Code : 031505

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

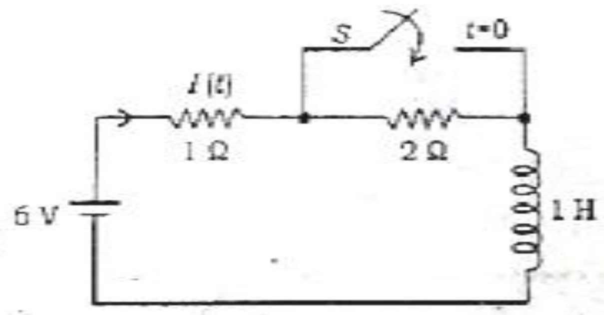

Fig. 1

(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

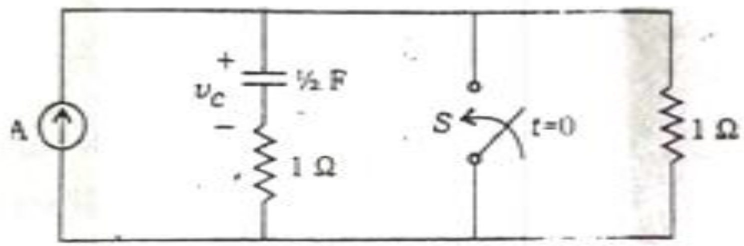

Fig. 2

(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

$$V_1 = 2V_2 + 0 \cdot 5 I_2$$
$$I_1 = 2V_2 + I_2$$

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) $\dfrac{3(s+3)}{s^2+2s+3}$

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

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

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

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

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

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

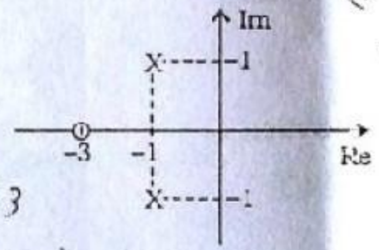

Fig. 3

$4 - 4 \times 12$

$= -4$

(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) $b + n$

$b = n+1+l$

$b-(n+1)$

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

Given

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

(i) 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 Ω, 1 Ω

(ii) 1 Ω, 2 Ω

(iii) 3 Ω, 2 Ω

(iv) 2 Ω, 3 Ω

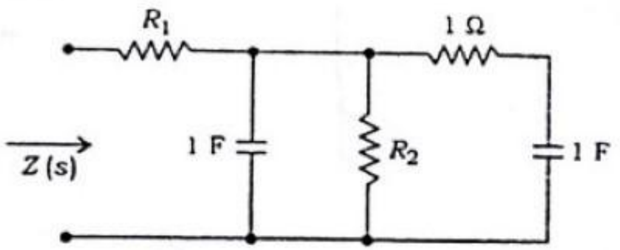

Fig. 4

(Turn Over)

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

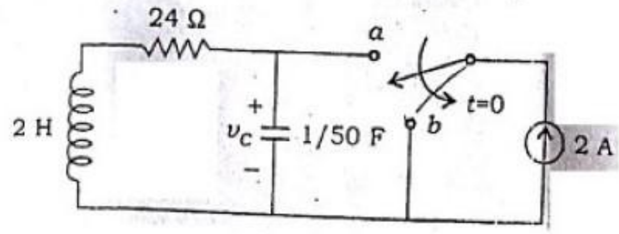

Fig. 5

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

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

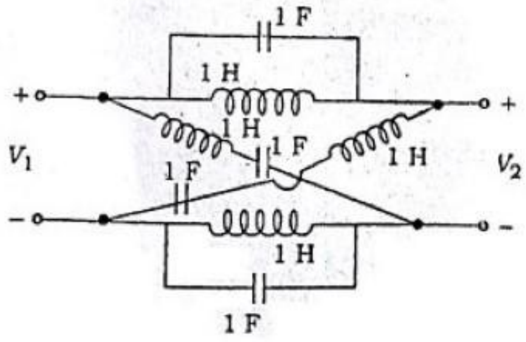

Fig. 6

Continued)

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

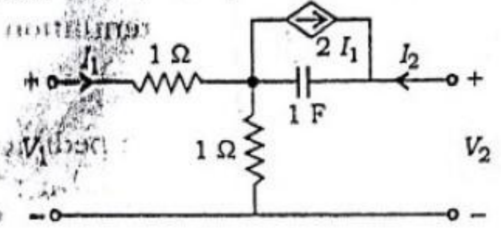

Fig. 7

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

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

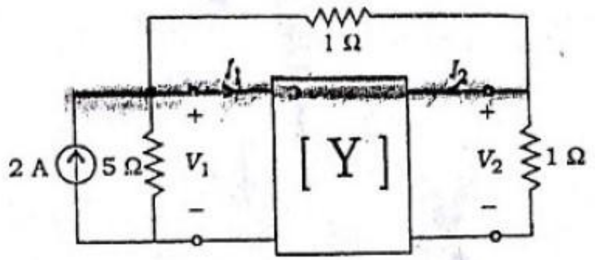

Fig. 8

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

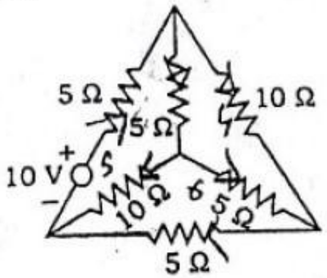

Fig. 9

6. If an m-derived high-pass filter has design impedance of 600 Ω 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 $t = 0$.

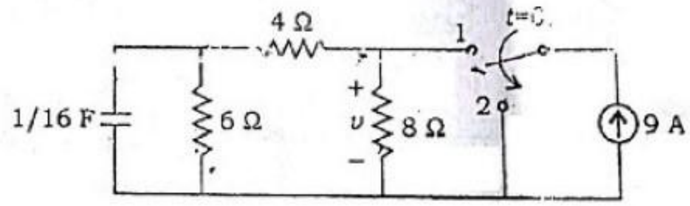

Fig. 10

(b) Find z-parameters in terms of h-parameters.

9. (a) Define the following terms :

(i) Tree

(ii) Cut set

(iii) Fundamental loop

(iv) Oriented graph

(b) Write the properties of positive real function.

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