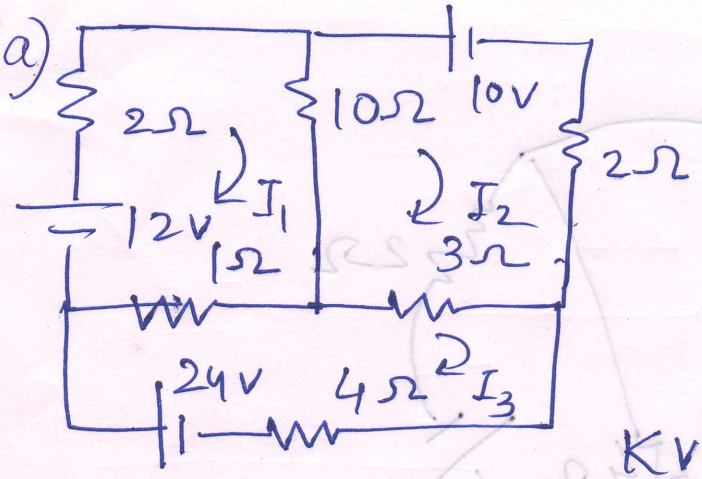
Solution TT1_EEEE

(Q-1a)



KVL in mesh (1)

$12-2I_1-10(I_1-I_2)-1(I_1-I_3)=0$

$12-2I_1-10I_1+10I_2-I_1+I_3=0$

$$\boxed{-13I_1+10I_2+I_3=-12} \longrightarrow (1)$$

KVL to mesh 2

$-10-2I_2-3(I_2-I_3)-10(I_2-I_1)=0$

$-10-2I_2-3I_2+3I_3-10I_2+10I_1=0$

$$\boxed{10I_1-15I_2+3I_3=10} \longrightarrow (2)$$

KVL to mesh 3

$-3(I_3-I_2)-4I_3+24-1(I_3-I_1)=0$

$-3I_3+3I_2-4I_3+24-I_3+I_1=0$

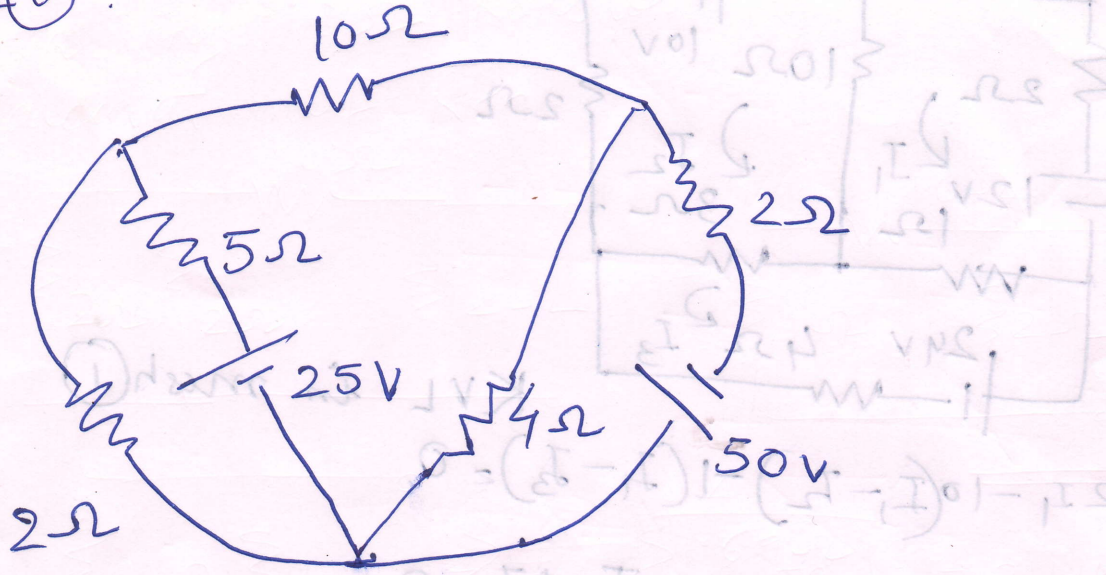
$$\boxed{I_1+3I_2-8I_3=-24} \longrightarrow (3)$$

