N. B. : (1) Question No. 1 is compulsory.
    (2) Attempt any three questions from remaining.
    (3) Figures to the right indicate full marks.
    (4) Assume suitable data if required.
    (5) Use smith chart for transmission line problem.

1. (a) Find the thevenin's equivalent network for terminals A and B.

(b) For the network shown, the switch is closed at $t = 0$. Find the current $i_1(t)$ for $t > 0$.

(c) State the condition for reciprocity of h-parameter and prove it.
(d) Obtain S-domain equivalent circuit of an inductor and capacitor having non-zero initial conditions.

(e) What are scattering parameters. State their properties.

2. (a) In the given network, what will be the $R_L$ to get maximum power delivered to it. Calculate power.
(b) For the network shown, determine the current $i(t)$ when the switch is closed at $t = 0$ with zero initial conditions.

\[ \begin{align*}
S & \quad \text{Switch} \\
V(t) & \quad \text{Voltage Source} \\
- & \quad \text{Diode} \\
\text{Load} & \quad \text{Load} \\
1H & \quad \text{Inductor} \\
\text{Ground} & \quad \text{Ground} \\
\end{align*} \]

(c) List the types of damping in series R-L-C circuit and mention the condition for each damping.

3. (a) Design a single stub match for a load of $(150 + j232.5) \Omega$ for 75\$\Omega$ transmission line at 500 MHz using smith chart.

(b) Define T-parameters and relate them to other parameter as indicated.
   (i) $A$ and $C$ in terms of $z$-parameters
   (ii) $B$ in terms of $y$-parameter

(c) Compare Foster form-I and Foster form-II of an L.C. network.

\[ Z(s) = \frac{6s(s^2 + 4)}{(s^2 + 1)(s^2 + \sqrt{4})} \]

4. (a) Check the positive real functions –

   (i) $F(s) = \frac{s^2 + 6s + 5}{s^2 + 6s + 14}$

   (ii) $F(s) = \frac{s^3 + 6s^2 + 7s + 3}{s^2 + 2s + 1}$

(b) Derive an expression for characteristic equation of a transmission line. Also obtain $\alpha$, $\beta$ and $\gamma$ of the line.

(c) What are standing waves. Define reflection coefficient and V.S.W.R. of a transmission line.

5. (a) Test whether the following polynomials are Hurwitz, use continuous fraction expansion

   (i) $s^7 + 2s^6 + 2s^5 + s^4 + 4s^3 + 8s^2 + 8s + 4$
   (ii) $s^4 + 2s^2 + 2$

| TURN OVER |
(b) Find the characteristic impedances, cut off frequency and passband frequency for given network.

(c) Obtain pole-zero plot for \( \frac{I_2}{I_1} \)

6. (a) Two identical sections of the network shown are connected in cascade manner. Obtain the transmission line parameters of over all connection.

(b) Find the current through 15-Ω resistor

(c) Compare Cauer form - I and Cauer form - II of RC Network

\[
Z(s) = \frac{3(s + 2)(s + 6)}{s(s + 4)}
\]