

B.Tech. 5th Semester Exam., 2013

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 option (any seven) :

(a) When switch S in the circuit shown in Fig. 1 is open, steady state is reached. When switch S is closed at $t=0$, $i(t)$ for $t > 0$ is

- (i) $6 - 4e^{-t}$
 (ii) $2 - 3e^{-t}$
 (iii) $3 - e^{-3t}$
 (iv) None of the above

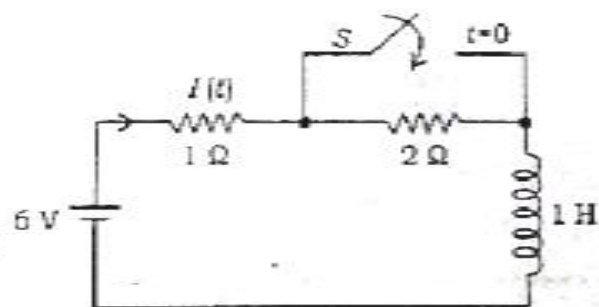


Fig. 1

(b) The circuit shown in Fig 2 is in steady state with switch S open. The switch is closed at $t=0$. The value of $v_c(0^+)$ and $v_c(\infty)$ will be respectively

- (i) 2 V, 0 V
 (ii) 0 V, 2 V
 (iii) 2 V, 2 V
 (iv) 0 V, 0 V

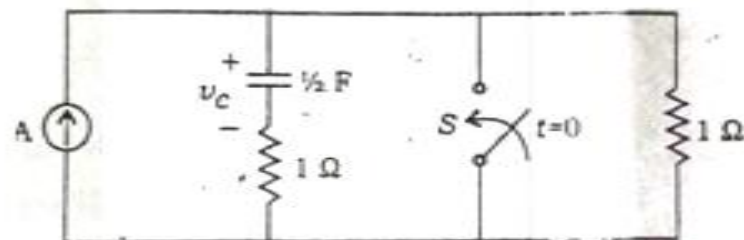


Fig. 2

(c) The condition for symmetry in ABCD parameter is

- (i) $AD = BC$
 (ii) $\frac{A}{D} = \frac{C}{B}$
 (iii) $AD - BC = 1$
 (iv) $A = D$

(d) A two-port network is described by the relations

$$V_1 = 2V_2 + 0.5 I_2$$

$$I_1 = 2V_2 + I_2$$

What is the value of h_{22} parameter of the network?

- (i) 1 mho
- (ii) 2 Ω
- (iii) -2 mho
- (iv) 4 Ω

(e) If a transmission line is terminated by its characteristic impedance, the reflection coefficient is

- (i) zero
- (ii) plus one
- (iii) minus one
- (iv) infinity

(f) The network function

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

represents

- (i) an RC impedance
- (ii) an RL impedance
- (iii) an RC impedance and an RL admittance
- (iv) an RC admittance and an RL impedance

(g) The driving point impedance $Z(s)$ of a network has the pole zero locations as shown in Fig. 3. If $Z(0) = 3$, then $Z(s)$ is

(i) $\frac{3(s+3)}{s^2 + 2s + 3}$

(ii) $\frac{2(s+3)}{s^2 + 2s + 2}$

(iii) $\frac{3(s+3)}{s^2 + 3s + 2}$

(iv) $\frac{2(s-3)}{s^2 - 2s - 3}$

$s^2 + 3s - s + 3$

$s(s+3) \pm 1(s+3)$

$(s+1)(s+3)$

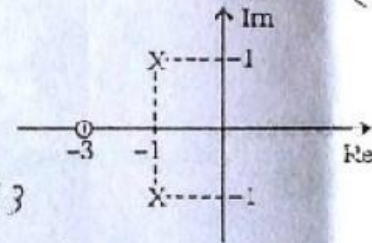


Fig. 3

(h) The number of links for a graph having n nodes and b branches is

- (i) $b - n + 1$
- (ii) $n - b + 1$
- (iii) $b + n - 1$
- (iv) $b + n$

$\frac{2 \pm \sqrt{4-4}}{2} = \frac{0}{2}$

$s^2 + 2s + 2 = -2 \pm \sqrt{4-4}$

$\Rightarrow 2 \pm \sqrt{4-4}$

$s^2 + 2s + 1 = 1$

$(s+1)(s+1) = 1$

$s = -2 \pm \sqrt{4-4}$

$4 - 4 \times 1/2 = -4$

- (i) For the reduced incidence matrix A , which is the set of branches forming a tree?

