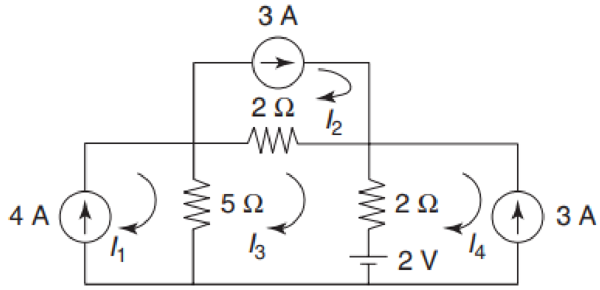
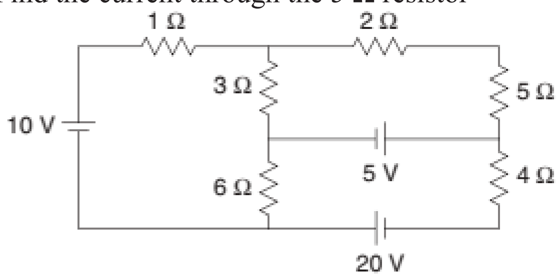
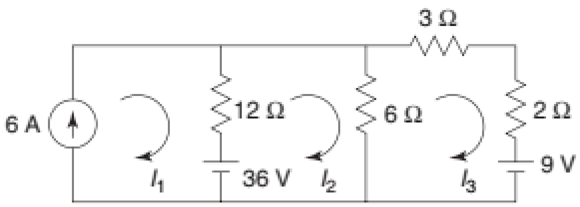
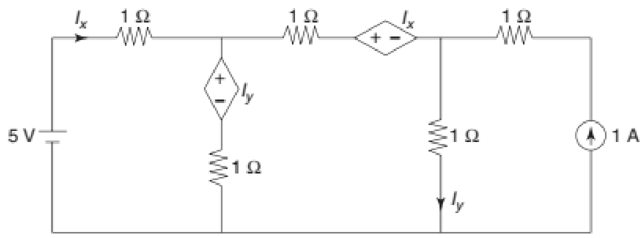
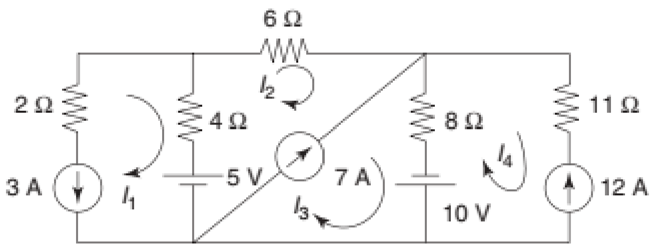
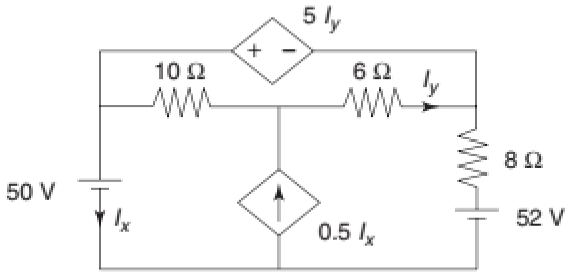
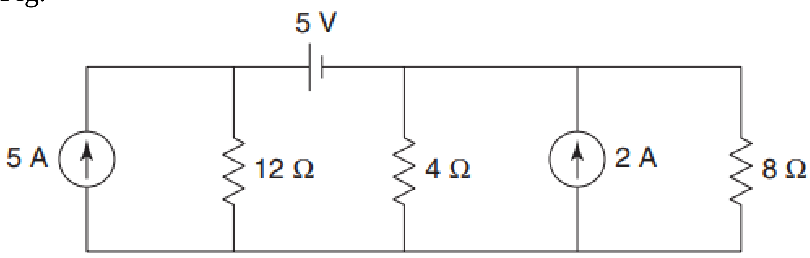
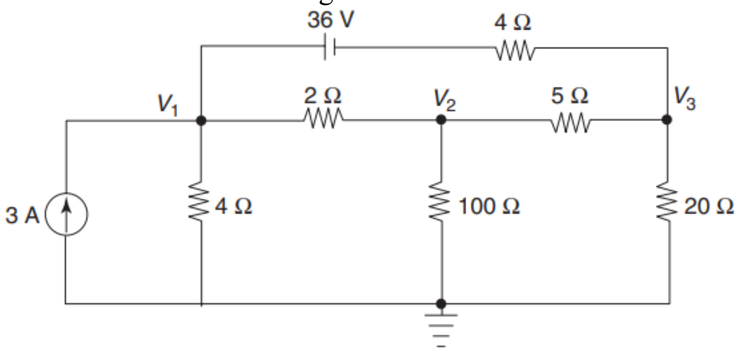
Dr. Babasaheb Ambedkar Technological University Lonere

<u>Question Bank for BTETC401 Network Theory</u>

Unit- 1 (Network Theorems)

Sr.No	Questions
1	Define the terms: Network and Circuit, Linear and Non-linear Elements, Active and Passive Elements, Unilateral and Bilateral Elements, Lumped and Distributed Elements, Active and Passive Network, Time-invariant and Time-variant Network
2	State and explain Kirchhoff's laws?
3	**Mesh Analysis**
i)	Find the current through the 5 Ω resistor in the network of Fig 
ii)	Find the current through the 5 Ω resistor 
iii)	Find the current through the 2 ohm resistor in the network of Fig 
iv)	Find the currents in the three meshes of the network shown 
v)	Find the current in the 3 Ω resistor of the network shown 

<table>
<tr><td>vi)</td><td>find current through the 8 ohm resistor

</td></tr>
<tr><td>4</td><td>Explain the concept of source transformation? Find the current through the 8 Ω resistor in Fig.

</td></tr>
<tr><td>5</td><td>Node Analysis</td></tr>
<tr><td>i)</td><td>Determine the current through the 5 Ω resistor for the network shown in Fig.

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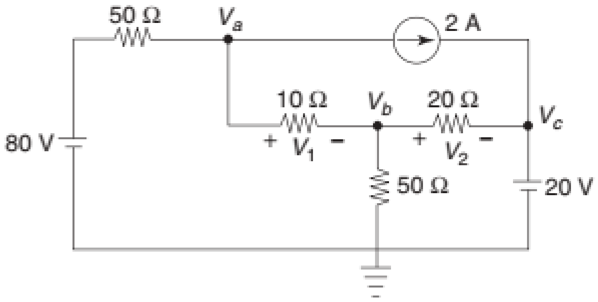
<tr><td>ii)</td><td>Find V1 and V2 for the network shown

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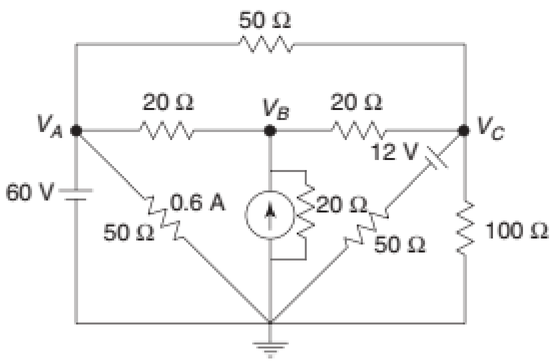
<tr><td>iii)</td><td>Find the voltage across the 100 Ω resistor for the network shown

