

Number of Printed Pages — 7

**EE-301**

**B.TECH.**

THIRD SEMESTER EXAMINATION, 2001-2002

**NETWORK AND SYSTEMS**

Time—3 Hours

Total Marks—100

**Note :** Answer all the *Five* questions.

1. Answer any *Two* parts of the following :— 10 × 2

(a) Draw the graph and find a tree for the network shown in figure-1. Considering 'O' as a datum node and assuming elements BD and BC as links, determine the tie-set schedule, branch impedance matrix and source voltage matrix. Obtain the loop equations using the above said matrices.

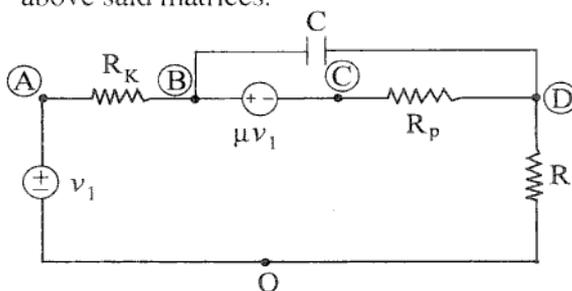


Figure-1

(b) (i) The fundamental cut-set matrix is given as :

Cut-Sets	Branches				Links		
	1	2	3	4	5	6	7
1	0	0	0	0	-1	0	0
0	1	0	0	0	1	0	1
0	0	1	0	0	0	1	1
0	0	0	1	0	0	1	0

Draw the oriented graph of the network.

- (ii) Derive general equilibrium equation of a network using cut-set matrix  $Q$ , branch admittance  $[Y_b]$ , current source vector  $[I_s]$  and voltage source vector  $[V_s]$
- (c) The switch in circuit of figure-2 has been closed for a very long time. It opens at  $t = 0$ . Find  $V_c(t)$  for  $t > 0$  using differential equation approach.

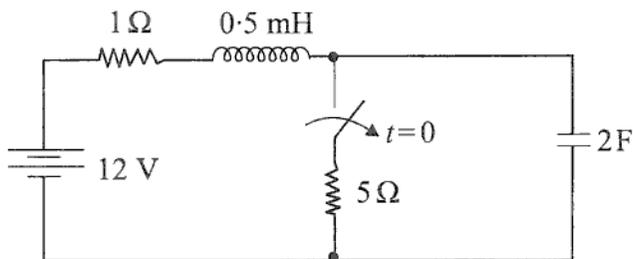


Figure-2

2. Answer any *Four* parts of the following :— 5 × 4

- (a) Find the Norton's equivalent of the network shown in figure-3.

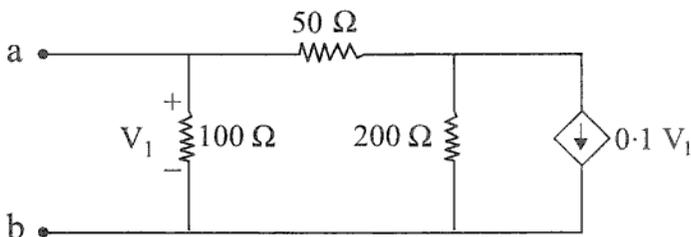


Figure-3

- (b) In the network shown in figure-4, two voltage sources act on a load impedance connected to terminals  $a$  and  $b$ . If the load is variable both in reactance and resistance, what load will  $Z_L$  receive the maximum power ?

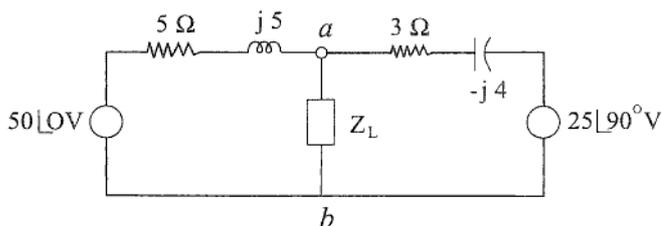


Figure-4

- (c) Determine the current in the capacitor branch by superposition theorem in circuit of figure-5.

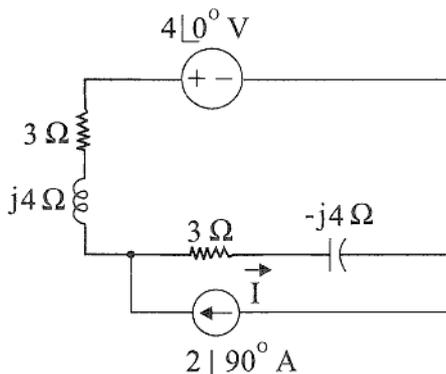


Figure-5

- (d) Draw the block diagram representation of the circuit of figure-6. The variables  $x$  and  $y$  are the input and output variables respectively.

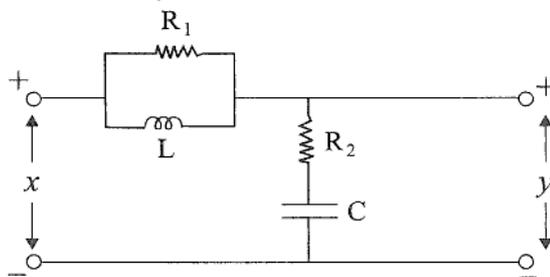


Figure-6

- (e) State and prove Thevenin theorem.
- (f) (i) State Millman's theorem.
- (ii) Calculate the load current  $I$  in the circuit of figure-7 by Millman's theorem.

