EE 102

ELECTRICAL

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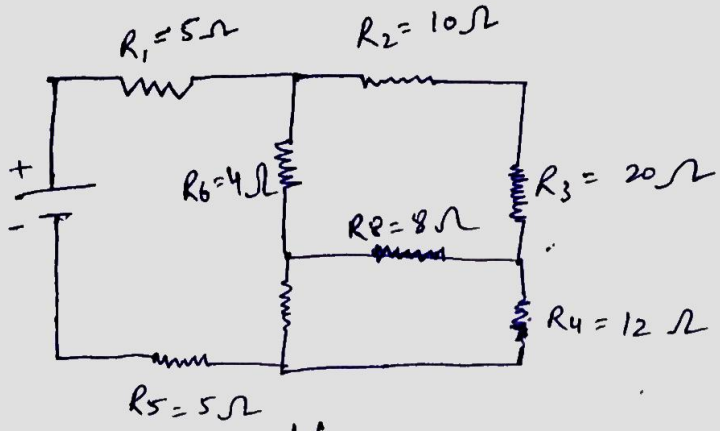
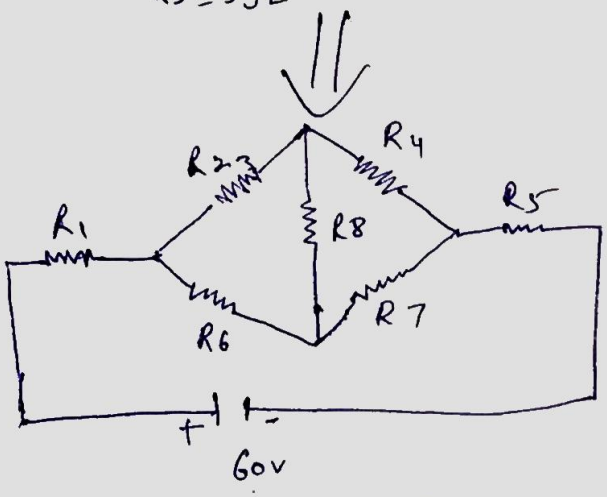
2K19/A14/35

Assignment No-2

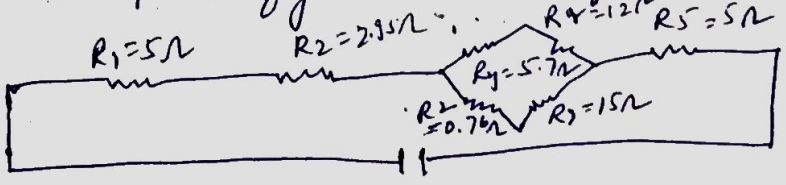
Ans 1 To find = current delivered by battery.

2)





Using Δ-Y Configuration transformation.

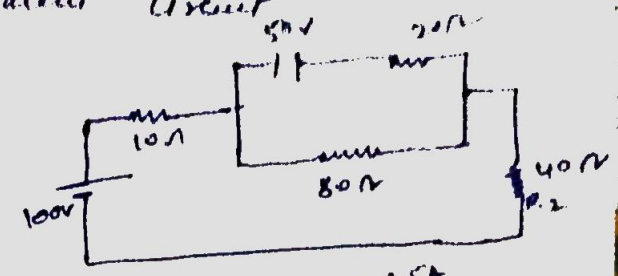


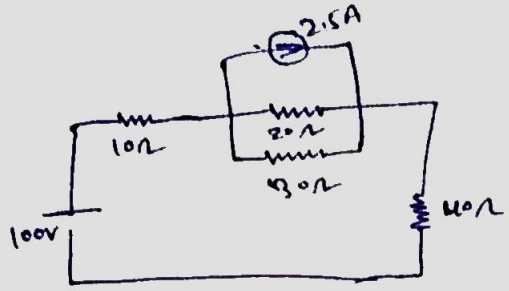
Now, Current $= \frac{60}{Req}$; $Rq = R_1 + Rx + R_5 + \left(\frac{1}{R_4+R_q} + \frac{1}{R_2+R_7}\right)$

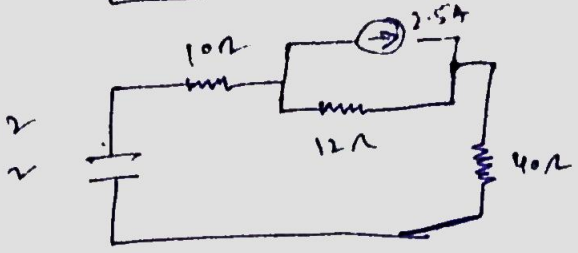
Current = 3.324 A.

