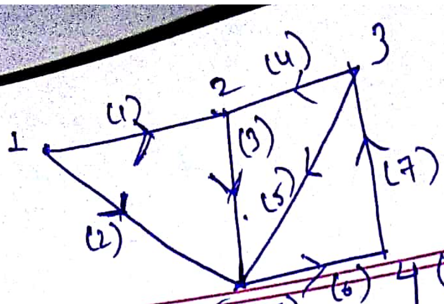
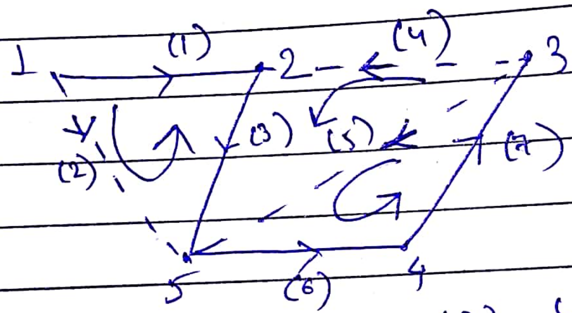
Q.



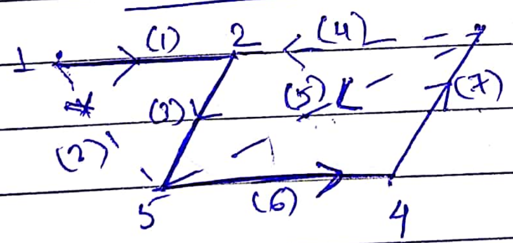
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1	1	0	0	0	0	0
2	-1	0	1	-1	0	0	-1
3	0	0	0	1	1	-1	1
4	0	0	0	0	0	1	0
5	0	-1	-1	0	-1		

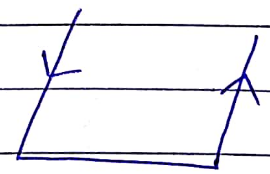


T2 [2 1 3]
T4 [4 3 7 6]
T5 [5 6 7]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T2	-1	1	-1	0	0	0	0
T4	0	0	1	1	0	1	1
T5	0		0	0	1	1	1

Cut-Set

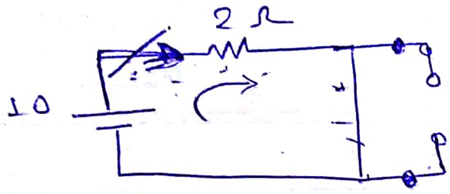




C1 [1 2]
C3 [3 4 2]
C6 [6 5 4]
C7 [7 5 4]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
C1	1	1	0	0	0	0	0
C3	0	1	1	1	0	0	0
C6	0	0	0	-1	-1	1	0
C7	0	0	0	-1	-1	0	1

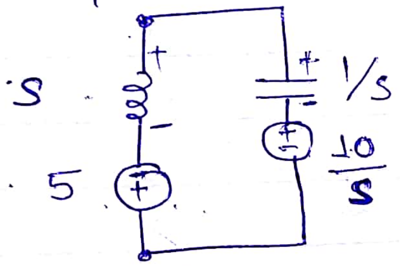
5. b) Steady state:



$i = \frac{10}{2} = 5A$

$V_0 = 10$

At $t=0$, open,



$I(S)\,S - 5 - \frac{10}{S} - \frac{I(S)}{S} = 0$

$I(S)\left[S - \frac{1}{S}\right] = 5 + \frac{10}{S} = \frac{5S+10}{S}$

$\Rightarrow I(S)\left[\frac{S^2-1}{S}\right] = \frac{5S+10}{S}$

$$I(S) = \frac{5S+10}{S^2-1} = \frac{5S}{(S^2-1)} + \frac{10}{S^2-1} = \frac{5S+10}{(S+1)(S-1)}$$

$$= \frac{A}{S+1} + \frac{B}{S-1}$$

$\frac{5+10}{2} = \frac{15}{2} = B$

$A = -\frac{5}{2}$

$\frac{-5+10}{-2}$ $-\frac{5}{2}$

$$\therefore = -\frac{5}{2}\left(\frac{1}{S+1}\right) + \frac{15}{2}\left(\frac{1}{S-1}\right)$$

$$= -\frac{5}{2}e^{-t} + \frac{15}{2}e^{t}$$

list

$$v(t) = u(t) - u(t-1)$$

$$V(s) = \frac{1}{s} - \frac{e^{-s}}{s} = \frac{1}{s}(1 - e^{-s})$$

$$\therefore\ v(t) = i(t)R + C.i(t)$$

$$\Rightarrow V(s) = I(s)\left[R + \frac{2}{s}\right] = I(s)\left(1 + \frac{2}{s}\right) = I(s)\left[\frac{s+2}{s}\right]$$

