Code : 031505

B.Tech 5th Semester Exam., 2014

NETWORK THEORY

Time : 3 hours *Full Marks* : 70

Instructions :

(i) *All questions carry equal marks.*

(ii) *There are* ***NINE*** *questions in this paper.*

(iii) *Attempt* ***FIVE*** *questions in all.*

(iv) *Question No.* ***1*** *is compulsory.*

1. Choose the correct answer from any *seven* of the following :

(a) In the circuit shown in Fig. 1

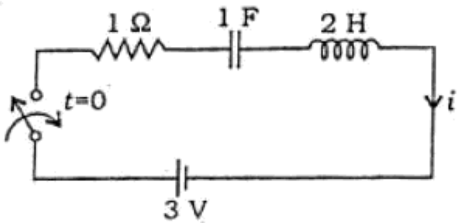

Fig. 1

the current i and the rate of change of current $\frac{di}{dt}$ at $t=0$ are given by

(i) 0, 0

(ii) 1, 2

(iii) 0, 3

(iv) None of the above

(b) For critical damping the value of C in the circuit, shown in Fig. 2

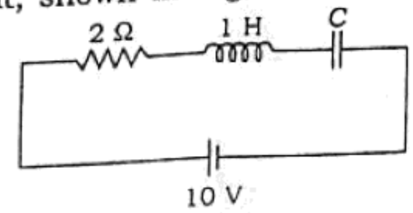

Fig. 2

is

(i) 2 F (ii) 1 F

(iii) 1·5 F (iv) 3 F

(c) The condition for reciprocity in h-parameters is

(i) $h_{12} = h_{21}$ (ii) $h_{12} = -h_{21}$

(iii) $h_{11} = h_{22}$ (iv) $h_{12} = h_{22}$

(d) The Z_{11} and Z_{22} parameters of the network shown in Fig. 3

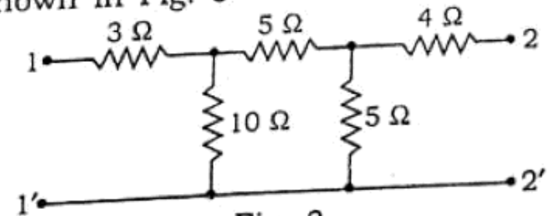

Fig. 3

are

(i) 8 Ω, 7·75 Ω

(ii) 13 Ω, 9 Ω

(iii) 12 Ω, 8·5 Ω

(iv) None of the above

(e) The cut-off frequencies of constant-k filters of all types are represented by

(i) $\frac{Z_1}{4Z_2} = 1$

(ii) $\frac{Z_1}{4Z_2} = 0$

(iii) $\frac{Z_1}{4Z_2} = -1$

(iv) None of the above

(f) The Cauer form-II of a reactive network synthesis is the successful removal of

(i) poles at infinity

(ii) zero at infinity

(iii) poles at origin

(iv) zero at origin

(g) If $F_1(s)$ and $F_2(s)$ are two positive real functions, then the function which is always positive real is

(i) $F_1(s)F_2(s)$

(ii) $\frac{F_1(s)}{F_2(s)}$

(iii) $\frac{F_1(s)F_2(s)}{F_1(s)+F_2(s)}$

(iv) $F_1(s)-F_2(s)$

(h) For a given network, the reduced incidence matrix is given as

$$\begin{array}{c} \begin{array}{ccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & -1 & 1 \\ -1 & -1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & -1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

The parallel branches in the graph are

(i) 1 and 2

(ii) 2 and 3

(iii) 6 and 7

(iv) None of the above

(i) Which one of the following statements is correct?

A tree in a network is a connected graph containing

(i) all the nodes only

(ii) all the branches only

(iii) all the branches and nodes

(iv) all the branches but no closed path

(j) For a transfer function, $H(s) = \frac{P(s)}{Q(s)}$, where $P(s)$ and $Q(s)$ are polynomials in s,