Ans 2 To find thevenin equivalent circuit

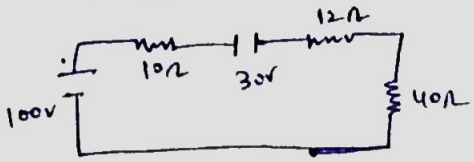
Converting 10V and 20Ω to Current Source.





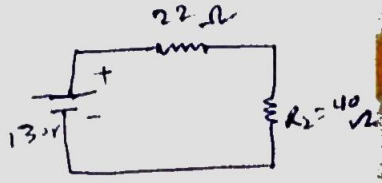


Converting 2.5A Current source to Voltage source.



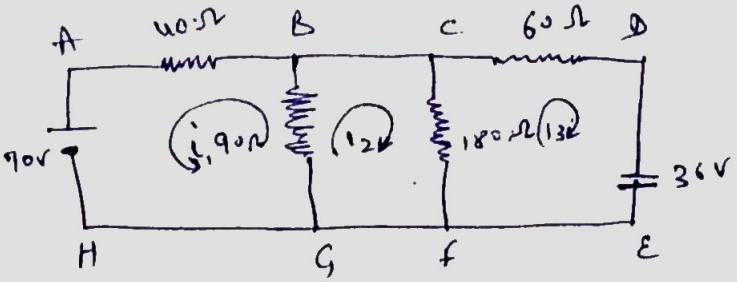
Now adding the voltage source, we have the required the venin Circuit

$R_1 = 40\Omega$ $R_{th} = 22\Omega$



Ans 3 To find: Current through 30Ω resistor

Assuming Current i_1, i_2 & i_3.



for ABGHA →

$7 = 40i_1 + 30i_2 + 90i_3$

for BCFGB →

$270i_1 = 90i + 180i_3$

for CDEFC →

$36 = 216i_3 - 180i_2$

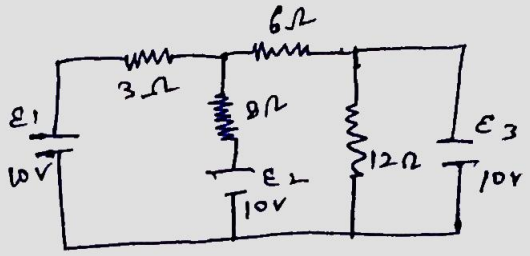
Solving Eqns ....

$i = \frac{37}{25}$ A ; $i_2 = \frac{34}{25}$ A & $i_3 = \frac{13}{10}$ A ∴ Through 90Ω resistor

$i_{net} = \frac{3}{25}$ A.

Ans 4 To Solve for Current using superposition

Shorting $\mathcal{E}_2$ and $\mathcal{E}_3$.



$i_1 = \frac{10}{17.42} = 0.579\,A \rightarrow 3\Omega$

$0.825 \rightarrow 6\Omega,\ 0.245 \rightarrow 8\Omega$

$0A \rightarrow 12\Omega$

Shorting $\mathcal{E}_1$ and $\mathcal{E}_3$.

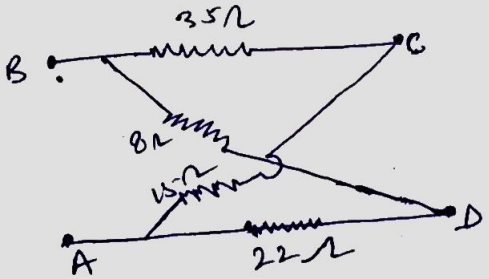
$i_2 = 1.42\,A \rightarrow$ total

$12\Omega \rightarrow 0.84A,\ 6\Omega \rightarrow 0.58A,\ 3\Omega \rightarrow -0.42A;\ 8A \rightarrow 0.16A$

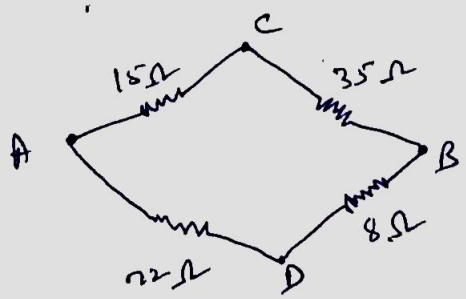
Adding all we have

$12\ \Omega$	$\rightarrow 0.84\,A$	top to bottom
$8\ \Omega$	$\rightarrow 0.591\,A$	top to bottom
$6\ \Omega$	$\rightarrow 0.79\,A$	left to right
$3\ \Omega$	$\rightarrow 0.573\,A$	left to right.

