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 problems.

1. (a) Find the current through 15Ω resistor.  
(b) Obtain the voltage response of series R-L circuit.  
(c) Determine $\frac{V_1}{I_1}$ and $\frac{V_2}{I_2}$ for the given network.  
(d) What are standing waves? Define reflection coefficient and VSWR of a transmission line.  
(e) A Π-section filter network consists of a series arm conductor of 20 mH and two shunt arm capacitors of 160 nF each. Calculate: (i) cut off frequency (ii) attenuation (iii) Phase shift at 15kHz. Also obtain the nominal impedance in pass-band.

2. (a) Find $I_1$ through 10Ω by Thevinin's theorem.
(b) Find $I_c$ and $V_c$ for $t > 0$

(c) Use Nodal analysis to find the voltage drop across 4 $\Omega$ and 10 $\Omega$ ref Qu. 2(a)

3. (a) Design a single stub match for a load of $150 \Omega + j232.5 \Omega$ for 75 $\Omega$ line at 500 MHz using Smith Chart.
(b) Compare foster realization with cauer realization.
(c) State the properties of Hurwitz polynomial.

4. (a) Define T-parameters and relate them to other parameter as indicated.
   (i) A and C interms of z-parameters
   (ii) B interms of y-parameters
   (iii) D interms of h-parameter.
(b) Test whether the following functions are positive real functions with proper reasons.
   (i) $F_1(s) = \frac{2s^3 + 2s^2 + 3s + 2}{s^2 + 1}$
   (ii) $F_2(s) = \frac{s^2 + 1}{s(s^2 + 4)}$

5. (a) What are scattering parameters? State their properties.
(b) Derive an expression of m-derived $\Pi$ section network starting from a constant k section.
(c) For given circuit,

switch 's' is opened at $t=0$. Switch 's' was on for long time.
Determine $V_L(0^+)$, $\frac{dV_L}{dt}(0^+)$ and $\frac{d^2V_L}{dt^2}(0^+)$
6. (a) Explain the graphical representation of series resonance circuit.

(b) Test whether following polynomials are Hurwitz

(i) \( P(s) = s^4 + s^3 + 5s^2 + 3s + 4 \)

(ii) \( P(s) = s^6 + 6s^4 + 4s^2 + 2 \)

(c) Find the characteristic impedance, cut off frequency and pass band for the network shown: