[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. Answer all the questions
   a) Find $R_1$ and $R_2$ in the following circuit.

   ![Circuit Diagram]

   b) Find $h$ parameters for the following 2-port network.

   ![2-Port Network Diagram]

   c) The poles of a driving point impedance function are at 0, -5, and zero at -2, find the function if $Z(-3) = 1/6$ and synthesize the same in cauer-I form.

   d) Draw the graph of the following network and obtain incidence matrix.

   ![Incidence Matrix Diagram]

2. a) For the circuit shown below, find the current through 3 ohms resistor, using superposition theorem.

   ![Superposition Theorem Diagram]
b) In the following series RC circuit the switch is closed at t=0, find the expression for the current through the capacitor and sketch i(t) versus t.

![Circuit Diagram]

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c) Find the driving point impedance for the following network.

![Network Diagram]

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3. a) Find the ABCD parameters for the following 2-port network.

![Network Diagram]

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b) Check whether the following functions are Hurwitz
i) \( F(S) = S^3 + 4S^2 + 2S \)
ii) \( F(S) = S^5 + 2S^4 + 5S^3 + 10S^2 + 4S + 8 \)

c) The graph of a network is given below. Obtain the tie-set matrix.

![Network Graph]

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4. a) Synthesize the following driving point impedance function in Cauer-I and Foster-I forms.

\[
Z(S) = \frac{(S^2 + 2)(S^2 + 6)}{3S(S^2 + 5)}
\]

b) Obtain h parameters in terms of z parameters.

c) State and prove initial value theorem.

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5. a) For the following network obtain the KVL equilibrium equation in matrix form using the concept of graph theory and hence find the link currents.

```
2 Ohms
\[ \begin{array}{c}
2 \text{Ohms} \\
5 \text{Ohms} \\
5 \text{Ohms}
\end{array} \]
\[ 15 \text{V} \]
\[ 10 \text{V} \]
```

b) Find \( I_2(S) \) for the following transformed circuit and hence find \( i_2(t) \) using Inverse Laplace Transform.

```
1 \text{Ohm}
1/(S+2)
1 \text{Ohm}
```


c) Test whether the following function is a Positive Real function.
\[ F(s) = \frac{(S^4+14S^2+45)}{(S^3+7S)} \]

6. a) In the circuit given below, the switch \( S_1 \) is opened and the switch \( S_2 \) is closed at \( t=0 \). The switch \( S_1 \) was closed for a long time before it is opened. Find the current \( i_2(t) \)

```
\[ \begin{array}{c}
4 \text{V} \\
2 \text{Ohms} \\
1 \text{H} \\
2 \text{Ohms}
\end{array} \]
2 Ohms
2 Ohms
1 Ohm
1 Ohm
```

b) For the following ladder network find \( V_2/V_1, I_1/V_1 \) and \( V_2/I_1 \)