Ans 5 To find equivalent resistence b/w A and B



$\Rightarrow$ The Circuit Can be resolved as.

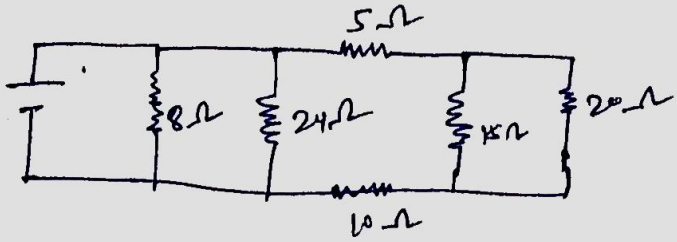


solving

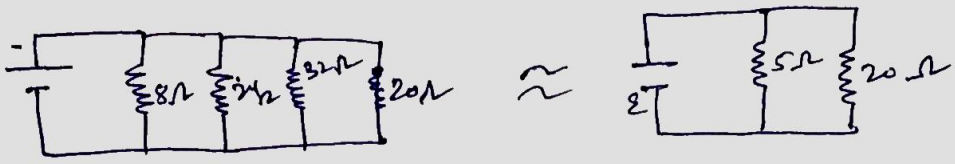
$R_{eq} = \frac{50 \times 30}{50 + 30}$

$= 18.75\ \Omega$

Ans 6 To find: $\mathcal{E}$ for power consumption 180W in 20Ω



for making Thevenin equivalent circuit, short circuit 20Ω and finding eq resistance.



Now potential drop across $20\Omega = \mathcal{E}$

Power $= i^2R$, $i = \frac{\mathcal{E}}{4}$ A, through: $20 = \left(\frac{\mathcal{E}}{4}\right)$

$= 180 = \frac{\mathcal{E}^2}{20+20} \times 20 \rightarrow$ $\boxed{\mathcal{E} = 60V}$

Ans 7 find current through $R_2 = 20\Omega$

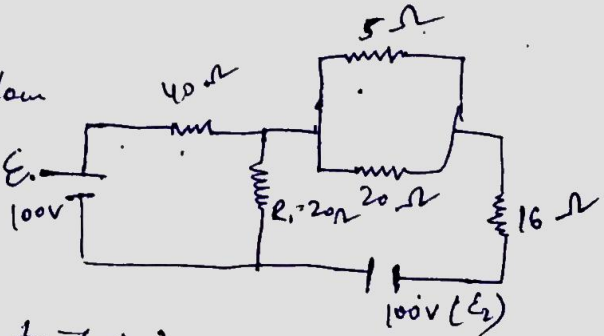
Shorting $\mathcal{E}_2$; we have

$i_1 = 2A \rightarrow$ total

= through $R_2 = 1A$, top to bottom

Shorting $\mathcal{E}_1$.

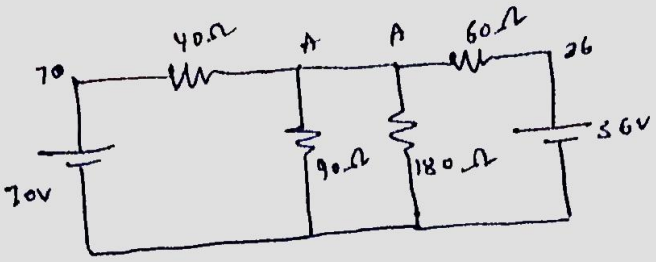
$i_2 = 3A \rightarrow$ total



2) through $R_2 = 2A$ (bottom to top)

Net current through $R_2 = 1A$. bottom to top.

