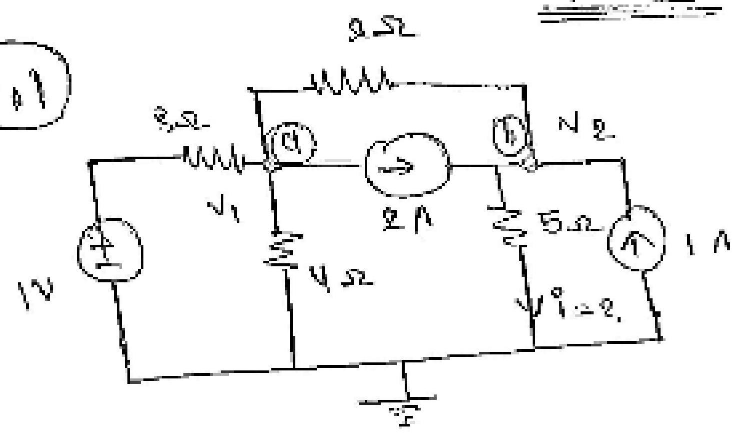
T - 1

Q 1



KCL at point (a)

$$\frac{V_1-1}{3}+\frac{V_1}{4}+\frac{V_1-V_2}{2}+2=0$$

$$\Rightarrow 4V_1-4+3V_1+6V_1-6V_2+24=0$$

$$13V_1-6V_2=-20 \quad \text{—— (1)}$$

KCL at node point (b)

$$-2-1+\frac{V_2}{5}+\frac{V_2-V_1}{2}=0$$

$$\Rightarrow -30+2V_2+5V_2-5V_1=0$$

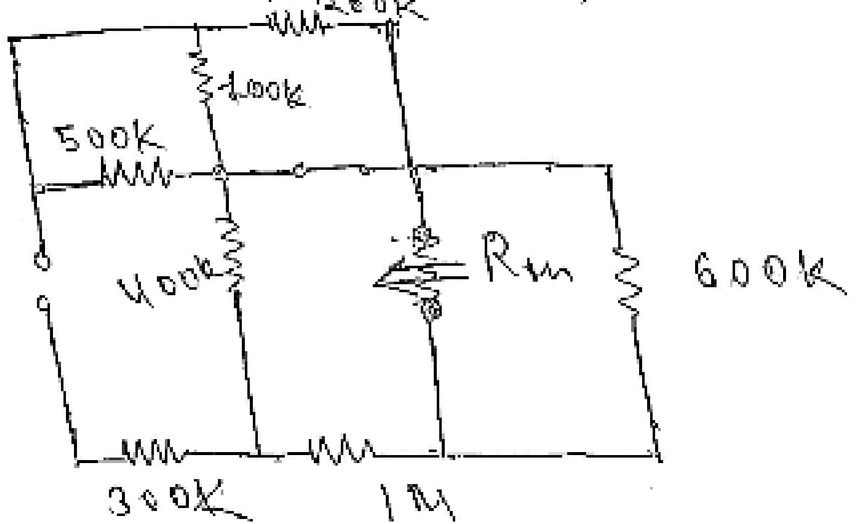
$$\Rightarrow -5V_1+7V_2=30 \quad \text{—— (2)}$$

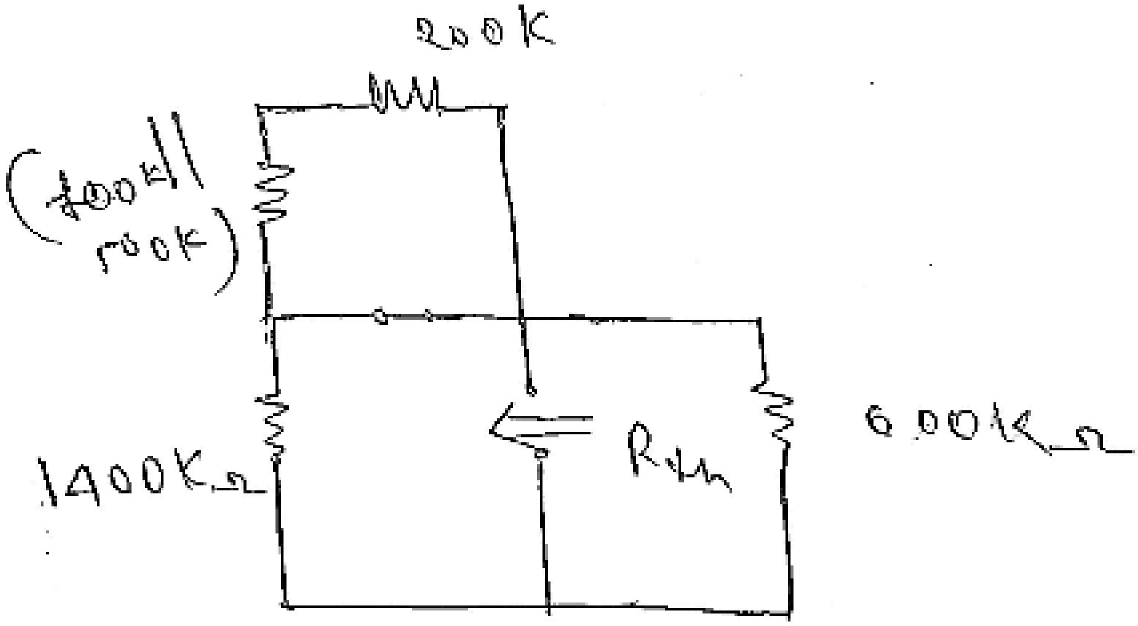
By solving (1) & (2)

$$V_1=40/61,\quad V_2=290/61$$

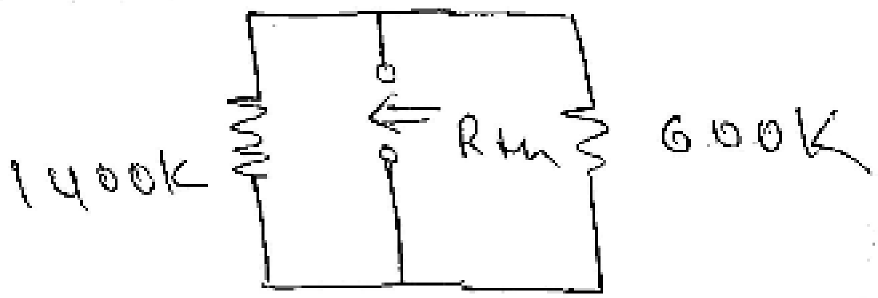
and $\boxed{i=V_2/5=0.95082\text{ A}}$ Ans

Q (2) for R_{th} solution →





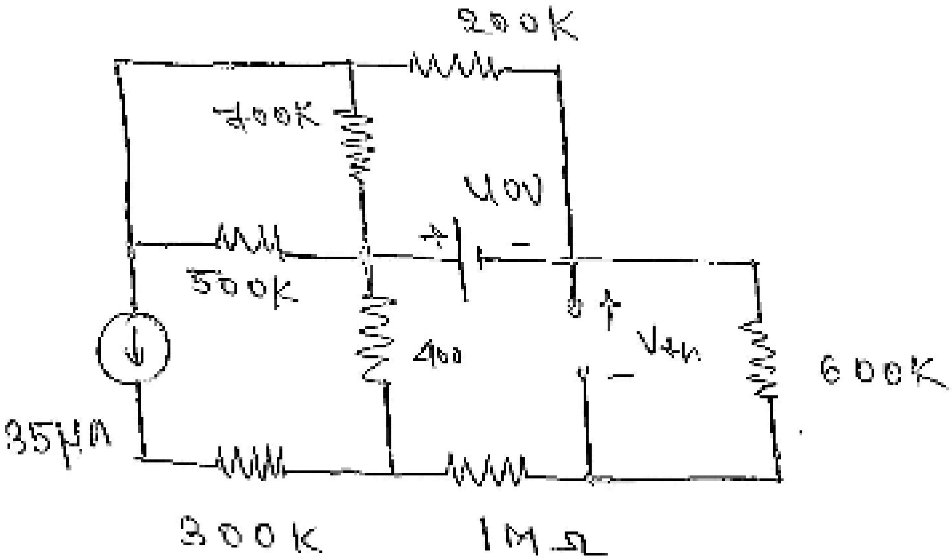
$\Rightarrow$



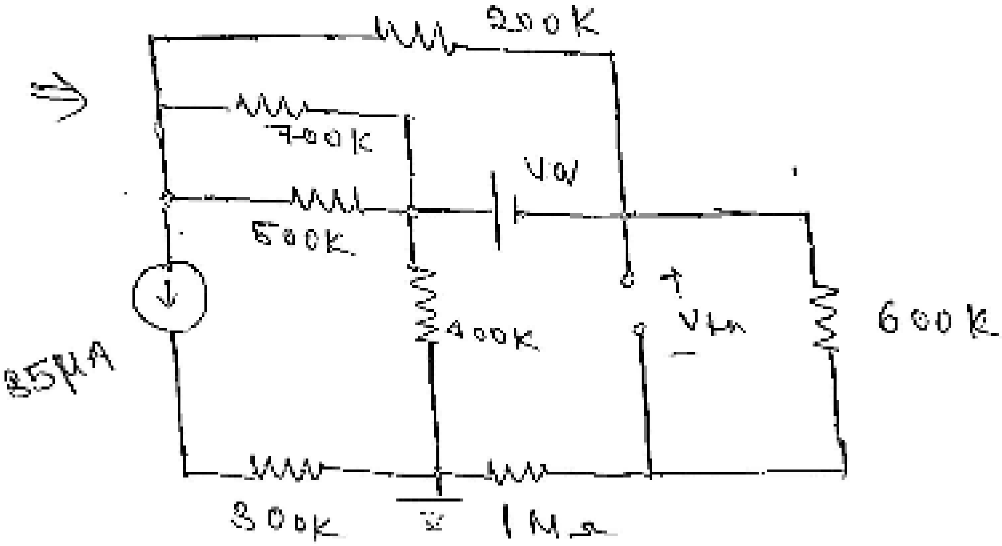
hence $R_{th} = 1400K \parallel 600K$

$= 420K\Omega.$

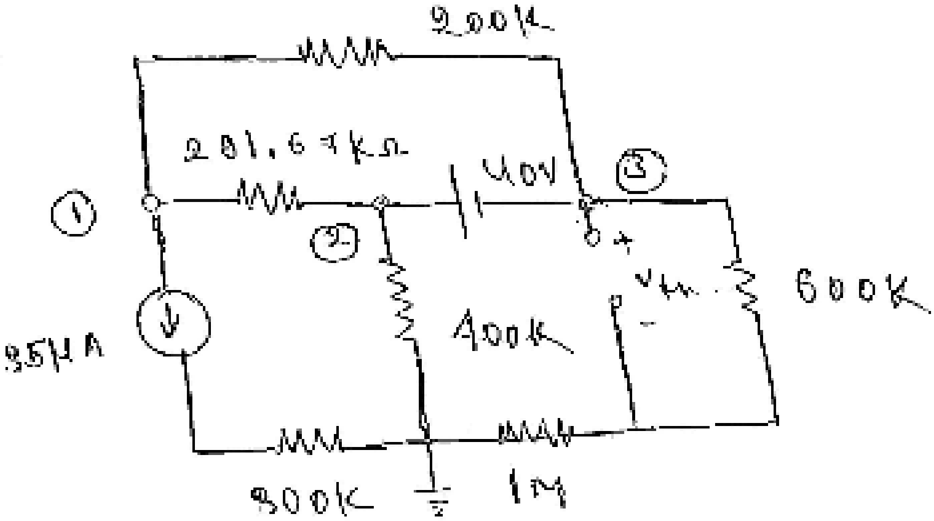
for V_{oc} or V_{th} calculation...



⇒



⇒



Then apply KCL at node (1)

$$0.035 + \frac{V_1 - V_2}{291.67} + \frac{V_1 - V_3}{200} = 0$$

$$V_1\left(\frac{1}{291.67} + \frac{1}{200}\right) - \frac{V_2}{291.67} - \frac{V_3}{200} = -0.035 \quad \text{—— (1)}$$

KCL at supernode (2) & (3)

$$\frac{V_2 - V_1}{291.67} + \frac{V_2}{400} + \frac{V_3}{1600} + \frac{V_3 - V_1}{200} = 0$$

$$\Rightarrow V_1\left(-\frac{1}{291.67} - \frac{1}{200}\right) + V_2\left(\frac{1}{400} + \frac{1}{291.67}\right)$$

$$+ V_3\left(\frac{1}{1600} + \frac{1}{200}\right) = 0 \quad \text{—— (2)}$$

$$-V_2 + 40 + V_3 = 0 \Rightarrow -V_2 + V_3 = -40$$

$$V_2 - V_3 = 40 \quad \text{—— (3)}$$

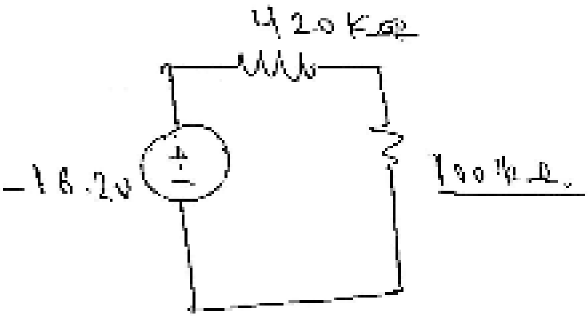
by solving (1), (2), (3)