Given

$$A = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 1 & -1 & -1 & -1 & 0 & 0 \\ 2 & 0 & 1 & 0 & 0 & -1 & 1 \\ 3 & 0 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

(i) 1, 2, 3 1 → 2 → 3

(ii) 2, 4, 6

(iii) 2, 3, 5

(iv) 1, 4, 6

- (j) For the network shown in Fig. 4, $Z(0) = 3 \Omega$ and $Z(\infty) = 2 \Omega$. The value of R_1 and R_2 will be, respectively

(i) $2 \Omega, 1 \Omega$

(ii) $1 \Omega, 2 \Omega$

(iii) $3 \Omega, 2 \Omega$

(iv) $2 \Omega, 3 \Omega$

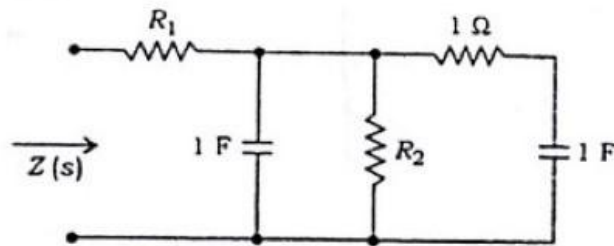


Fig. 4

2. Find $v_c(t)$ for the circuit shown in Fig 5, if the switch is moved from position a to position b at $t=0$.

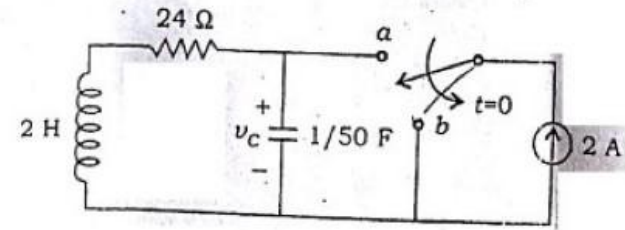


Fig. 5

3. (a) Define (i) network function, (ii) poles and (iii) zeros.

- (b) Determine voltage transfer function, $G_{12}(s) = \frac{V_2(s)}{V_1(s)}$ for the circuit shown in Fig. 6.

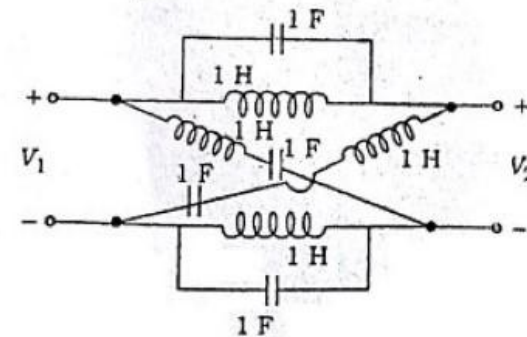


Fig. 6

4. (a) Find h -parameters for the circuit shown in Fig. 7.

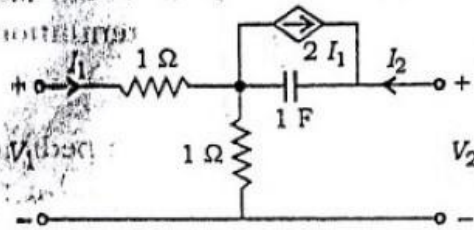


Fig. 7

- (b) Find V_1 and V_2 in the network shown in Fig. 8, if y -parameters are

$$y_{11} = \frac{3}{2} \text{ U}, \quad y_{22} = \frac{5}{6} \text{ U}, \quad y_{12} = y_{21} = -\frac{1}{2} \text{ U}$$

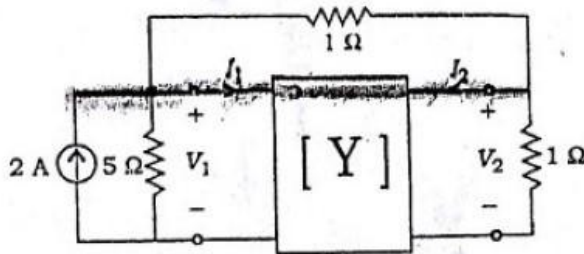


Fig. 8

5. For the network shown in Fig. 9, write the tie-set matrix and determine the loop currents and branch currents.

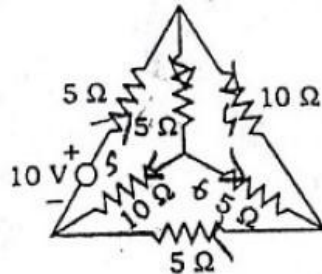


Fig. 9

6. If an m -derived high-pass filter has design impedance of 600Ω and cut-off frequency of 3.6 kHz and infinite attenuation at 2.5 kHz , design the filter.
7. Synthesize the following impedance function in Foster I form and Cauer II form :

$$Z(s) = \frac{s^4 + 10s^2 + 9}{s^3 + 4s}$$

8. (a) For the circuit shown in Fig. 10, find the voltage $v(t)$ for $t > 0$, if the circuit is in steady state at $t = 0^-$ and the switch is moved from position 1 to position 2 at $t = 0$.

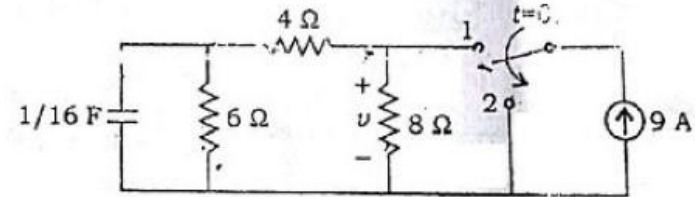


Fig. 10

- (b) Find z -parameters in terms of h -parameters.
9. (a) Define the following terms :
- Tree
 - Cut set
 - Fundamental loop
 - Oriented graph
- (b) Write the properties of positive real function.
