[Time: 3 Hours] [Marks: 80]

Please check whether you have got the right question paper.

N.B: 1. Question one is compulsory.
2. Answer any three questions from the remaining five.
3. Assume suitable data if required.

1. a) Find y parameters.

\[ \begin{align*}
5 \text{ ohms} & \quad 5 \text{ ohms} \\
\text{V1} & \quad \text{V2}
\end{align*} \]

b) Find the current through 5Ω resistor

\[ \begin{align*}
5 \text{ Ohms} & \quad 2 \text{ Ohms} \\
5 \text{V} & \quad 3 \text{ Ohms}
\end{align*} \]

\[ \begin{align*}
ix & = 5 \text{Amps} \\
\text{20 ohms} & \quad \text{20 ohms}
\end{align*} \]

c) What is a Positive Real function? What are the properties of PR function?

d) Realize the following function in Cauer-I and Cauer-II forms

\[ Z(s) = \frac{S(S+3)}{(S+1)} \]

2. a) Find the current through RL, in the circuit given below using Norton’s theorem and also find power dissipated in R_L.

\[ \begin{align*}
12 \text{Vols} & \quad 3ix \\
6 \text{ Ohms} & \quad 3 \text{ Ohms}
\end{align*} \]

b) Check whether the following functions are Hurwitz

\[ P(s) = S^4+6S^3+10S^2+18S+36 \]

\[ P(s) = S^6 + 2S^5 + 5S^4 + 8S^3 + 8S^2 + 8S + 1 \]

c) Draw the graph of the network whose incidence matrix is given below.

\[
\begin{bmatrix}
1 & 0 & 1 & 0 & 0 & 0 & 0 & -1 \\
0 & -1 & 0 & -1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & -1 & 0 & -1 & 0 & 1 & 0
\end{bmatrix}
\]
3. a) Find the overall ABCD parameters of the following network, by dividing the network into two or more sections.

\[ Z(S) = \frac{4(S + 2)(S + 7)}{S(S + 4)} \]

b) State and prove final value theorem.

c) Test whether the following function is Positive Real

\[ F(S) = \frac{(2S^2 + 2S + 1)}{(S^2 + 2S^2 + S + 2)} \]

4. a) Synthesize the following function in Foster-I and Foster-II forms

\[ Z(S) = 4 \frac{(S + 2)(S + 7)}{S(S + 4)} \]

b) Find h parameters in terms of z parameters

c) In the following network the switch is closed at \( t = 0 \), find \( i_1(0^+) \), \( di_1(0^+)/dt \), \( d^2i_1(0^+)/dt^2 \), \( i_2(0^+) \), \( di_2(0^+)/dt \).

5. a) Obtain the tieset and f-cutset matrix for the graph given below.

b) Find the condition for symmetry and reciprocity of a 2 port network

c) Find \( 12/I_1 \) for the following network.
6. a) Find the voltage across 10Ω resistor using mesh analysis

\[ V = \frac{100 \angle 45}{10 + 5} \]

b) Find \( i(t) \) using Laplace Transform the input voltage is \( e^{-2t} \).

\[ i(t) = \frac{1}{2H} e^{-2t} \]

c) The pole zero plot of a driving point admittance function is given below. Find the function if \( Z(-4) = 5 \) and state whether it is RL, RC or LC function.