(i) the degree of $P(s)$ is always greater than the degree of $Q(s)$

(ii) the degree of $P(s)$ and $Q(s)$ are the same

(iii) the degree of $P(s)$ is independent of the degree of $Q(s)$

(iv) the maximum degree of $P(s)$ and $Q(s)$ differ at the most by one

2. For the circuit shown in Fig. 4, find $i_L(t)$ and $v_C(t)$ for $t > 0$:

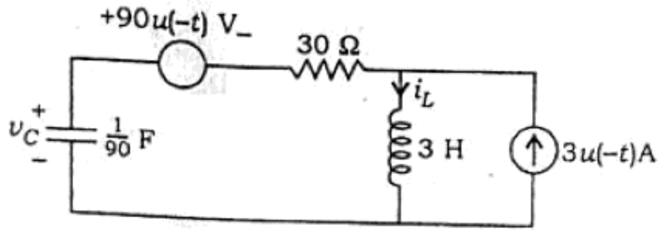

Fig. 4

3. (a) A one-port network has a coil of inductance L and resistance R shunted by a capacitance C. If poles and zeros of driving-point impedance $Z(s)$ of this network are as poles at $-1 \pm j\sqrt{3}$ and zero at -2 with $Z(s)$ at $s = 0$ equal to 2, find R, L and C.

(b) For the network shown in Fig. 5, find the transfer admittance function $Y_{12}(s)$:

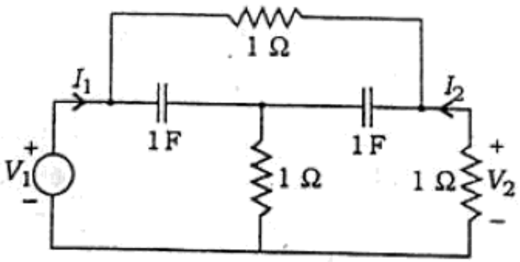

Fig. 5

(Turn Over)

4. For the network shown in Fig. 6, determine Y-parameters :

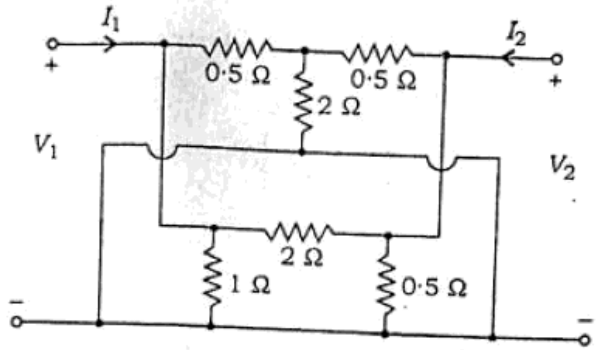

Fig. 6

5. For the network shown in Fig. 7, draw the grap find the fundamental loop matrix taki branches 2, 4, 5 as tree branches and write t loop impedance matrix and loop equations :

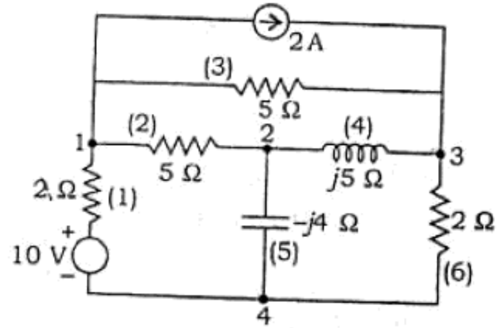

Fig. 7

6. If a constant-k high-pass filter has cut-c frequency of 10 kHz and the nominal impedan R_0 is 700 Ω, design the T- and π-sections of th filter. Determine its characteristic impedanc phase constant at 25 kHz and attenuation a 8 kHz.

7. Synthesize the following impedance function in Foster Form-II and Cauer Form-I :

$$Z(s) = \frac{3(s+2)(s+4)}{s(s+3)}$$

8. (a) The switch in the circuit shown in Fig. 8 is opened at $t = 0$. Determine $v(t)$ for $t > 0$:

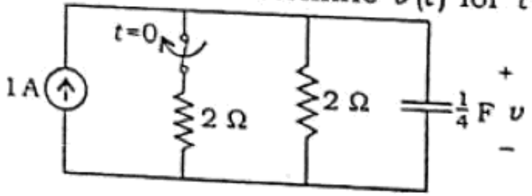

Fig. 8

(b) Derive reciprocity condition for two-port network in terms of hybrid parameters.

9. (a) The matrix A given below is a reduced incidence matrix of a graph. Draw the graph :

Nodes	Branches 1	2	3	4	5	6
1	1	0	0	−1	0	1
2	−1	0	1	0	1	0
3	0	1	−1	0	0	0

(b) Write the properties of L-C immittance function.

★★★