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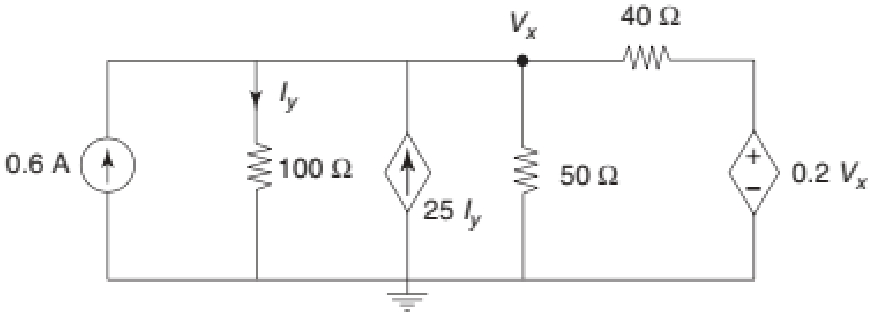
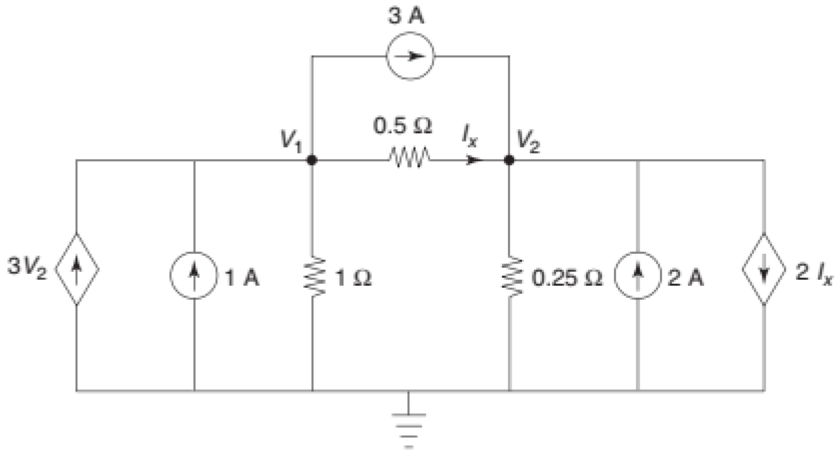
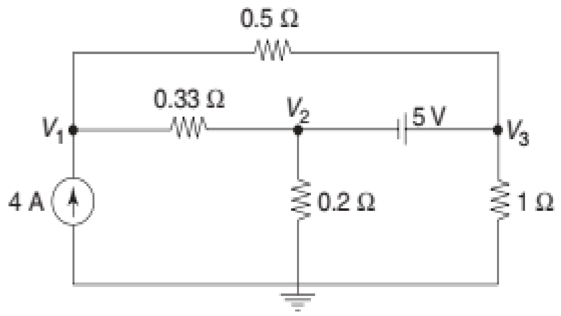
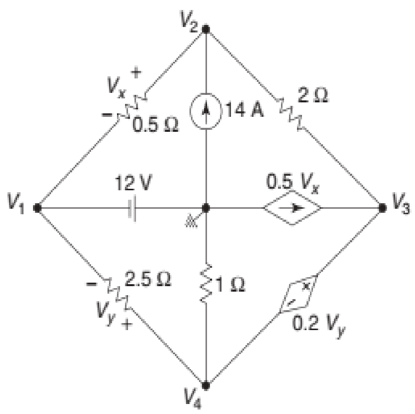
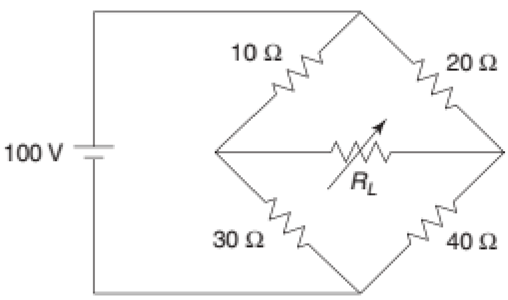
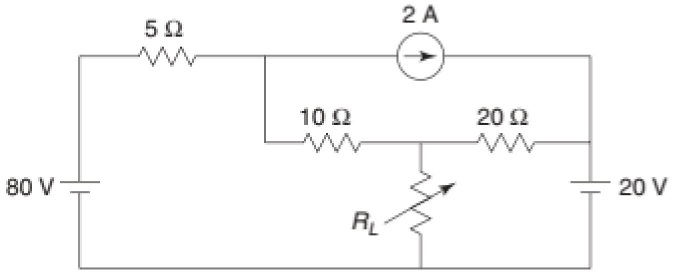
iv)	For the network shown in Fig, find the voltage V_x 
v)	For the network shown, find the node voltages V1 and V2. 
vi)	find the node voltages 
6	**Maximum Power Transfer Theorem**
i)	What is the condition for maximum power transfer to the load?
ii)	For the value of resistance R_L in Fig. for maximum power transfer and calculate the maximum power 

<table>
<tr><td>iii)</td><td>For the value of resistance R_L in Fig. for maximum power transfer and calculate the maximum power.

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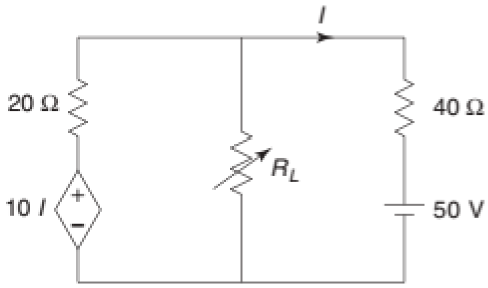
<tr><td>iv)</td><td>For the network shown, find the value of R_L for maximum power transfer. Also, calculate maximum power.

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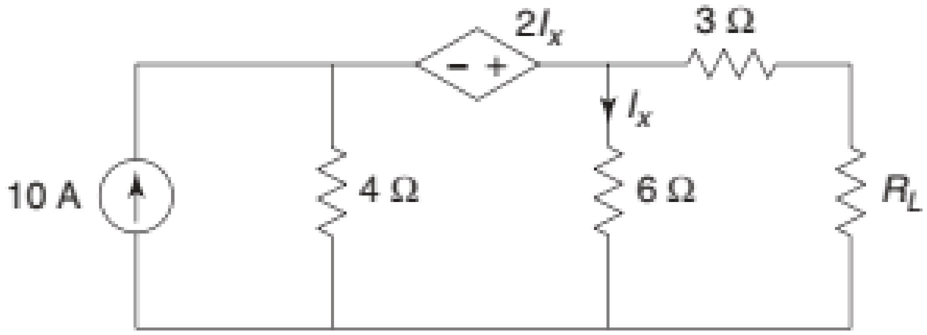
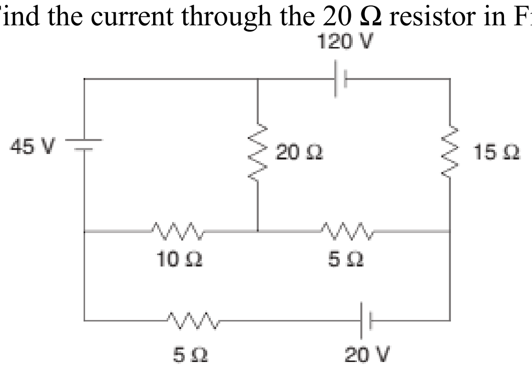
<tr><td>v)</td><td>Calculate the maximum power that may be dissipated in the load resistor RL.

</td></tr>
<tr><td>7</td><td>Thevenin's Theorem.</td></tr>
<tr><td>i)</td><td>Find the current through the 20 Ω resistor in Fig

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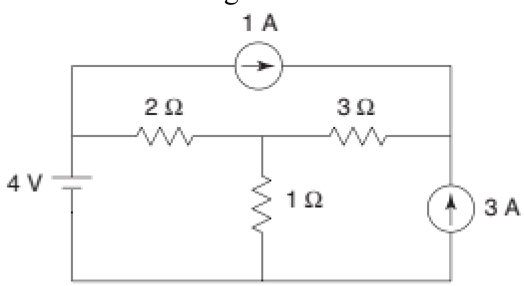
<tr><td>ii)</td><td>Find the current through the 1 Ω resistor

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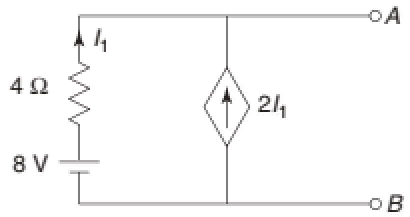
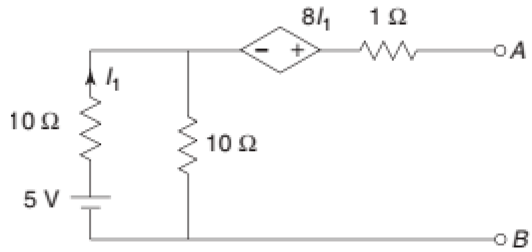
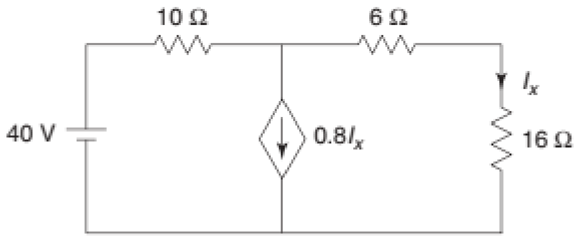
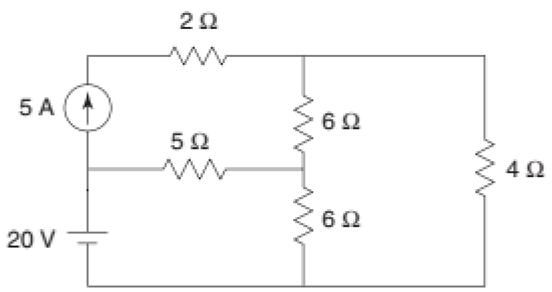
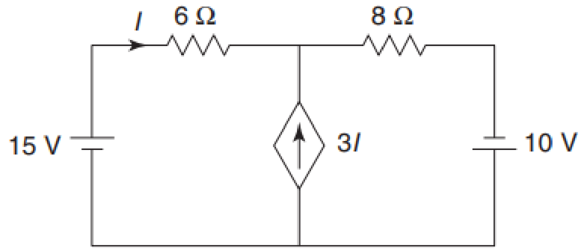
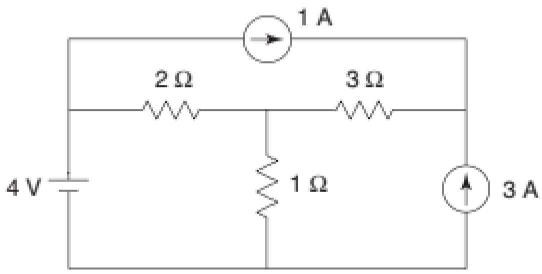
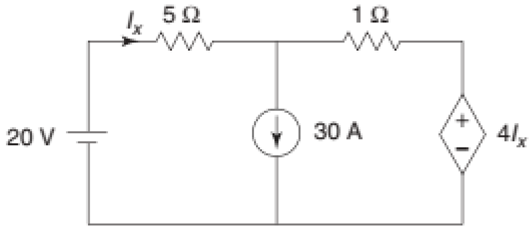
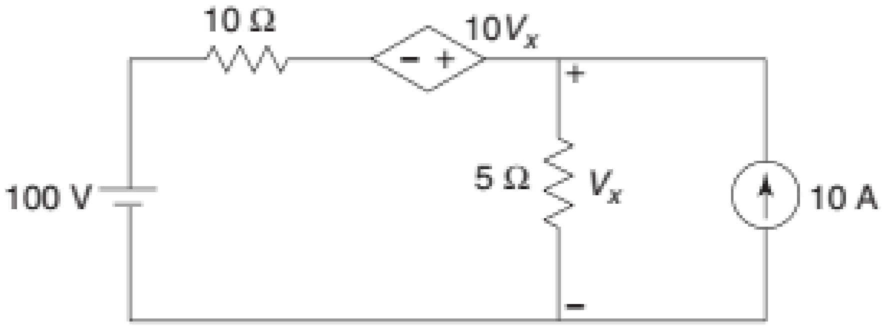
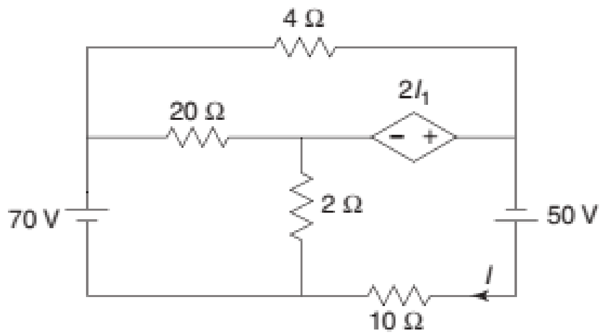
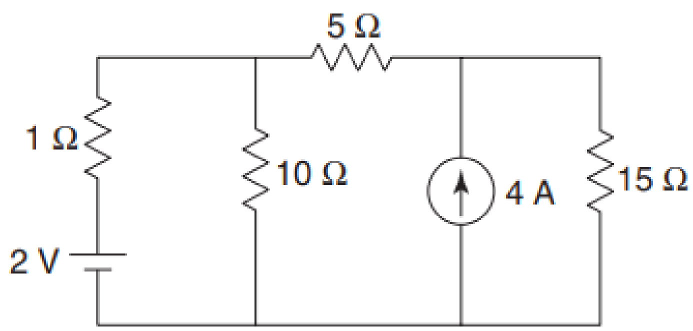
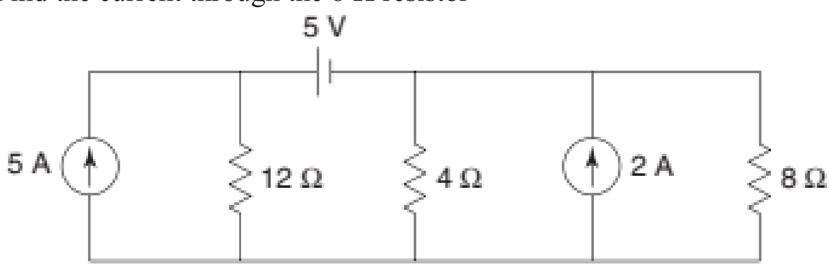
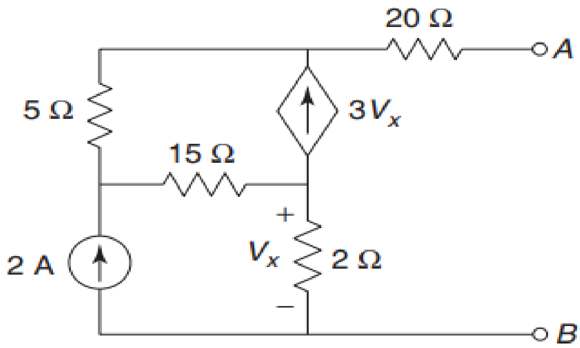
iii)	Obtain the Thevenin's equivalent network for the given network between terminal A and B 
iv)	Obtain the Thevenin's equivalent network for the given network between terminal A and B 
v)	Find the current in the 16 Ω resistor 
8	**Superposition Theorem.**
i)	Find the current through the 4 Ω resistor 
ii)	State and explain Superposition theorem? Find the current through the 6 Ω resistor 
iii)	Find the current in the 1 Ω resistors 