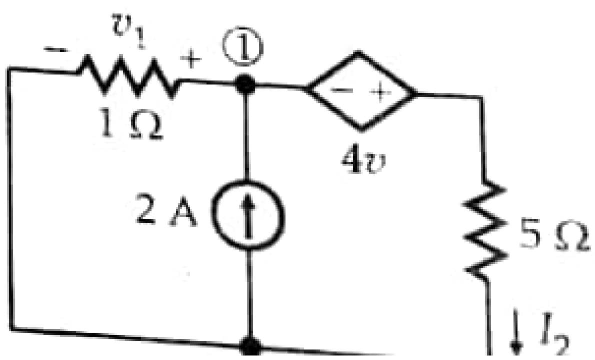
$$\therefore\ I(s) = \frac{s.V(s)}{s+2} = \frac{\cancel{s}}{(s+2)} \cdot \frac{(1-e^{-s})}{(\cancel{s})}$$

$$i(t) = \frac{1-e^{-s}}{s+1} = \frac{1}{s+2} - \frac{e^{-s}}{s+2} = e^{-2t} - e^{-2t}.u(t-1)$$

... taking the current source only, referring Fig. E3.137(b), at *node* (1),

$$2 = \frac{v_1}{1} + \frac{v_1 + 4v_1}{5} = v_1 + 0.2\, v_1 + 0.8\, v_1$$

or $$v_1 = 1\,\text{V}.$$



Superposition,

$$i = i' - i'' = 6 + 8 = \mathbf{14\ A}.$$

Imp

EXAMPLE 3.137 *Find the power loss in 5 Ω resistor by Superposition theorem in Fig. E3.137.*

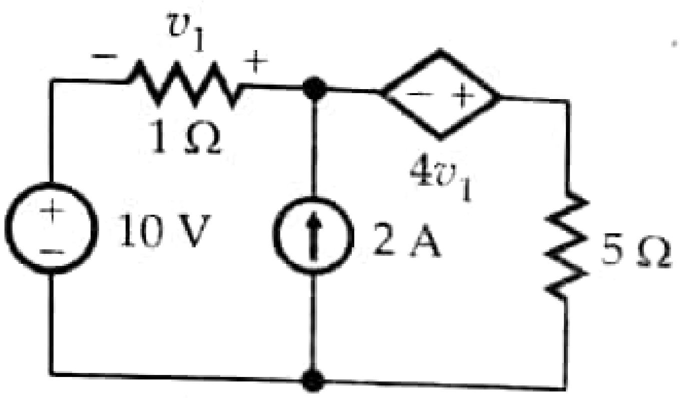


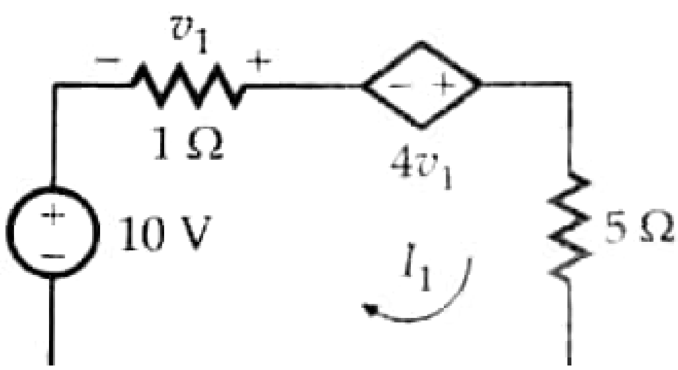
Fig. E3.137

SOLUTION. Assuming the 10 V source first (Fig. E3.137(*a*)), KVL yields

$$-10 - v_1 - 4v_1 + 5I_1 = 0$$

or, $$5I_1 = 5v_1 + 10 \quad ...(1)$$

But $$v_1 = -1 \times I_1 \quad ...(2)$$



[I] = [Y][V]

