1. Attempt all questions:

(a) Find the voltage across the nodes A & B.
(b) For the following resonant circuit calculate the resonant frequency, half-power frequencies and Q-factor.

(c) A series connected load draws a current \( i(t) = 3 \cos(50\pi t + 15^\circ) \text{A} \), when applied voltage is \( v(t) = 80 \cos(50\pi t - 10^\circ) \text{V} \). Find the apparent power and power factor of the load.

(d) The hybrid circuit model of a device is shown. Obtain the h-parameters for the same.
(e) Find steady state dc current $i$. 

2. (a) Write node voltage equation and determine the current in each branch for the network.

(b) Obtain the equivalent resistance $R_{ab}$ for the circuit and use it to find current $i$. (use star-delta transformation).
(c) Use source transformation to find $v_o$ in the circuit.

3. (a) Draw dual circuit of the network.

(b) Determine the current flowing through 5Ω resistor in the circuit using Norton’s theorem.
(c) Determine the load resistance to receive maximum power from the source, also find the maximum power delivered to the load in the circuit.

4. (a) Obtain the mesh current equations for the following network and find out the current $I_0$. 

P.T.O.
(b) Using Superposition theorem find out the current $i_x$ in the circuit.

$$\begin{align*}
\frac{1}{8} F & \quad 3 \Omega \\
5 \cos(2t + 10^\circ) A & \quad 10 \cos(2t - 60^\circ) V
\end{align*}$$

5. (a) Find the Thevenin’s equivalent for the network across terminals A and B. Also determine the value of $R_L$ which can extract maximum power out of this circuit.

(b) Calculate the power extracted by 1Ω resistance,

$$V = 10 \angle 0^\circ$$
(c) Design a RC high pass filter with the cut-off frequency of 10 kHz. Obtain the output voltage at twice the cut-off frequency when input voltage is 10 V.

6. (a) Obtain z-parameters for the following circuit. Comment about the reciprocity and symmetry of this circuit.

(b) Obtain y-parameters in terms z-parameters. What is the reciprocity and symmetry criterion in case of y-parameters?

(c) Obtain y-parameters for the circuit in part (a) and draw its equivalent y-parameters circuit model.
7. (a) In series circuit the switch is closed on position 1 at \( t = 0 \) and at \( t = 500 \) µs, the switch is moved to position 2. Obtain the equations for the current in both the intervals \( 0 \leq t \leq 500 \) µs and \( t > 500 \) µs and sketch the transients.

(b) In the circuit the switch is moved from position 1 to position 2 at \( t = 0 \). Obtain the current \( i_2 \) at \( t = 34.7 \) ms.