iv)	Find the current Ix 
v)	Determine the current through the 10 Ω resistor 
vi)	Calculate the current I in the network shown 
9	**Norton's Theorem**
i)	State and explain Norton's theorem.
ii)	Find the current through the 10 Ω resistor in Fig. Using Norton's theorem. 
iii)	Find the current through the 8 Ω resistor 

<table>
<tr><td>iv)</td><td>For the network shown in Fig., find Norton’s equivalent network

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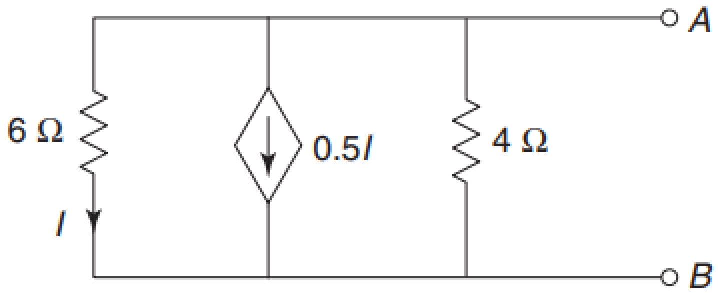
<tr><td>v)</td><td>Find Norton’s equivalent network to the left of terminal A-B in Fig.

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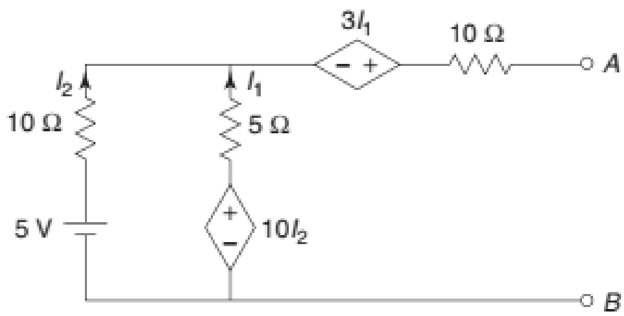
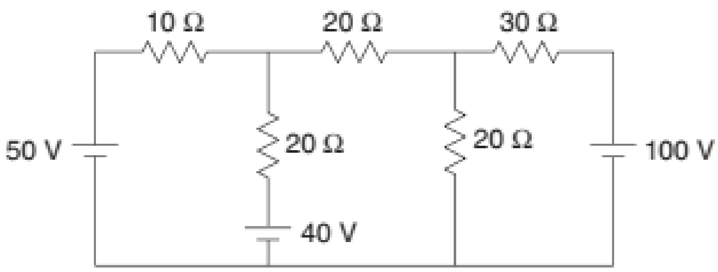
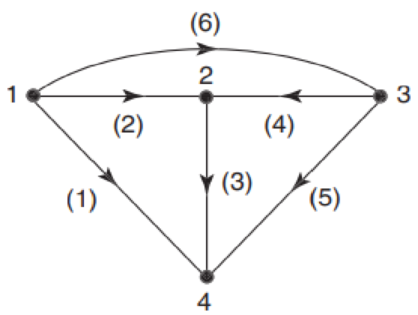
<tr><td>vi)</td><td>Find Norton’s equivalent network across terminals A and B

</td></tr>
<tr><td>vii)</td><td>Find the current through the 10 Ω resistor

</td></tr>
<tr><td>10</td><td>Graph Theory</td></tr>
<tr><td>i)</td><td>Define the following (i) Branch (ii) Sub graph (iii) Node (iii) Tree and co-tree (iv) Planar and non-Planar Graph (V) Loop or circuit</td></tr>
<tr><td>ii)</td><td>For the graph shown below find incidence and cut set matrices.