On solving (1), (2) & (3) we get

$I_3=4.1A$

$I_{4\Omega}=4.1A(\leftarrow)$

Q-16



node Voltage at node 1

$$\frac{V_1-0}{2}\times 5 + \frac{V_1-V_2}{10} + \frac{V_1-25}{5} = 0 \Rightarrow 5V_1 + V_1 - V_2 + 2V_1 - 50 = 0$$

$$\boxed{8V_1 - V_2 = 50}$$

node Voltage at node 2

$$\frac{V_2+50}{2} + \frac{V_2-0}{4} + \frac{V_2-V_1}{10} = 0$$

$$10V_2 + 500 + 5V_2 + 2V_2 - 2V_1 = 0$$

$$-2V_1 + 17V_2 + 500 = 0$$

$$2V_1 - 17V_2 - 500 = 0$$

$$\boxed{2V_1 - 17V_2 = 500}$$

$$\boxed{V_2 = -29.104\,V}$$

$$\boxed{V_1 = 2.612\,V}$$

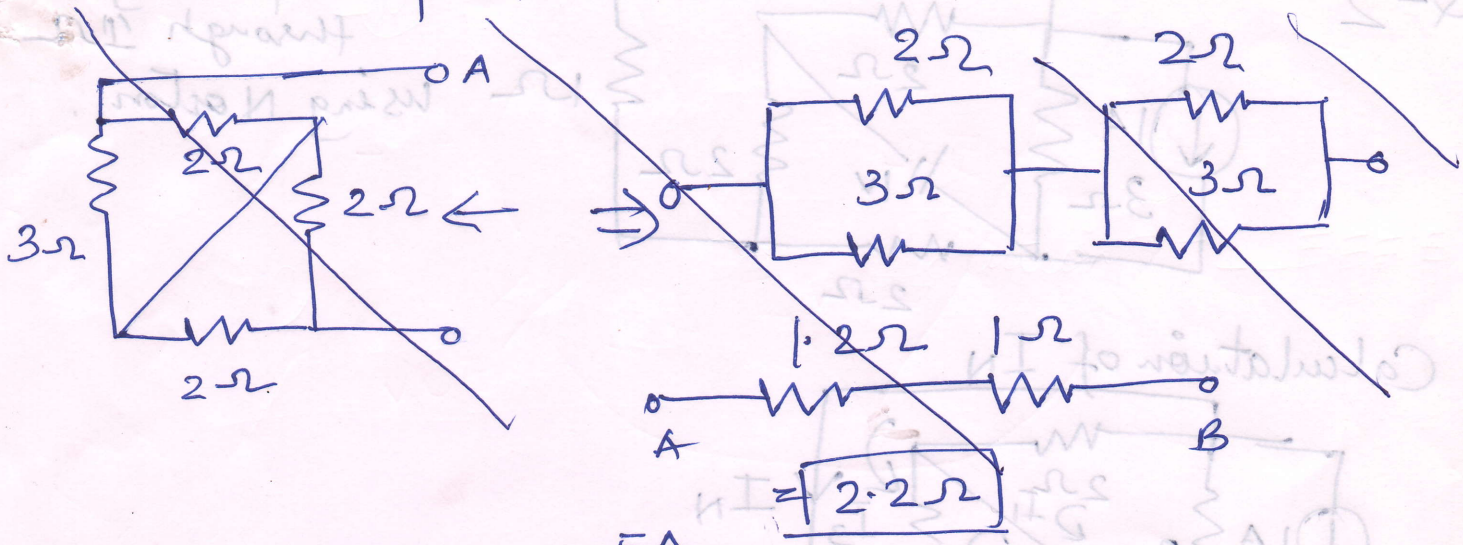
Current in 10Ω Resistor is

$$I = \frac{V_A - V_B}{10} = \frac{2.612 - (-29.104)}{10} \Rightarrow \boxed{3.1716\,A}$$

