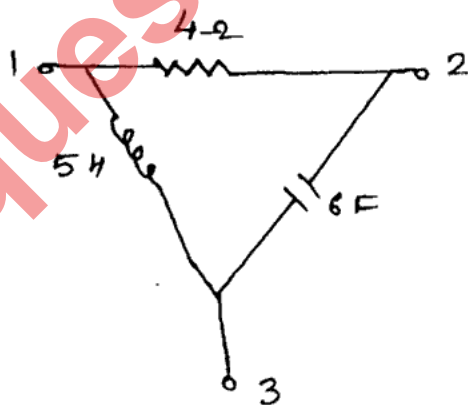


Figure 4.3

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

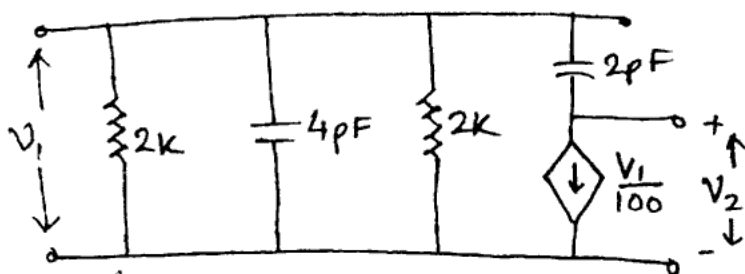


Figure 4.4

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### UNIT - V

- 5 (a) Show that the function  $\frac{s(3s+8)}{(s+1)(s+3)}$  represents an RL immittance. 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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