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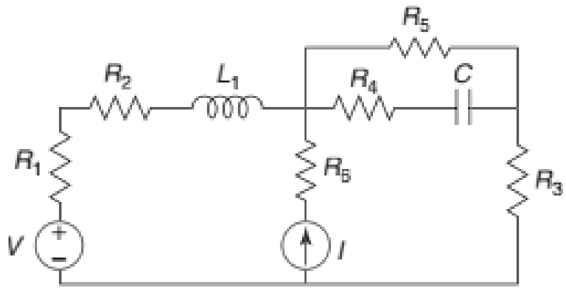
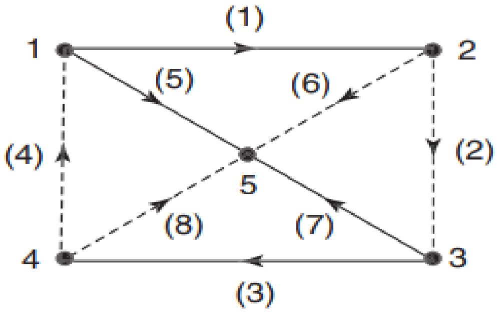
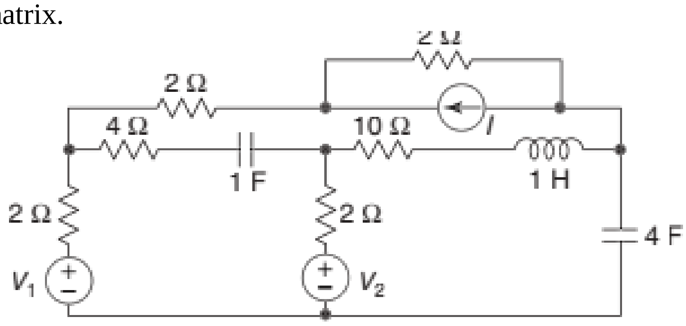
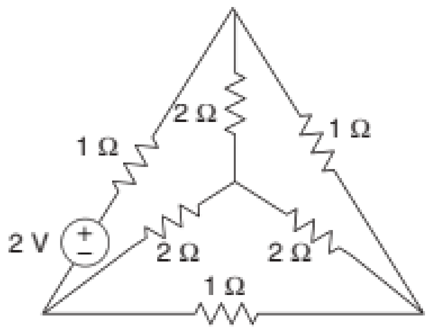
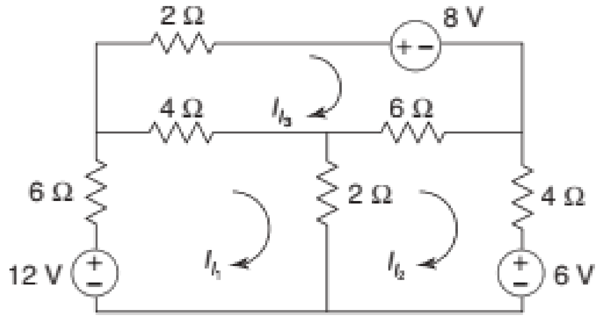
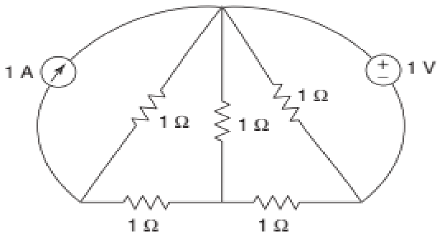
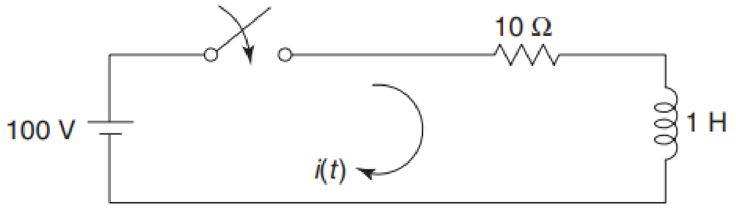
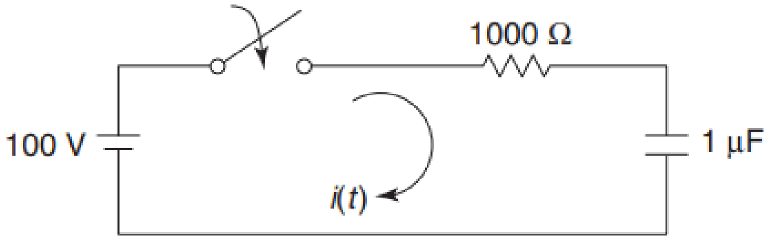
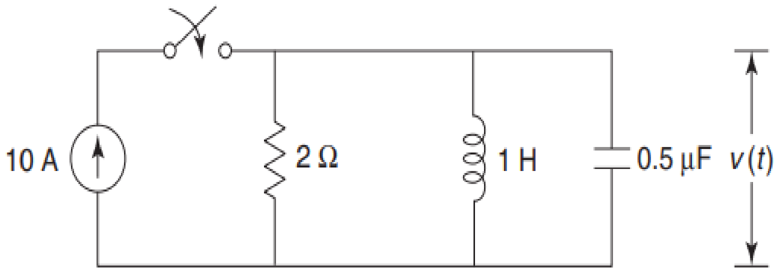
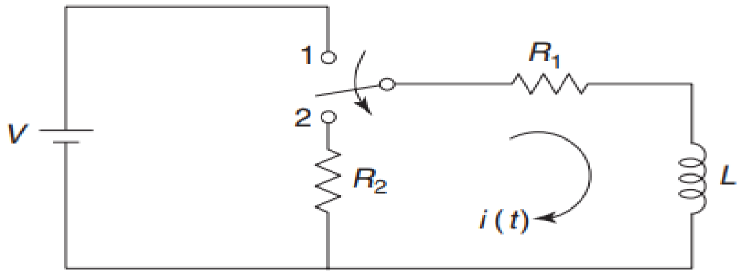
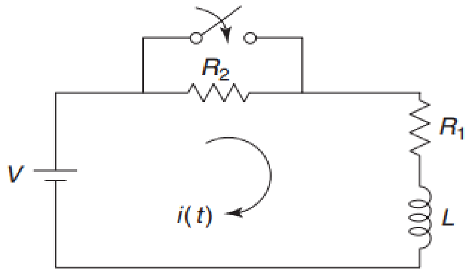
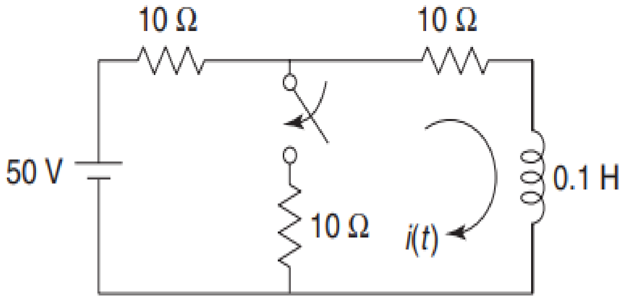
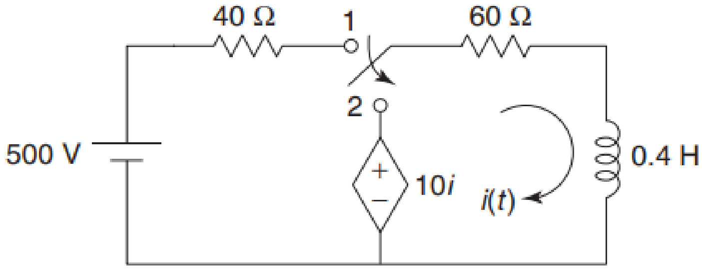
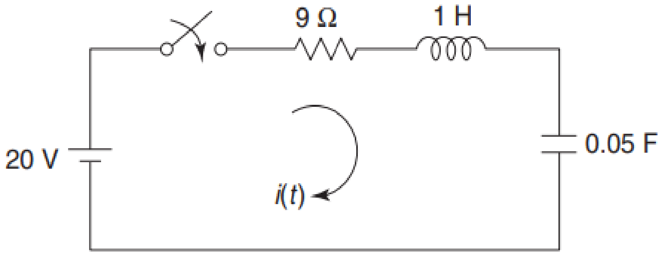
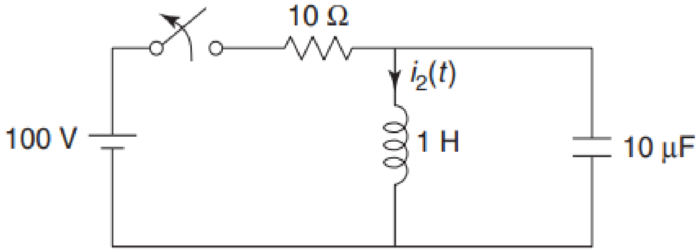
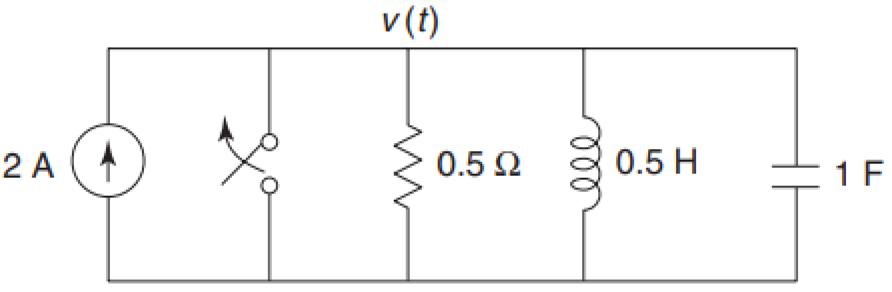
iii)	For the circuit shown , draw the oriented graph and write the (a) incidence matrix, (b) tieset matrix, and (c) f-cutset matrix. 
iv)	For the graph shown in Fig. , write the incidence matrix, tieset matrix and f-cutset matrix 
v)	Draw the oriented graph and write the (a) incidence matrix, (b) tieset matrix, and (c) f-cutset matrix. 
vi)	The reduced incidence matrix of an oriented graph is $$A = \begin{bmatrix} 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$$ (a) Draw the graph. (b) How many trees are possible for this graph? (c) Write the Tieset and Cutset matrices
vii)	Write down the tieset matrix and obtain the network equilibrium equation in matrix form using KVL. Calculate the loop currents and branch currents. 

viii)	Write down the tieset matrix and obtain the network equilibrium equation in matrix form using KVL. Calculate loop currents 
ix)	Draw the oriented graph. Write the tieset schedule and hence obtain the equilibrium equation on loop basis. Calculate the values of branch currents and branch voltages. 

Unit-2 (Transient Analysis and Frequency Domain Analysis)

Sr.No	Questions	
1	What are initial conditions? Explain the initial conditions for Resistor, capacitor and inductor.	
2	In the given network of Fig., the switch is closed at t = 0. With zero current in the inductor, find i, di/dt and d^2i/dt^2 at $t = 0^+$. 	
3	In the network of Fig., the switch is closed at t = 0. With the capacitor uncharged, find value for I, di/dt and d^2i/dt^2 at $t = 0^+$. 	
4	For the network shown in Fig. , the switch is closed at t = 0, determine v, dv/dt and d^2v/dt^2 at $t = 0^+$. 	
5	In the network of Fig., the switch is initially at the position 1. On the steady state having reached, the switch is changed to the position 2. Find current i(t). 	
6	In the network shown in Fig., the switch is closed at t = 0, a steady state having previously been attained. Find the current i (t). 	

7	In the network of Fig. , the switch is open for a long time and it closes at t = 0. Find i (t). 	
8	For the network shown in Fig. , find the current i(t) when the switch is changed from the position 1 to 2 at t = 0. 	
9	In the network of Fig. , the switch is closed at t 0 � . Obtain the expression for current i (t) for t = 0 	
10	In the network of Fig. , the switch is closed and a steady state is reached in the network. At t =0 , the switch is opened. Find the expression for the current i (t) 2 in the inductor. 	
11	In the network of Fig. , the switch is opened at t =0 obtain the expression for v (t). Assume zero initial conditions. 	