power dissipated $= I^2R = (3.172)^2 \times 10$

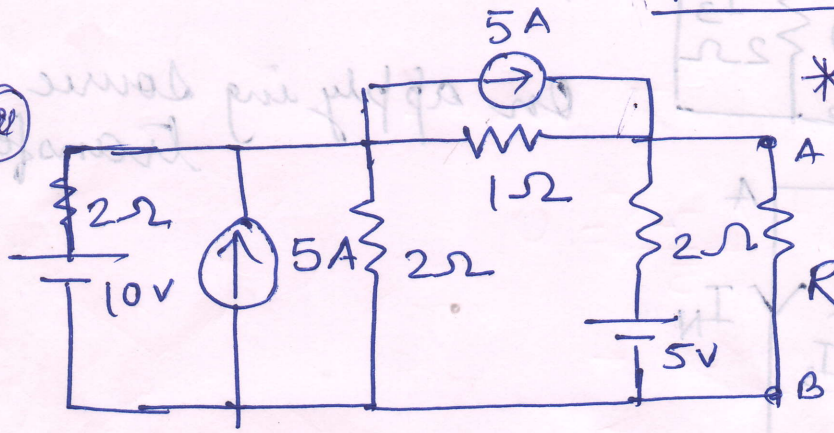
$$\Rightarrow \boxed{100.6\,W}$$

Calculation of R_N



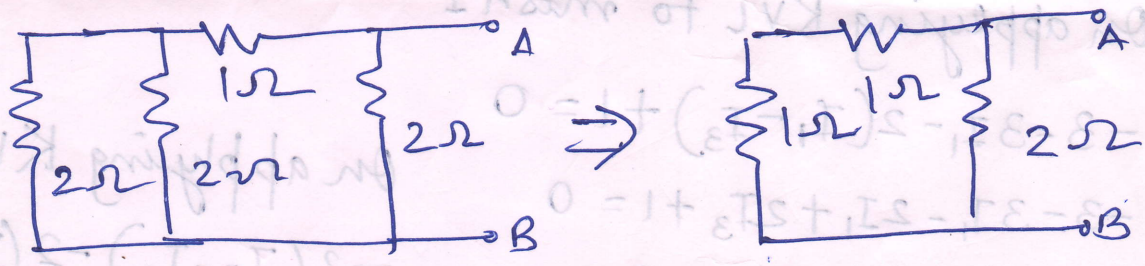
$= 2.2\Omega$

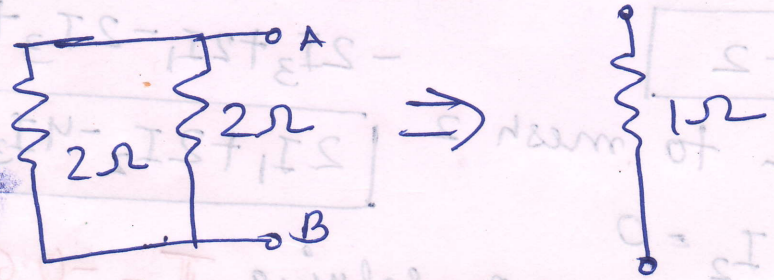
Q-2 (a)