$V_1 = \cancel{-20.28V}$, $V_2 = \cancel{7.6}$, $V_3 = \cancel{-32.4}$

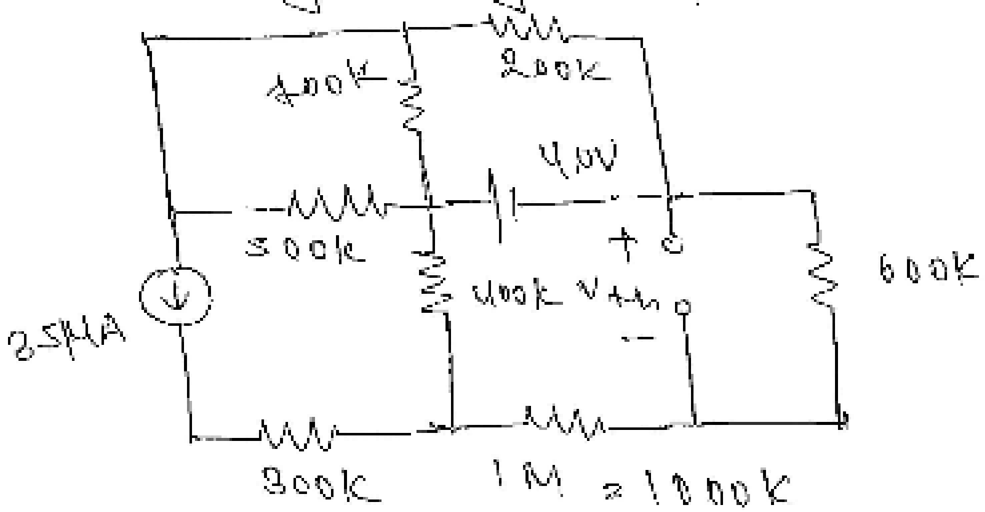
$= -31.081V$, -3.2, -43.2

Hence $V_{th} = \left(\frac{V_3 \times 600}{600+1000}\right) =$

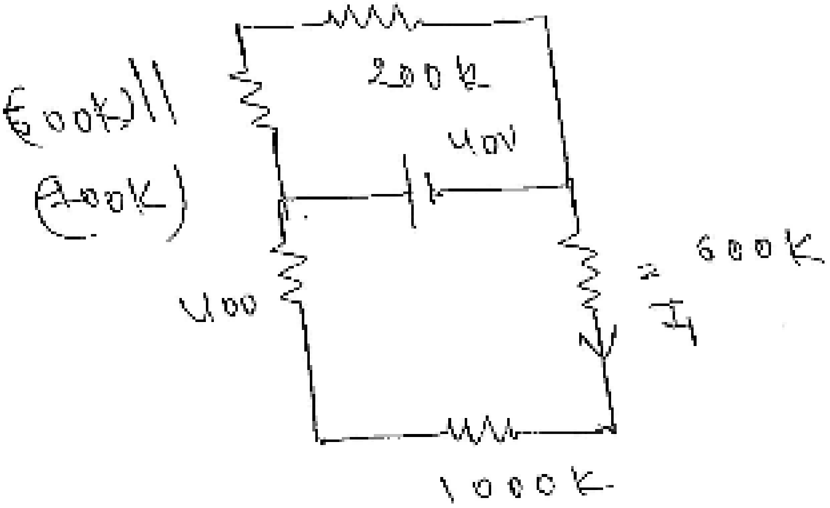
$= -16.2V$ ckt



V_{th} by using superposition –



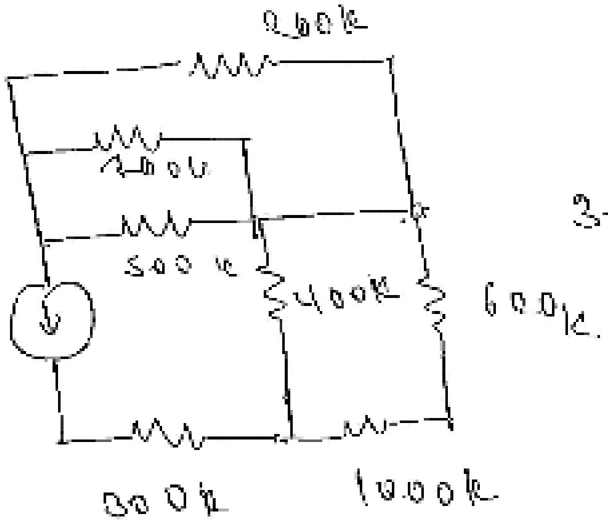
1st consider 40V battery

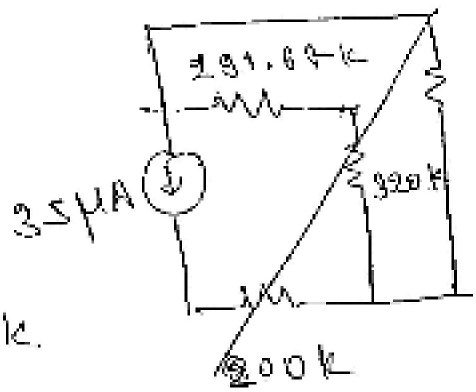


$$I_1 = \left(\frac{-40}{2000}\right)$$

$$\boxed{I_1 = -0.02\,mA}$$

2nd consider current source –





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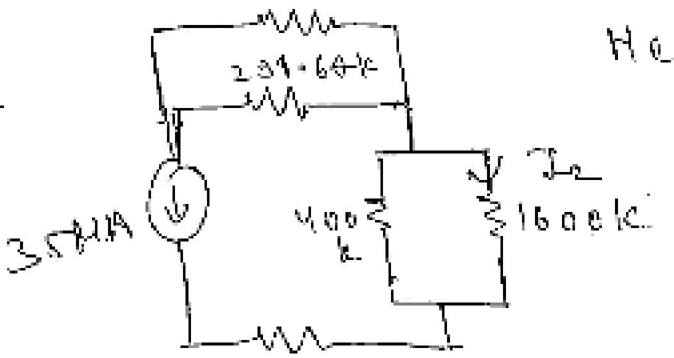


Hence

$$I_2 = \frac{-0.035 \times 400}{400 + 1600} = -7 \times 10^{-3} \text{ mA}$$

Total current $= I_1 + I_2$

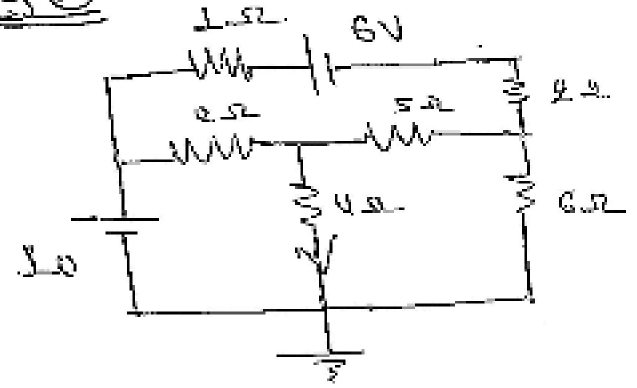
$= (-0.02 + 0.007)$ mA

$= -0.027$ mA

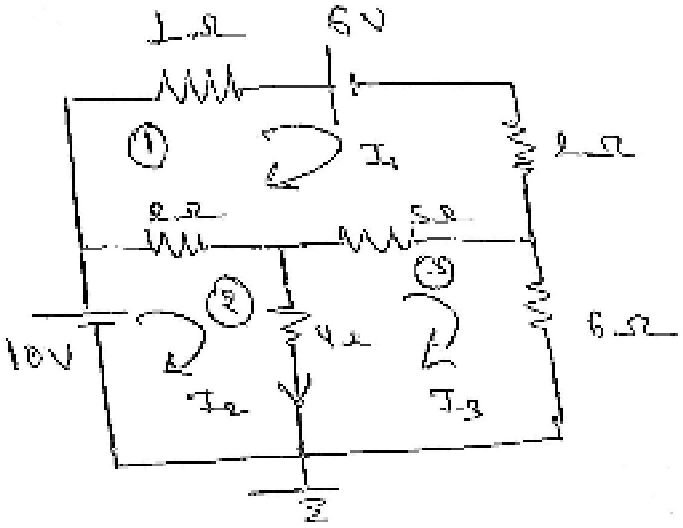
Hence $V_{ou} = (600\ k\Omega) \times (-0.027 \text{ mA})$

$= -16.2$ Volt Ans

Q3



$\Rightarrow$



applying KVL in Loop ①

$$2(I_1 - I_2) + I_1 + 6 + 2I_1 + 5(I_1 - I_3) = 0$$

$$\Rightarrow 2I_1 - 2I_2 + 3I_1 + 6 + 5I_1 - 5I_3 = 0$$

$$\Rightarrow 10I_1 - 2I_2 - 5I_3 + 6 = 0 \quad \text{—— ①}$$

applying KVL in Loop ②

$$-10 + 2(I_2 - I_1) + 4(I_2 - I_3) = 0$$

$$\Rightarrow 6I_2 - 2I_1 - 4I_3 - 10 = 0$$

$$\Rightarrow -2I_1 + 6I_2 - 4I_3 - 10 = 0 \quad \text{—— ②}$$

apply KVL in Loop ③

$$4(I_3 - I_2) + 5(I_3 - I_1) + 6I_3 = 0$$

$$\Rightarrow 15I_3 - 4I_2 - 5I_1 = 0$$

$$\Rightarrow -5I_1 - 4I_2 + 15I_3 = 0 \quad \text{—— ③}$$

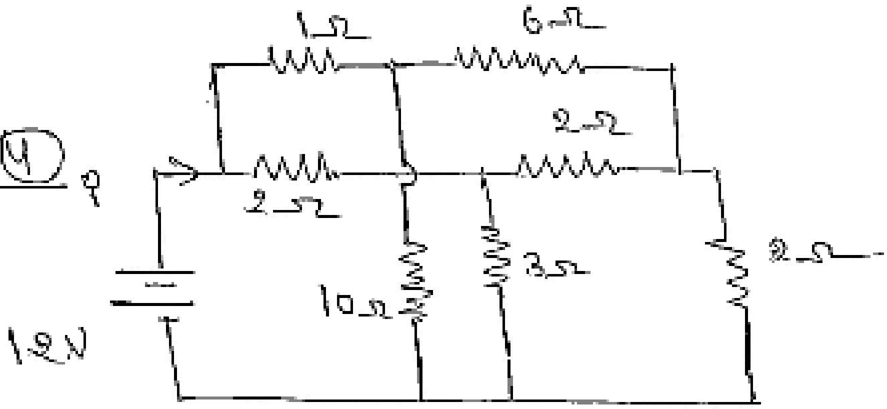
by solving ①, ② , ③

$$I_1 = \frac{28}{225}\,A, \quad I_2 = \frac{19}{9}\,A, \quad I_3 = \frac{136}{225}\,A$$ Ans

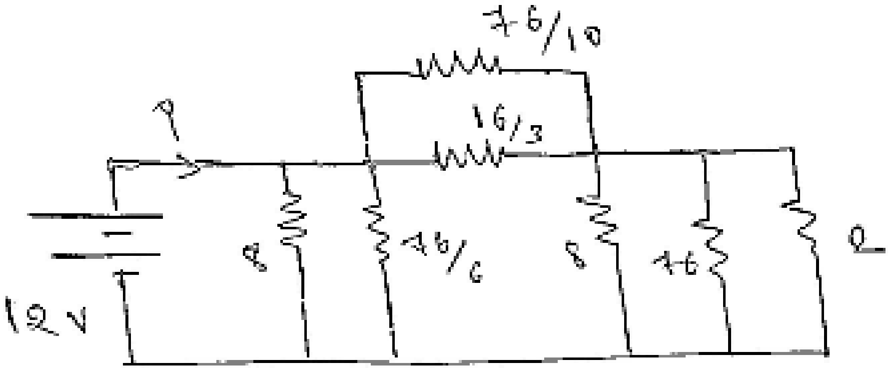
Hence $I_{4\Omega} = I_2 - I_3$

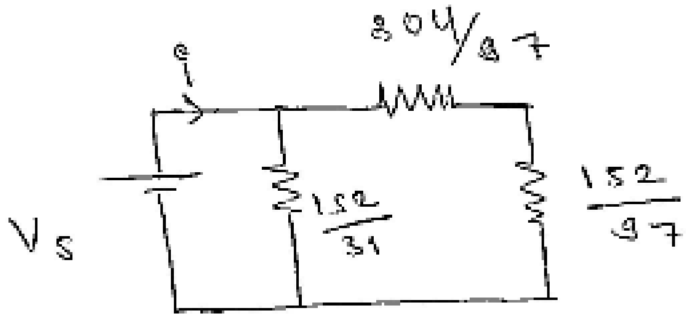
$$\boxed{I_{4\Omega} = 1.5067\,A}$$ Ans

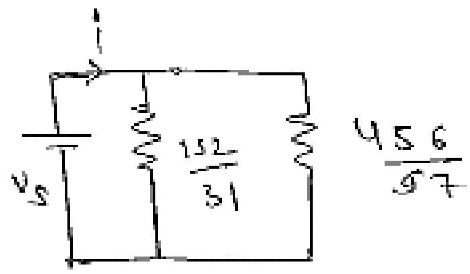
Q(4)



convert star n/w into delta n/w

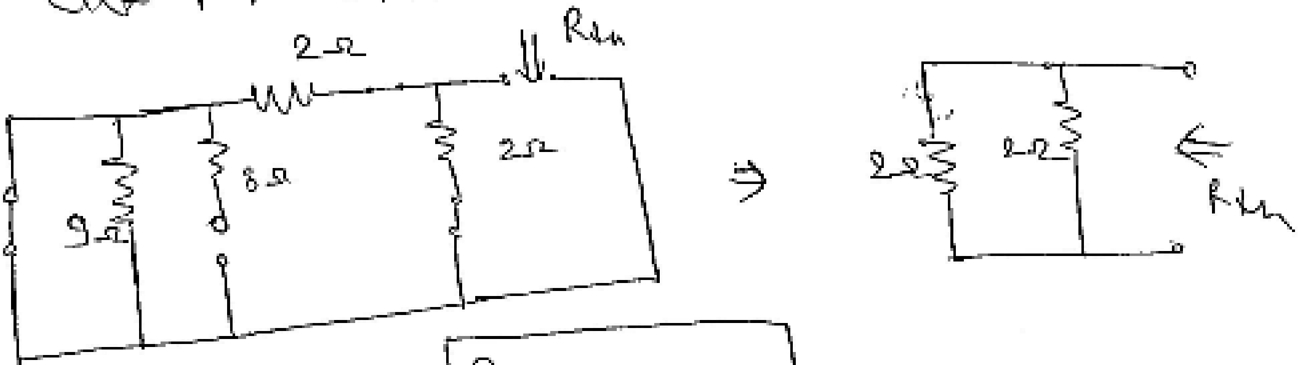






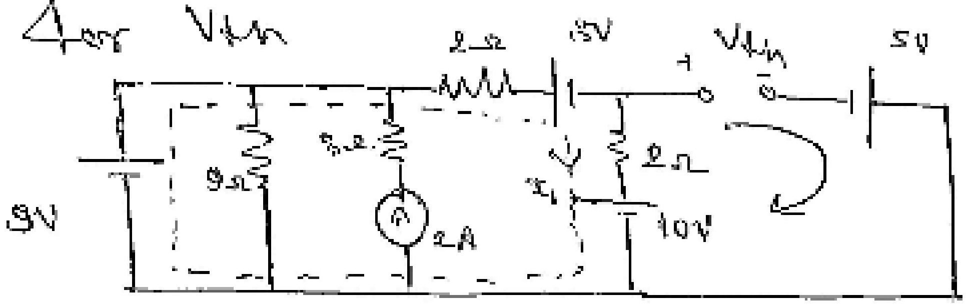
$$\boxed{R_{eq} = \frac{V_s}{i} = \frac{12}{5} = 2.4\Omega}$$ Ans

Q(5) ckt for R_{th} across 3Ω



Hence $\boxed{R_{th} = 1\Omega}$

For V_{th}



apply KVL

$$-9+2I_1+3+2I_1+10=0 \Rightarrow \boxed{I_1=-1\,A}$$

apply KVL

$$+V_{th}-5-10-2I_1=0$$

$$V_{th}-15-2(-1)=0 \Rightarrow \boxed{V_{th}=13V}$$

Hence equivalent thevenin N/w across 3Ω

Hence $(P_{diss})_{3Ω} = I^2R$

$$=\left(\frac{13}{4}\right)^2 \times 3 = 31.6875 \text{ Watt}$$

Ans