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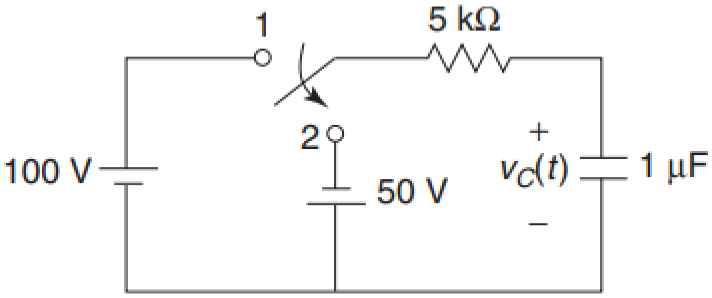
<tr><td>12</td><td>The switch in the circuit of Fig. is moved from the position 1 to 2 at t = 0. Find $v_C(t)$

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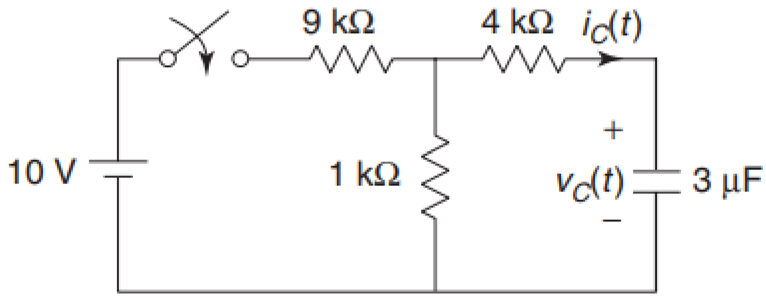
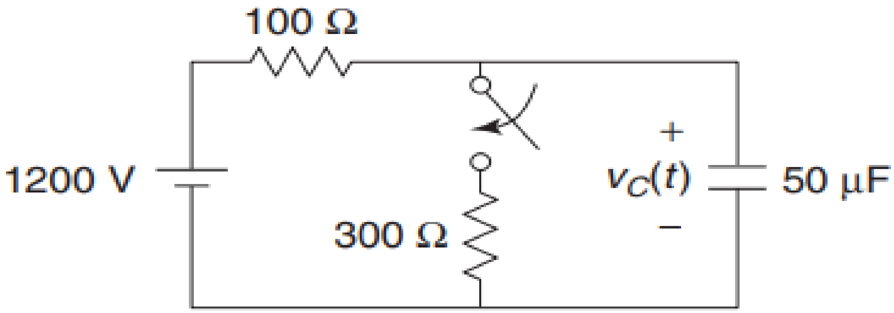
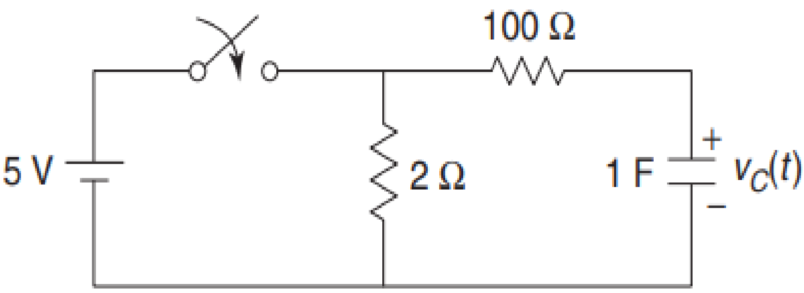
<tr><td>13</td><td>In the network shown in Fig., the switch closes at t = 0. The capacitor is initially uncharged. Find v_C (t) and i_C (t).

</td><td></td></tr>
<tr><td>14</td><td>For the network shown in Fig. , the switch is open for a long time and closes at t = 0. Determine vC (t).

</td><td></td></tr>
<tr><td>15</td><td>In Fig shown, the switch is closed at t = 0 Find $v_C(t)$ for t = 0.

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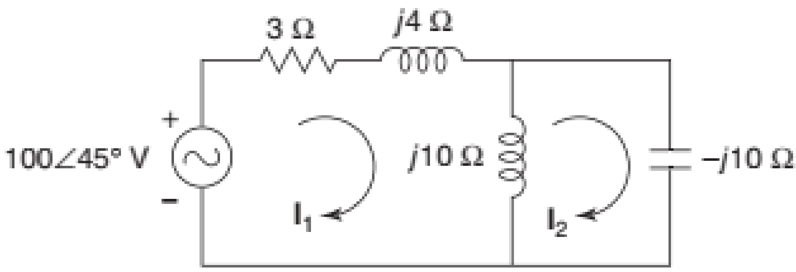
<tr><td>16</td><td>Find mesh currents I1 and I2 in the network using Mesh Analysis