* considering for 1Ω Resistor

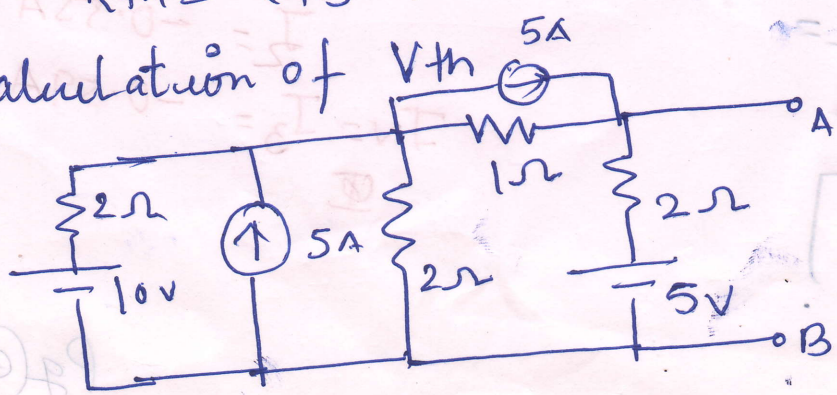
Calculation of Rth.



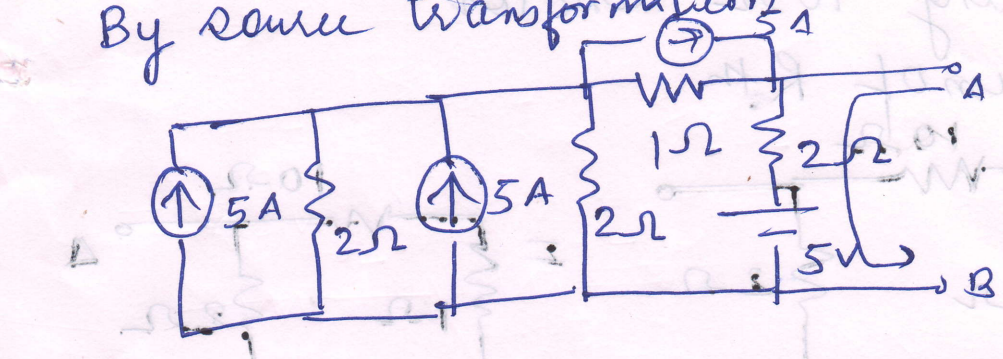


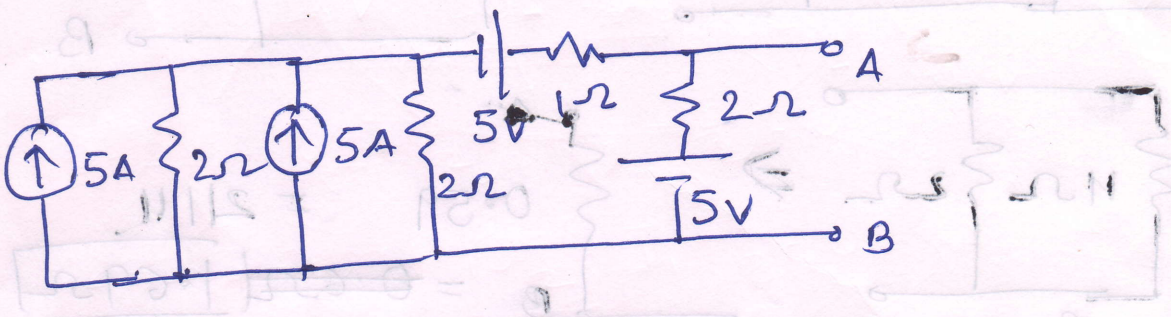
$R_{th} = R_{AB} = 1\Omega$

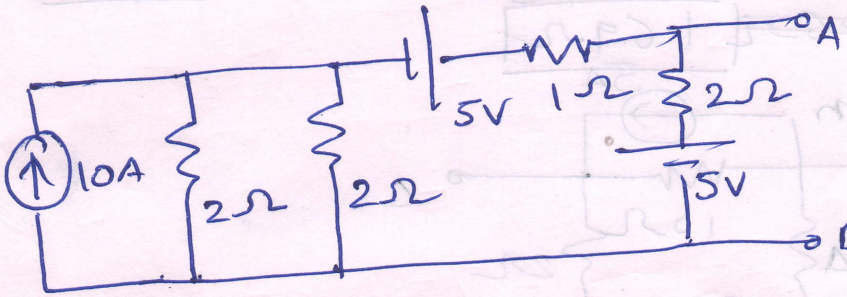
Calculation of Vth

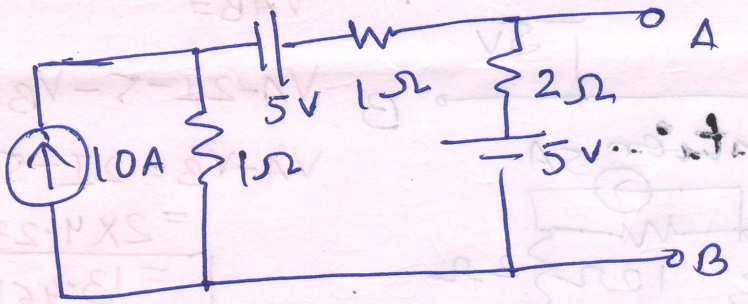


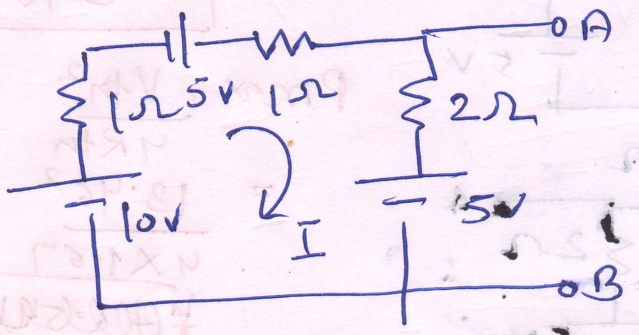
By source transformation