$$V1 = AV2 - BI2$$

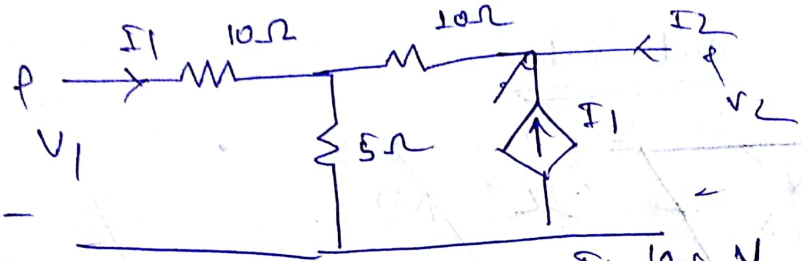
$\frac{V1}{V2} = A \bigg| \frac{V1}{I2} = \cdot$ $\quad \frac{V1}{V2} = A \Big|_{I_2 = 0}$ $\quad \frac{V1}{V2} = C$

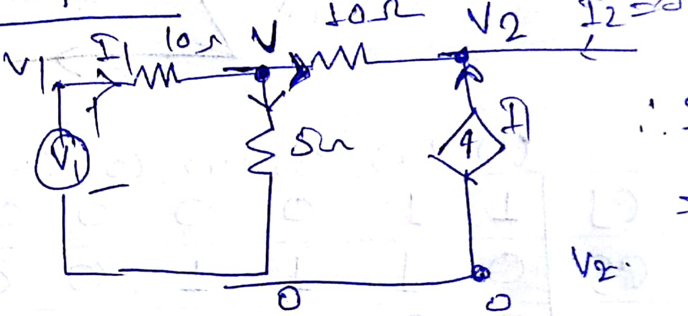
$\frac{V_1 - V}{\cancel{5}} = \frac{V}{\cancel{5}}$

$V_1 = 2V$

$V = \frac{V_1}{2}$

Z.





$V1 = Z_{11} I_1 + Z_{12} I_2$

$V_2 = Z_{21} I_1 + Z_{22} I_2$

$Z_{11} = \frac{V_1}{I_1} \Big|_{I_2 = 0}$ $\quad Z_{21} = \frac{V_2}{I_1} \Big|_{I_2 = 0}$

$\therefore I_1 = \frac{V_1 - V}{10} = \frac{V_1 - \frac{V_1}{2}}{10} = \frac{V1}{20}$

$$\frac{V_1 - V}{10} = \frac{V}{5} + \frac{V - V2}{10} \quad \text{—(1)}$$

$$\frac{V - V2}{10} + I_1 = 0$$

$V_1 = V_2$

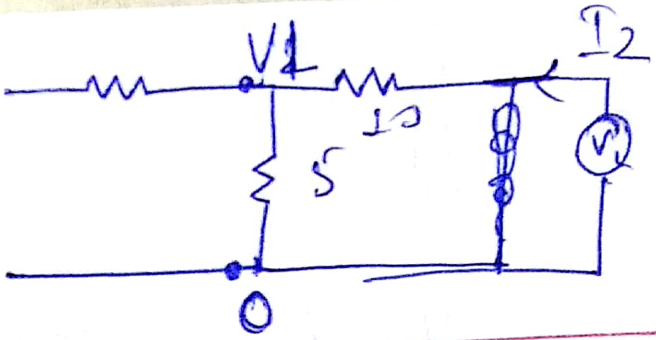
$Z_{11} = \frac{V_1}{I_1} = \frac{V_1}{V_1/20} = 20$

$\Rightarrow \frac{V_1 - V}{10} = \frac{V}{5} + \frac{V - V_1}{10}$ $\quad \Rightarrow \frac{V_1 - V}{10} + \frac{V_1 - V}{10}$ $\quad \Rightarrow \frac{V - V_2}{10} + \frac{V_1 - V}{10} = 0.$

$\Rightarrow \cancel{V} \cancel{V} - V_2 + V_1 - \cancel{V} 10$ 20

$Z_{21} = 20$

nce, finally, $I_1 = 1.5 I_3 - 1.5$ 5



EXPT. NO.

$\frac{V_1}{I_2} = Z_{12}$

$\frac{V_2}{I_2} = Z_{22}$

$I_1 = 0$.

$\therefore V_2 = 15 I_2$

$\Rightarrow \frac{V_2}{I_2} = 15 = Z_{22}$

$V_1 = 5 \times I_2 \Rightarrow \frac{V_1}{I_2} = 5 \quad Z_{12}$.