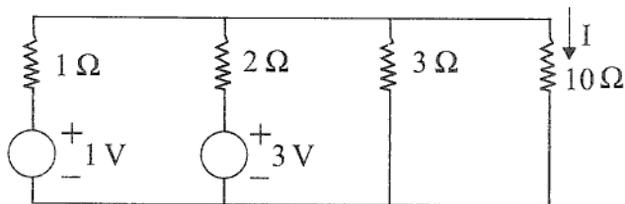


Figure-7

3. Answer any *Two* of the following :— 10 × 2

(a) Find inverse Laplace of  $F_1(s) \cdot F_2(s)$  by convolution integral for the following :

(i)  $F_1(s) = \frac{1}{s + a}$  ,  $F_2(s) = \frac{1}{(s + b)(s + c)}$

(ii)  $F_1(s) = \frac{s}{s + 1}$  ,  $F_2(s) = \frac{1}{s^2 + 1}$

(b) Obtain the relationship between various nature of location of poles in  $s$ -plane and their corresponding time responses for a second order characteristic equation.

(c) Construct Bode Magnitude and phase plot for impedance of the network shown in figure-8.

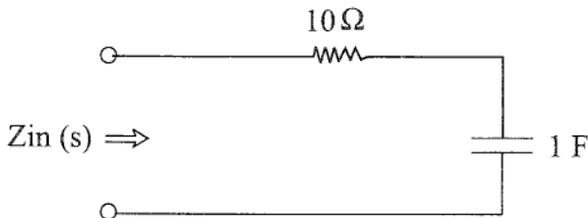


Figure-8

4. Answer any *Four* of the following :—

5 × 4

- (a) Find short circuit parameters of the circuit shown in figure-9.

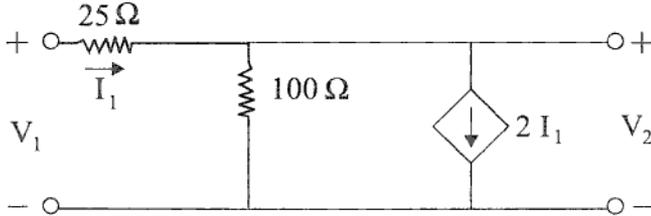


Figure-9

- (b) What is meant by symmetry in two-port network ? Determine the condition of symmetry in terms of hybrid parameters for a two-port network.
- (c) Derive transmission parameters in terms of short circuit and open circuit impedance of a two-port network.
- (d) Determine transmission parameters of a T-network shown in figure-10 considering three sections as shown in the figure, assuming connected in cascade manner.

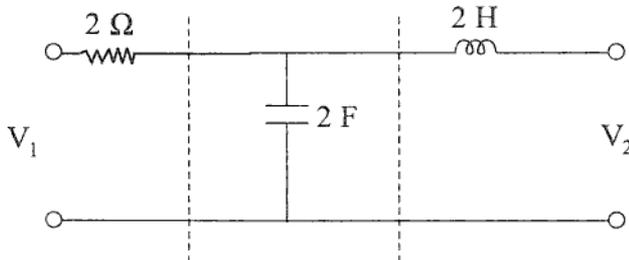


Figure-10

- (e) Find hybrid parameters of the network shown in figure-11.

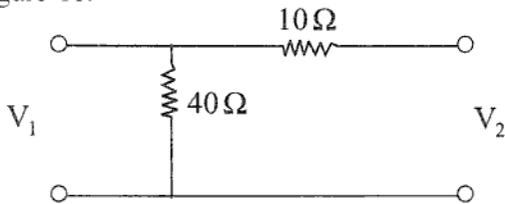


Figure-11

- (f) Write the necessary conditions for a network function to be a transfer function.

5. Answer any *Four* of the following :— 5 × 4

- (a) Without finding the inverse Laplace transform of  $F(s)$ , determine  $f(0^+)$  and  $f(\infty)$  for each of the following functions :

(i) 
$$\frac{4e^{-2s}}{s(s+50)}$$

(ii) 
$$\frac{s^2 + 6}{s^2 + 7}$$

- (b) Find the Laplace transform of the time function shown in figure-12.

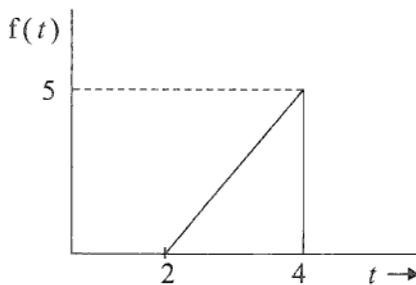


Figure-12

- (c) The network shown in figure-13 is initially under steady state conditions. At  $t = 0$ , the switch across the source  $i_0(t)$  is opened. Using Laplace transform approach, obtain the expression for voltage  $V_L(t)$  across the inductance.

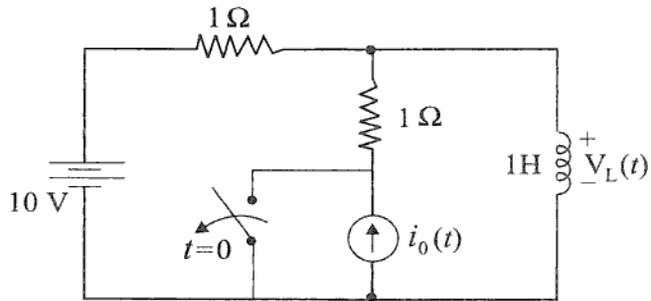


Figure-13

- (d) Check the positive realness of the following functions :—

(i) 
$$\frac{s^2 + s + 6}{s^2 + s + 1}$$

(ii) 
$$\frac{s^2 + 6s + 5}{s^2 + 9s + 14}$$

- (e) Synthesize –

$$Z(s) = \frac{(s+1)(s+3)}{s(s+2)} \text{ in Cauer I form.}$$

- (f) Synthesize –

$$Z(s) = \frac{(s+5)}{(s+1)(s+6)} \text{ in forster's II form.}$$