$5 - I - 2I - 5 + 10 - I = 0$

$-4I + 10 = 0$

$I = 10/4 = 5/2 = 2.5A.$

$V_A - 2 \times I - 5 - V_B = 0$

$V_A - 2 \times 2.5 - 5 - V_B = 0$

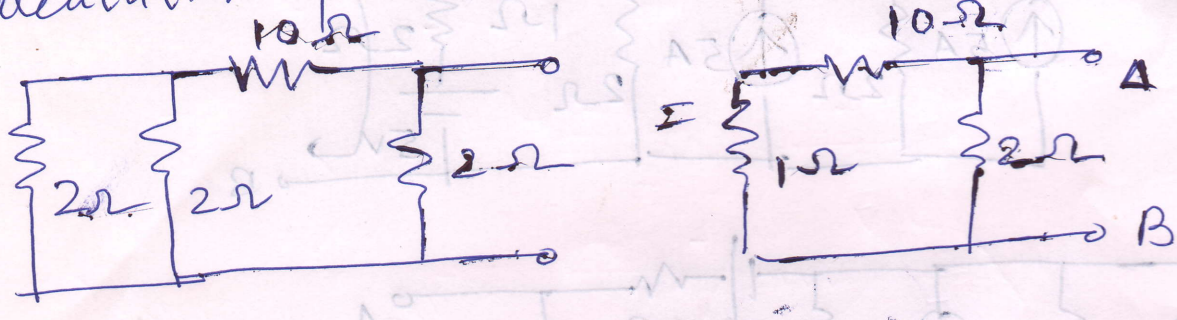
$V_A - V_B = 10V$

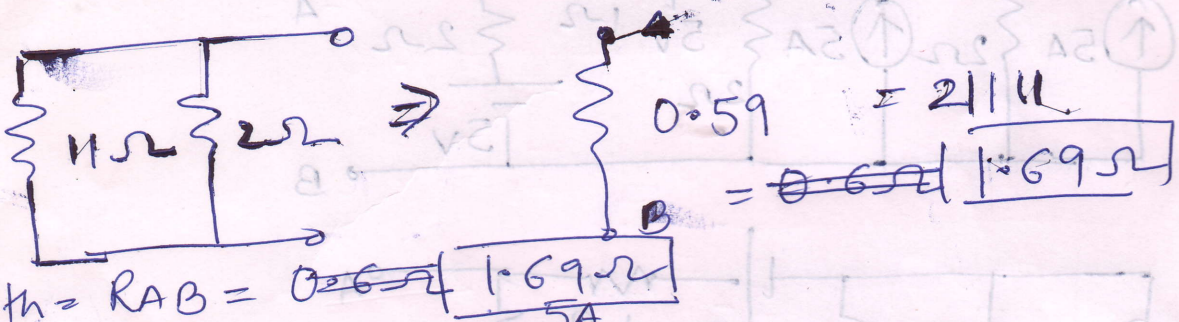
maximum power delivered

$P_{max} = \frac{V_{th}^2}{4R_{th}} = \frac{10 \times 10}{4 \times 1}$

$= 25W$

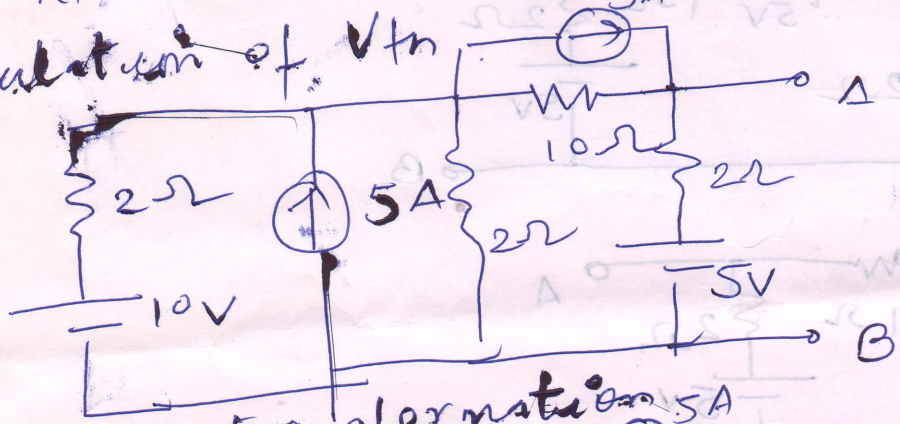
