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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.

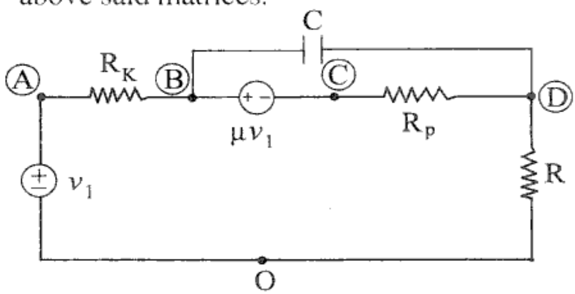

Figure-1

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

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

Draw the oriented graph of the network.

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(*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.

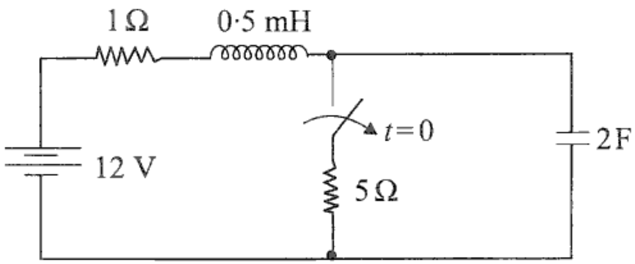

Figure-2

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

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

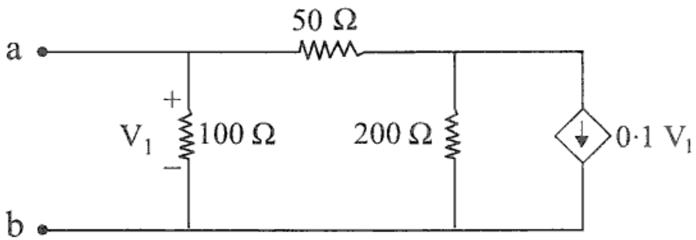

Figure-3

(*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 ?

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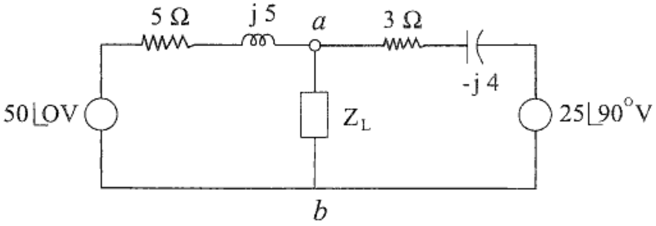

Figure-4

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

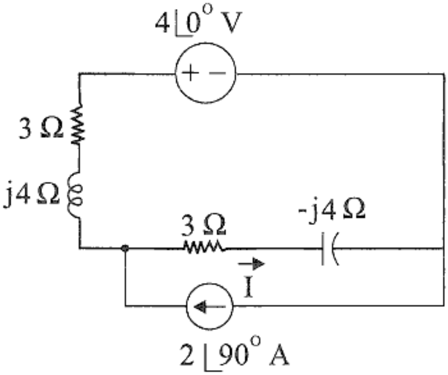

Figure-5

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

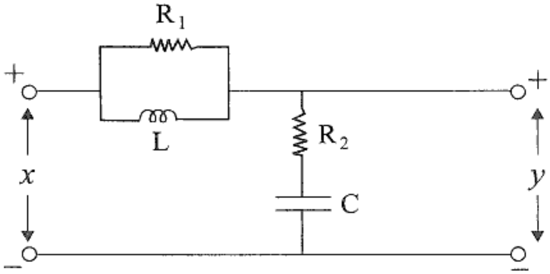

Figure-6

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(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.

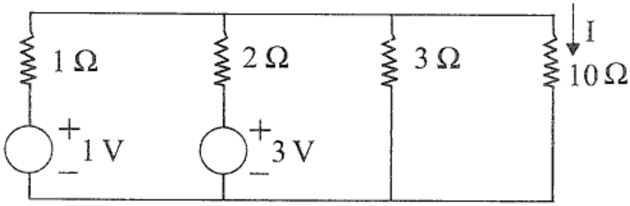

Figure-7

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

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

(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.

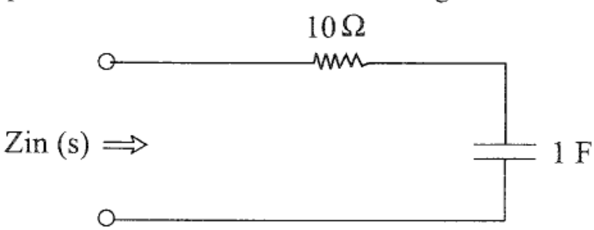

Figure-8

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

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

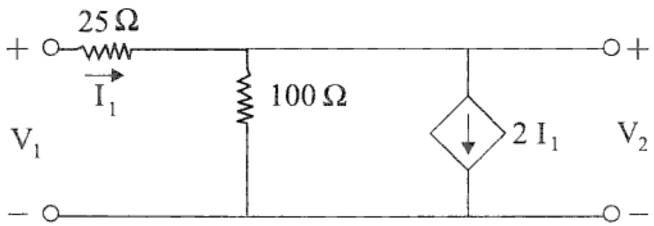

Figure-9

(*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.

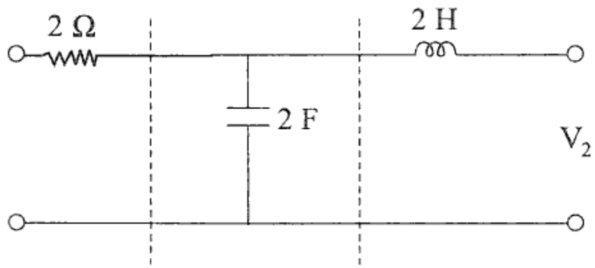

Figure-10

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

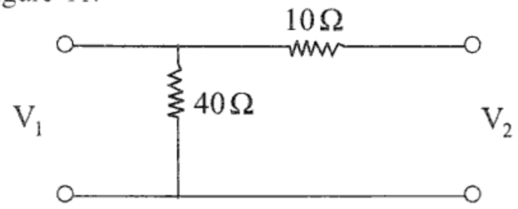

Figure-11

(*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*) $\dfrac{4e^{-2s}\,(s+50)}{s}$

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

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

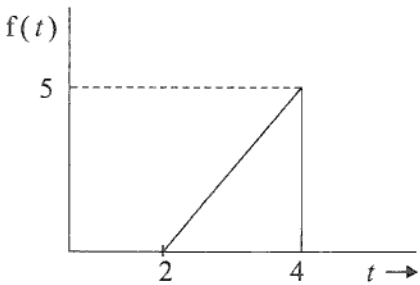

Figure-12

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(*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.

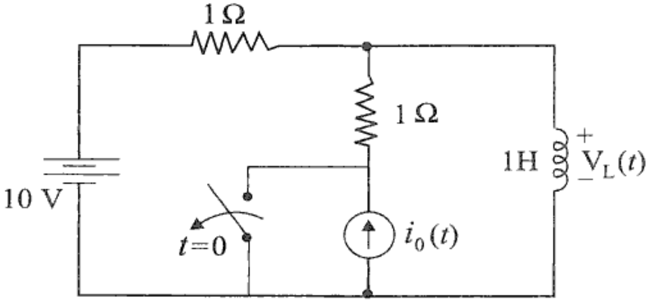

Figure-13

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

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

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

(*e*) Synthesize –

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

(*f*) Synthesize –

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

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