8)



At Node A,

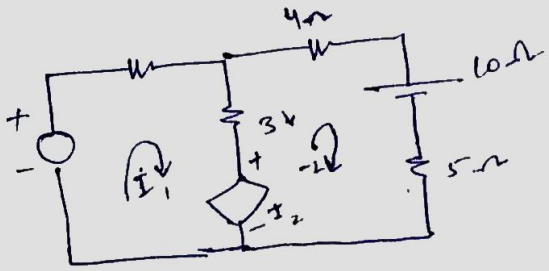
$$\frac{V_A - 70}{40} + \frac{V_A}{90} + \frac{V_A}{180} + \frac{V_A - 36}{60} = 0$$

$$V_A = 40.285\ V$$

Current through 90 Ω,

$$\frac{V_A}{90} = 0.448\ A.$$

9)



Using mesh analysis

$$\begin{bmatrix} 2+3-3 \\ -3 & 3+4+5 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 10V \\ V-10 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 5 & -3 \\ -3 & 12 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 10-V \\ V-10 \end{bmatrix}$$

Constraint of V

$$V = \alpha I_2 = I_2 \quad (\alpha = 1)$$

$5I_1 - 3I_2 = 10 - I_2 \Rightarrow 5I_1 - 2I_2 = 10 \quad -①$

$-3I_1 + 12I_2 = I_2 - 10 \Rightarrow +3I_1 - 11I_2 = +10 - ②$

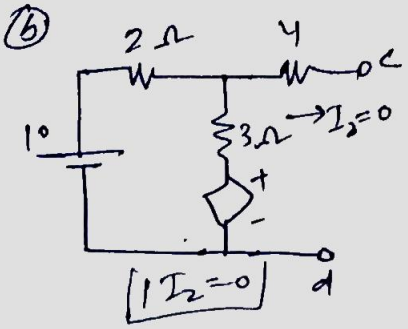
$① \times 11 - ② \times 2$

$\Rightarrow 55I_1 - 6I_1 = 90$

$49I_1 = 90$

$I_1 = \frac{90}{49} = 1.83\,A.$

⑥



$V_{oc} = 6V$

$R_{TH} = \frac{V_{oc}}{I_{sc}}$

for Isc

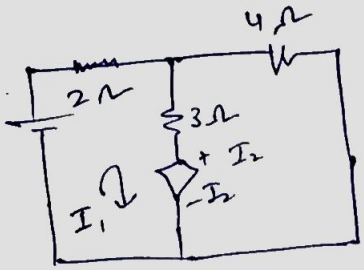
$10 - 2I_1 - 3(I_1 - I_2) - I_2 = 0$

$\Rightarrow 5I_1 - 2I_2 = 10 \quad -①$

$I_2 + 3(I_1 - I_2) - 4I_2 = 0$

$3I_1 - 6I_2 = 0$

$\boxed{I_1 = 2I_2}$

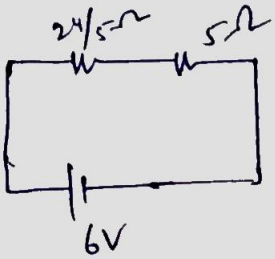


$10I_2 - 2I_2 = 10$

$I_2 = \frac{5}{4}A$

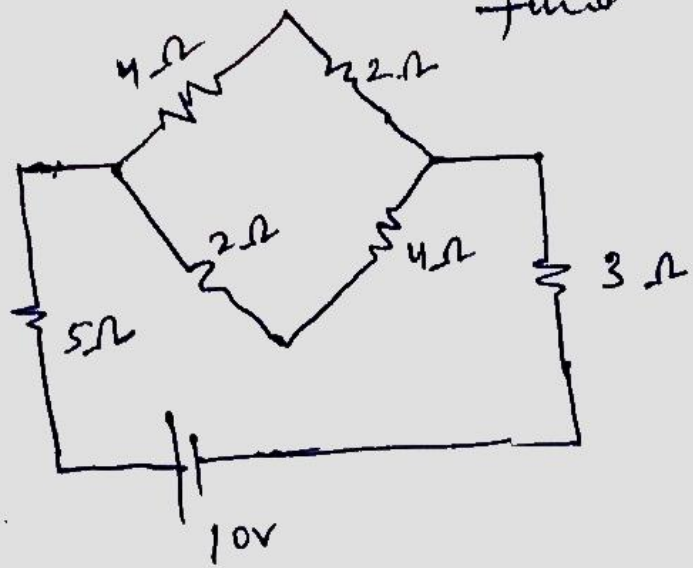
$R_{TH} \Rightarrow \frac{6 \times 4}{5} = \frac{24}{5}\,\Omega$ Ans

Hence, thevinin eq/ Circuit



Ans

(10) find the Current through 3Ω resister



It satisfy condition for balanced wheat stone bridge hence $I = 0$.

$$R_{eq} = 5 + \frac{6 \times 6}{6+6} + 3$$

$$R_{eq} \Rightarrow 11\ \Omega$$

$$I_1 = \frac{10}{11} = 0.909.$$

I Through 3Ω resistor = 0.91 Amps