Calculation of Rth



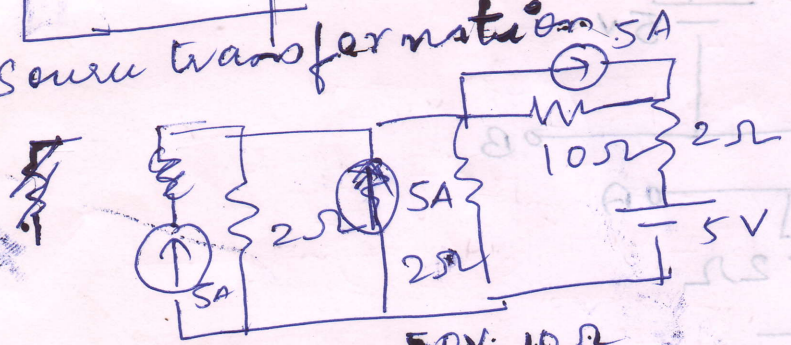


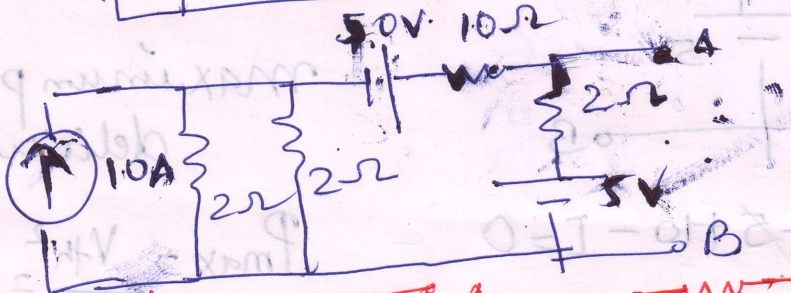
Rth = RAB = ~~0.67~~ 1.69Ω

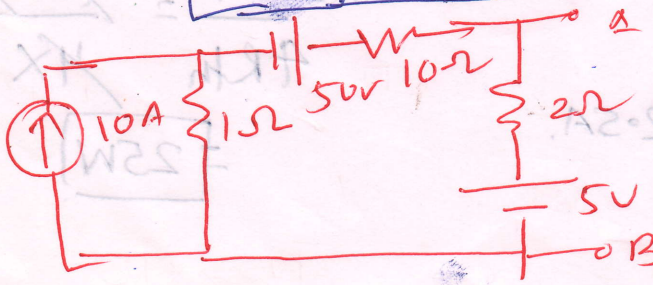
Calculation of Vth



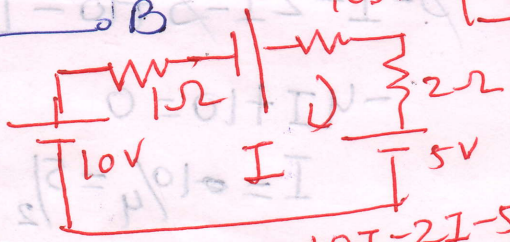
By Source transformation







⇒



V_{AB} =

$V_A - 2I - 5 - V_B = 0$

$V_A - V_B = 2I + 5$

$= 2 \times 4.23 + 5$

$= 13.46V$