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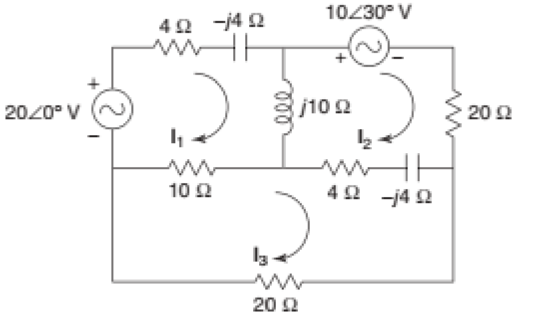
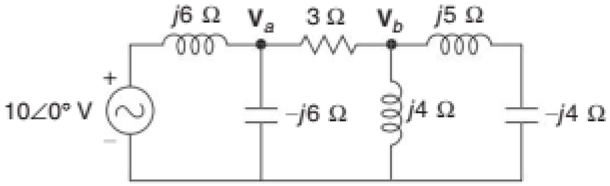
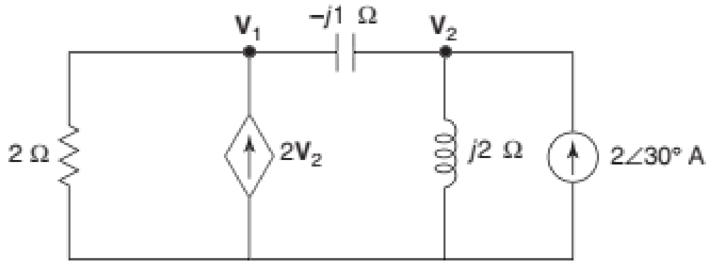
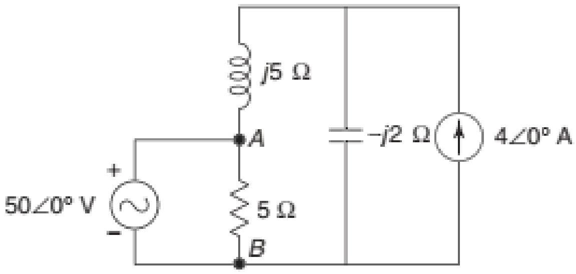
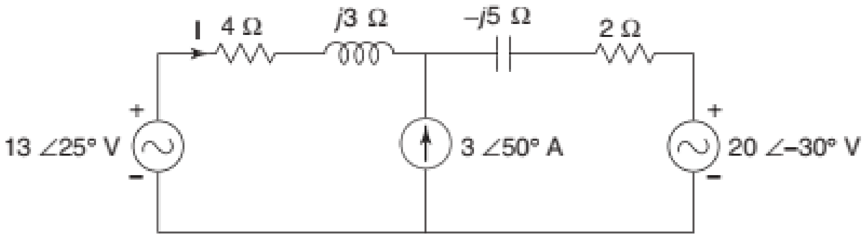
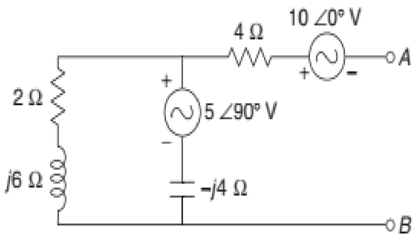
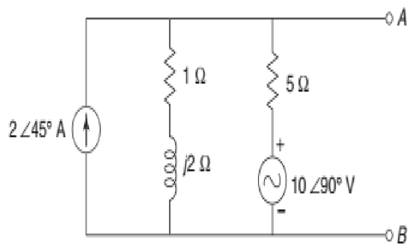
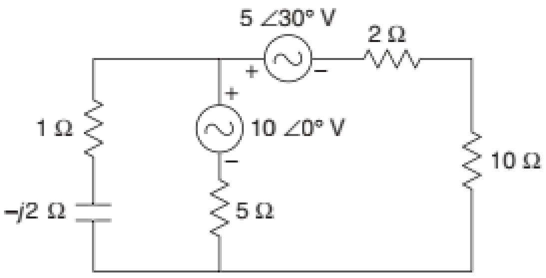
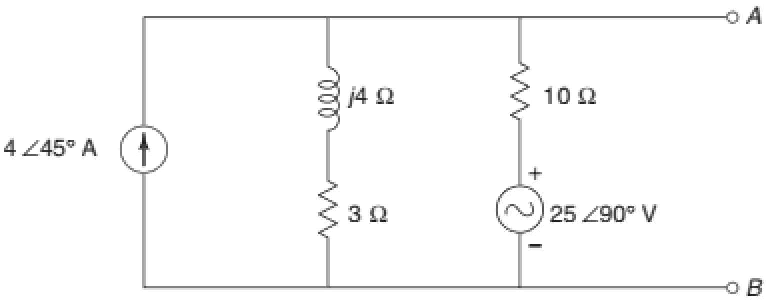
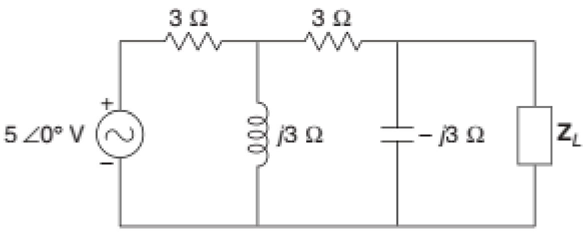
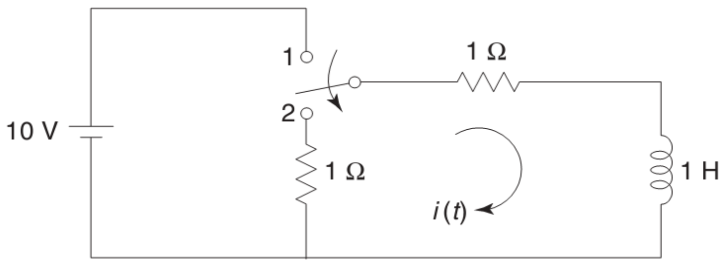
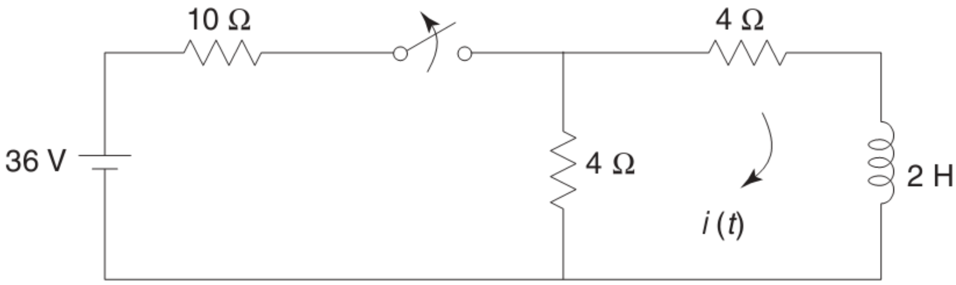
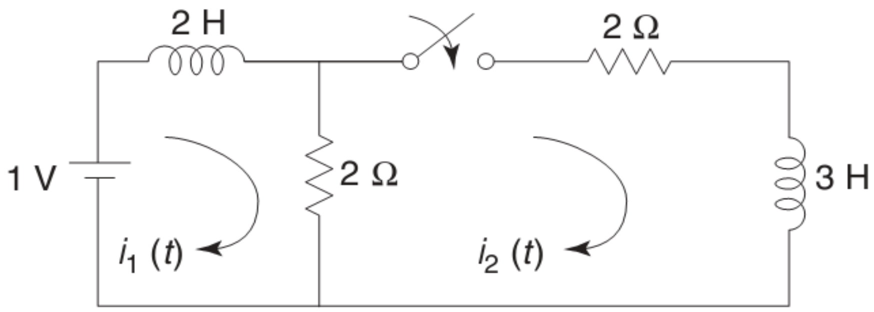
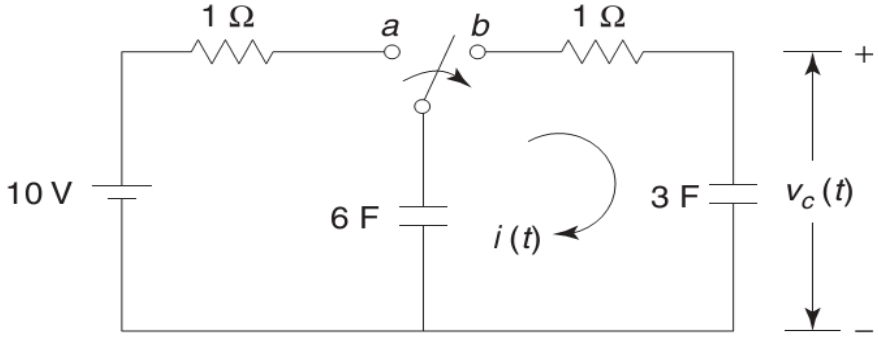
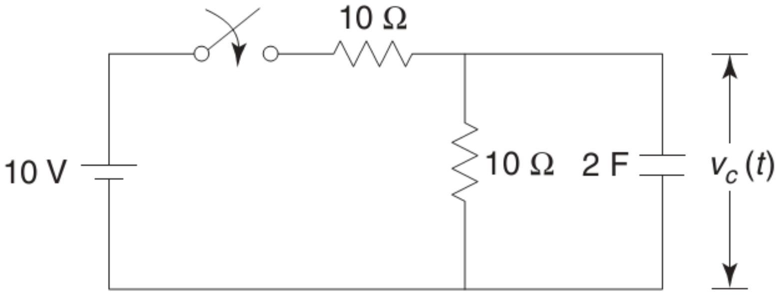
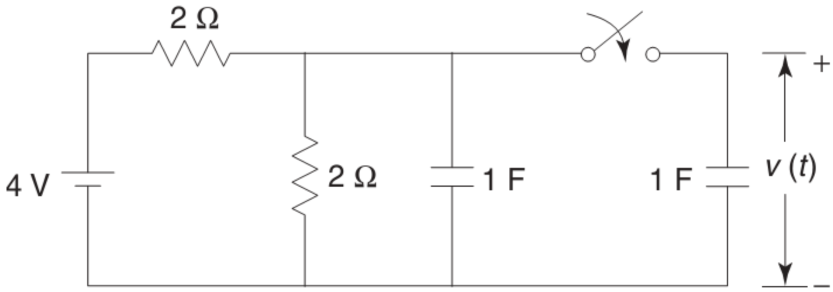
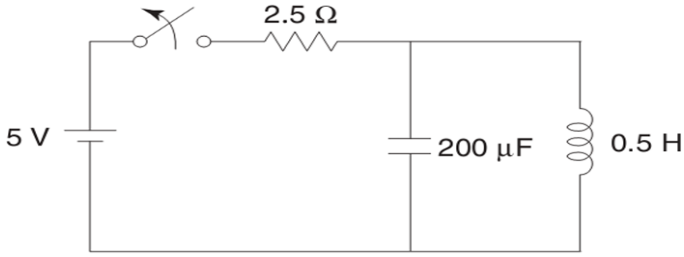
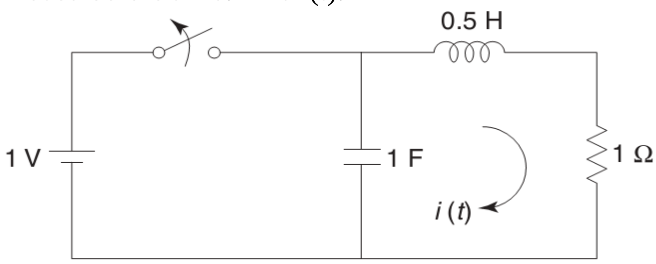
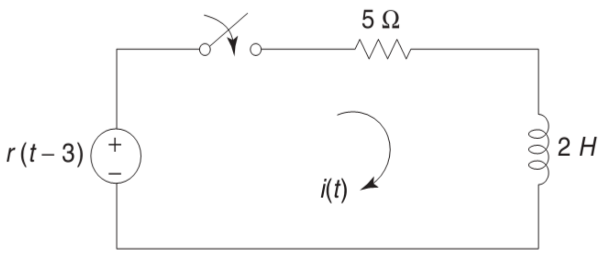
</table>

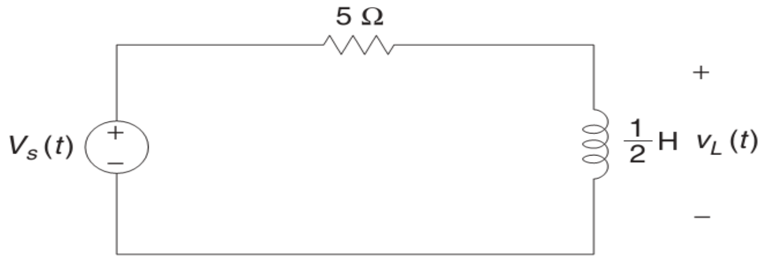
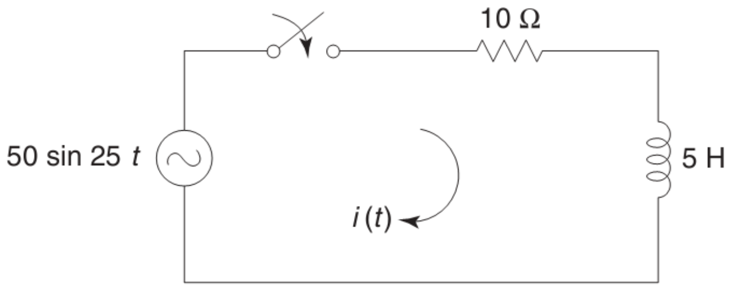
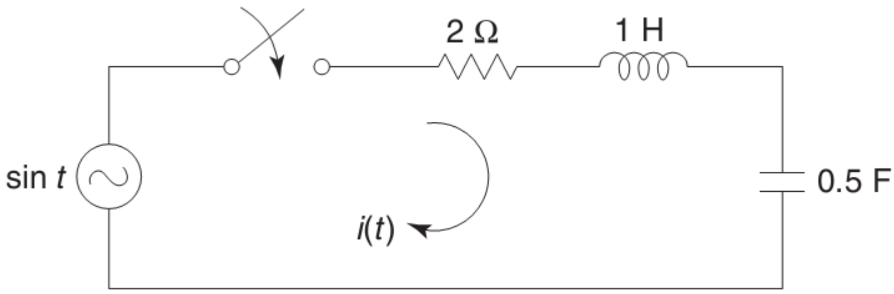
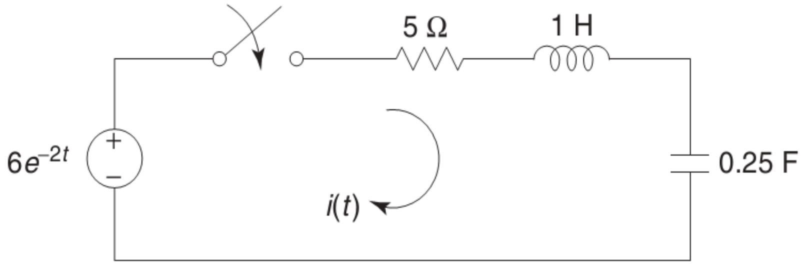
17	Find the value of the current I_3 in the network shown 	
18	Determine V_a and V_b using node Analysis 	
19	Determine V_1 and V_2 using node Analysis 	
20	Determine the voltage V_{AB} for the network shown, using Superposition Theorem 	
21	Find the current I in the network using Superposition Theorem 	
22	Obtain Thevenin's equivalent network  	

23	find the current through the 10 Ω resistor using Thevenin's theorem 	
24	Obtain Norton's equivalent network 	
25	Find the impedance Z_L so that maximum power can be transferred to it in the network of Figure shown. Find maximum power 	

Unit-3 (Laplace transform and its circuit applications)

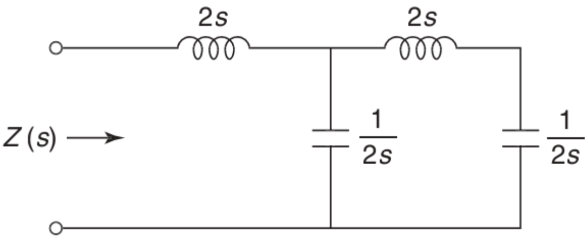
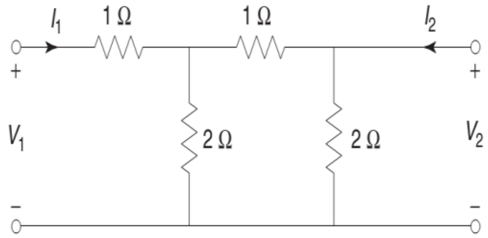
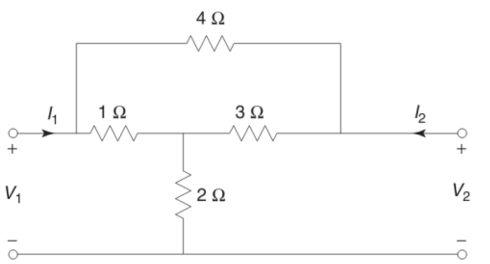
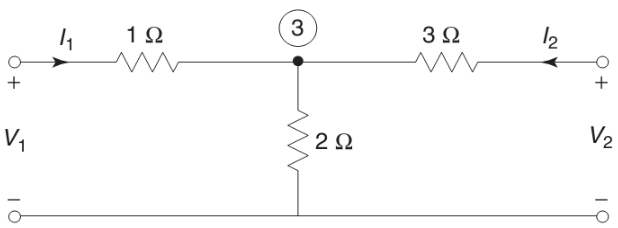
Sr.No	Questions	
1	Derive Transient and steady state response of R-L, R-C , R-L-C circuit to various functions (i.e.with Unit step, Unit ramp and Unit impulse function)	
2	Explain the Behaviour of basic elements in Laplace Transform	
3	Find Laplace Transform of various standard time domain functions	
4	In the network of Fig. given below , the switch is moved from the position 1 to 2 at t = 0,steady-state condition having been established in the position 1. Determine i (t) for t > 0.  	
5	In the network of Fig. below, the switch is opened at t =0. Find i(t).  	
6	In the network shown in Fig, the switch is closed at t = 0, the steady-state being reached before t = 0. Determine current through inductor of 3 H.  	
7	In the network of Fig, the switch is closed at t = 0 with the network previously unenergised. Determine currents $i_1(t)$.  	

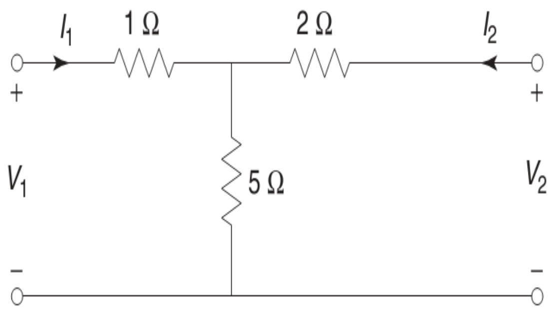
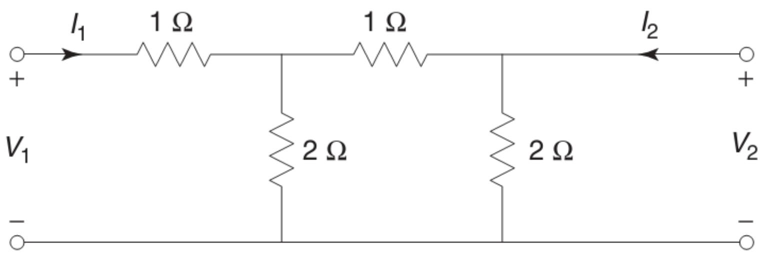
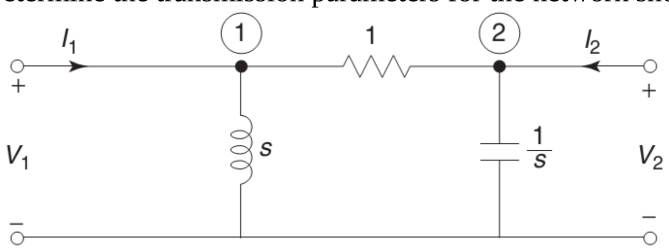
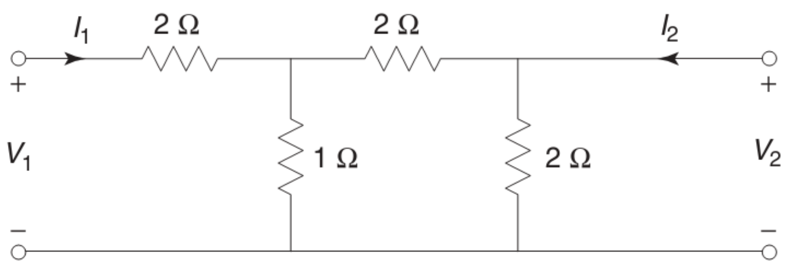
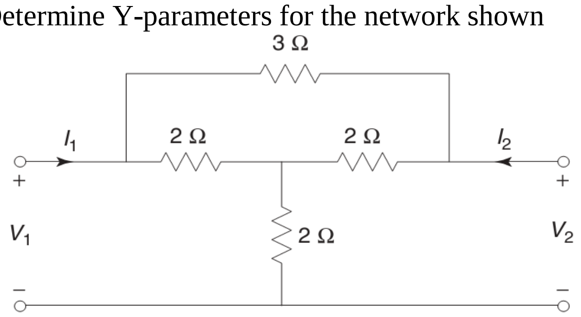
8	The switch in the network shown in Fig. is closed at t = 0. Determine the voltage cross the capacitor  	
9	The network shown in Fig. has acquired steady-state at t < 0 with the switch open. The switch is closed at t = 0. Determine v (t).  	
10	In the network of Fig, the switch is closed and steady-state is attained. At t = 0, switch is opened. Determine the current through the inductor  	
11	In the network shown below, the switch is opened at t = 0. Steady-state condition is achieved before t = 0. Find i(t).  	
12	For the network shown below, determine the current i(t) when the switch is closed at t = 0. Assume that initial current in the inductor is zero.  	

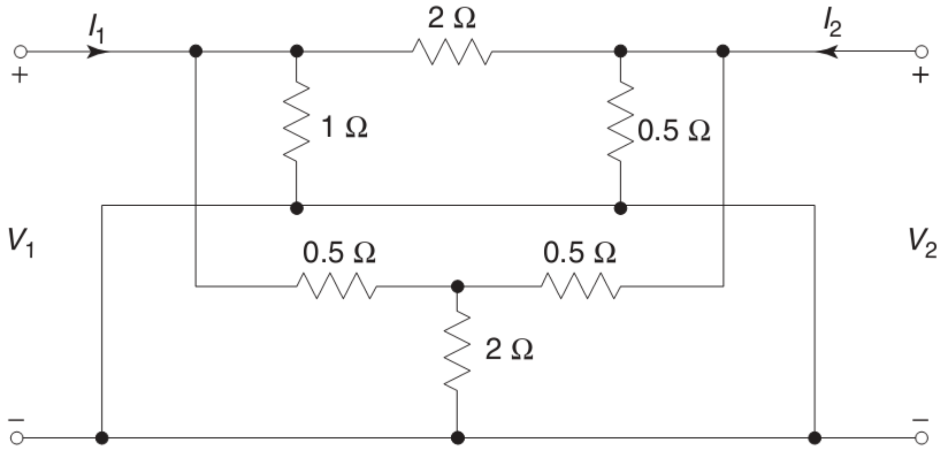
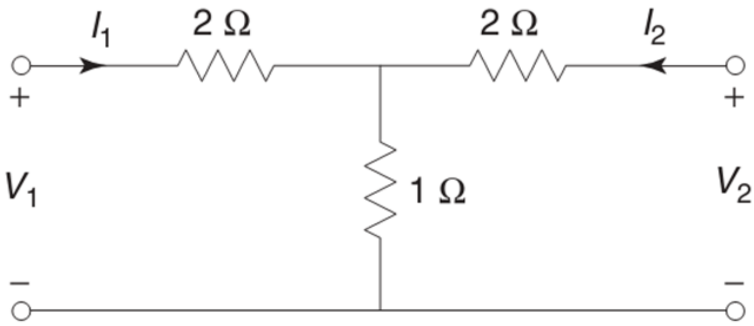
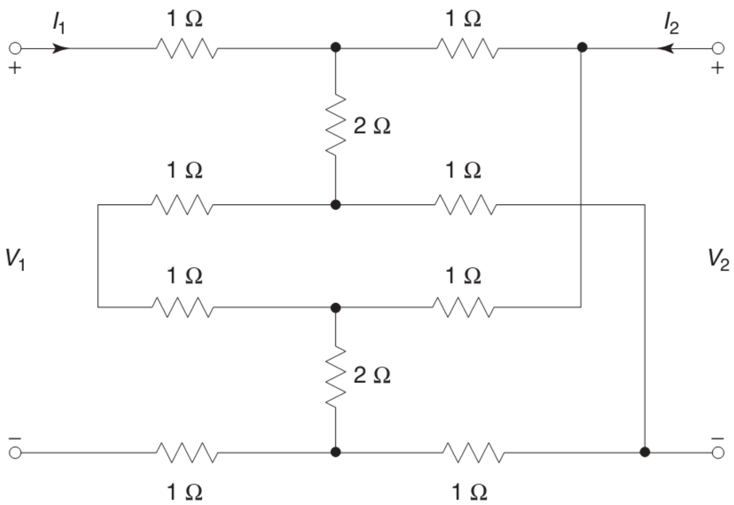
<table>
<tr><td>13</td><td>Determine the expression for v_L (t) in the network shown. Find $v_L(t)$ when (i) $v_s(t) = \delta$ (t), and (ii) $v_s(t) = e^{-t}$ u(t).

</td><td></td></tr>
<tr><td>14</td><td>For the network shown, determine the current i (t) when the switch is closed at t = 0.

</td><td></td></tr>
<tr><td>15</td><td>For the network shown, the switch is closed at t = 0. Determine the current i(t) assuming zero initial conditions

</td><td></td></tr>
<tr><td>16</td><td>

For the network shown above, the switch is closed at t =0. Determine the current i(t) assuming zero initial conditions in the network elements</td><td></td></tr>
<tr><td>17</td><td>To find Initial and Final values if they exist of the signal with L.T.
$\frac{(S+10)}{S^2+3S+2}$ and $\frac{S^2+5S+2}{S^2+3S+2}$</td><td></td></tr>
</table>

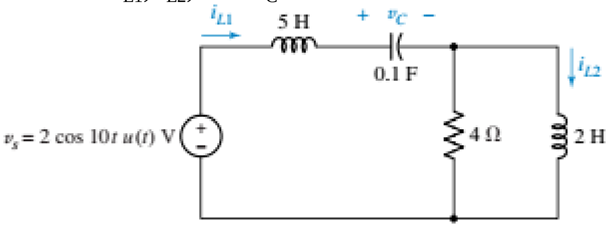
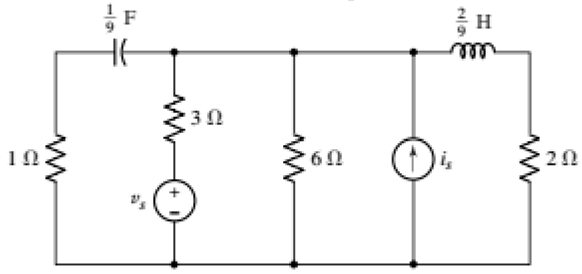
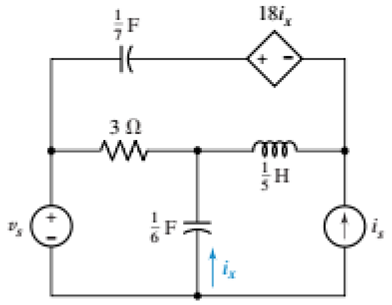
Unit-4 (Two Port Networks)

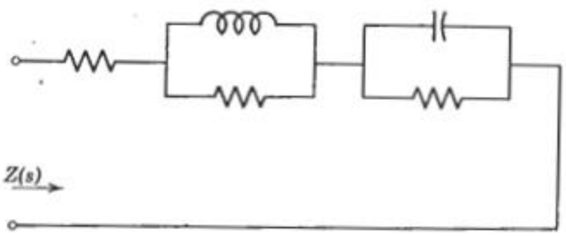
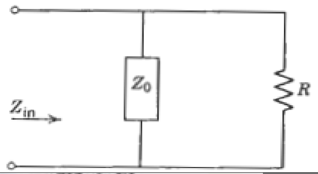
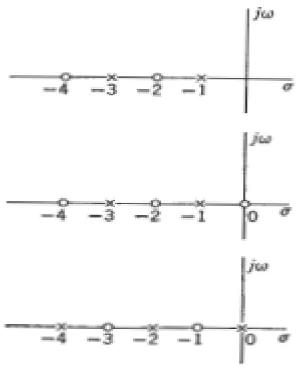
Sr.No	Questions	
1	Define the term 1. Driving-point Impedance Function 2. Driving-point Admittance Function 3. Voltage Transfer Function 4. Current Transfer Function 5. Transfer Impedance Function 6. Transfer Admittance Function	
2	Determine the driving-point impedance of the network shown 	
3	Find Z parameter for the network given below and Determine whether the network is symmetrical and reciprocal 	
4	Find the open-circuit impedance parameters for the network shown below. Determine whether the network is symmetrical and reciprocal 	
5	Find Y-parameters, h-parameter and Z-parameter and ABCD parameter for the network given below 	

6	• Derive Z parameter in terms of Y-parameter, h-parameter and ABCD parameter • Derive Y-parameter in terms of Z parameter, h-parameter and ABCD parameter • Derive h -parameter in terms of Z parameter, Y-parameter and ABCD parameter	
7	Find h-parameter, Y-parameters and Z-parameter and ABCD parameter for the network given below 	
8	Obtain ABCD parameters for the network shown 	
9	Determine the transmission parameters for the network shown 	
10	Determine hybrid parameters for the network shown.Determine whether the network is reciprocal. 	
11	Determine Y-parameters for the network shown 	

12	Find Y-parameters for the network shown 	
13	Two identical sections of the network shown in Fig, are connected in series. Obtain Z-parameters of the overall connection 	
14	Determine h-parameters for the network shown 	

Unit-5 (State Variable Analysis and RL & RC Network Synthesis)

Sr.No	Questions	
1	Write a set of normal-form equations for the circuit shown in Fig, Order the state variables as i_{L1}, i_{L2}, and v_C. 	
2	Write a set of normal-form equations for the circuit of Fig shown 	
3	Find the set of normal-form equations for the circuit 	
4	Using the state vector q = $\begin{bmatrix} i \\ v \end{bmatrix}$, determine the system matrix and the forcing-function vector for the circuit of Fig. shown. (b) Repeat for the state vector q = $\begin{bmatrix} v \\ i \end{bmatrix}$	
5	a)Which of the following functions are L-C driving point impedances? Why? $Z_1(s) = \frac{s(s^2+4)(s^2+16)}{(s^2+9)(s^2+25)}, \quad Z_2(s) = \frac{(s^2+1)(s^2+8)}{s(s^2+4)}$ b) Synthesize the realizable impedances in a foster and cauer form	
6	Indicate which of the following functions are either R-C, R-L or L-C impedance functions (a) $Z(s) = \frac{s^3+2s}{s^4+4s^2+3}$ (b) $Z(s) = \frac{s^2+6s+8}{s^2+4s+3}$ (c) $Z(s) = \frac{s^2+4s+3}{s^2+6s+8}$ (d) $Z(s) = \frac{s^2+5s+6}{s^2+s}$ (e) $Z(s) = \frac{s^4+5s^2+6}{s^3+s}$	

7	Synthesize $Z(s) = \frac{(s+2)(s+4)}{(s+1)(s+5)}$ into the form shown in the figure. 	
8	The input impedance for network shown is, $$Z_{in} = \frac{2s^2+2}{s^3+2s^2+2s+2}$$ If Z_0 is an L-C network: (*a*) Find the expression for Z_0. (*b*) Synthesize Z_0 in a Foster series form. 	
9	Synthesize the following functions in Cauer form. $$Z(s) = \frac{s^3+2s^2+s+1}{s^3+s^2+s}$$ $$Z(s) = \frac{s^3+s^2+2s+1}{s^4+s^3+3s^2+s+1}$$ $$Z(s) = \frac{4s^3+3s^2+4s+2}{2s^3+s}$$	
10	Of the three pole-zero diagrams shown, pick the diagram that represents an R-L impedance function and synthesize in a series Foster form 	
11	a. Explain about classification of filters. Draw the characteristics of Low-pass and High-pass filters. b. Explain about Propagation constant and Characteristic impedance in Π-network filters and T-network filters. c. Explain about Constant-K low-pass filter, Constant-K high-pass filter, Constant-K band –pass filter in detail.	
12	A constant K low pass filter is designed to cut-off at a frequency of 1000Hz and the resistance of the load circuit is 50Ω. Calculate the values of the corresponding components required.	
13	Design a constant k low pass filter Π and T sections at a frequency of 5KHz and a design impedance of 1000Ω. Calculate the attenuation constant at a frequency of 6kHz and phase shift of 1kHz.	

14	The elements of a T section of a constant K low pass filter are as shown Inductance=50m H each And Capacitance=0.01μ F. calculate the cut-off frequency and characteristic impedances at a frequency of 1KHz and 5KHz. Also find the attenuation and phase shift at 1 kHz and 5 kHz.	
15	Design a constant k-high pass filter band pass filter to have a cut-off frequency of 2000Hz , 5000Hz , 2 KHz and a design impedance of 100Ω.	