$P_{max} = \frac{V_{th}^2}{4R_{th}}$

$= \frac{13.46^2}{4 \times 1.69}$

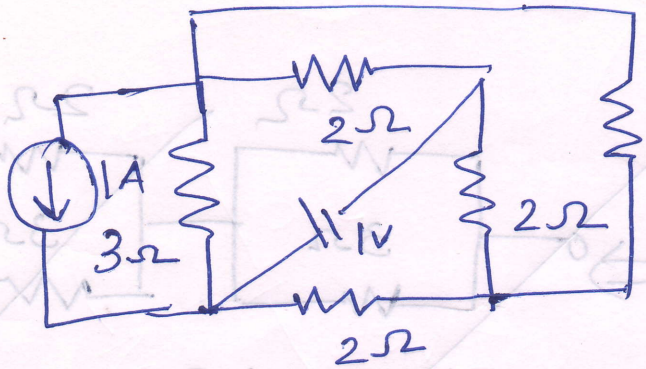
~~26.8W~~ 26.8W

$+10 - I + 50 - 10I - 2I - 5 = 0$

$55 - 13I = 0$

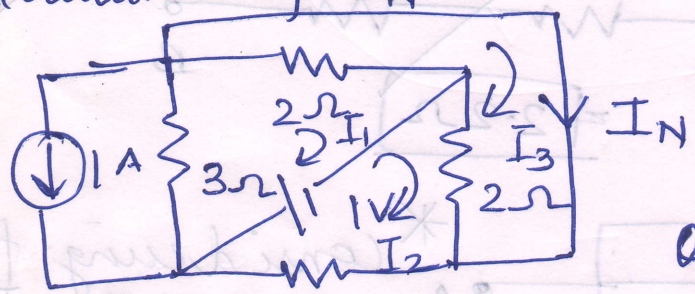
$I = 55/13 = 4.23A$ (5)

Q-2

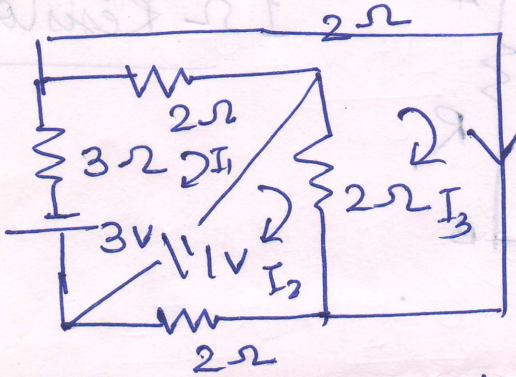


Current flowing through 1Ω using Norton..

Calculation of I_N



On applying source transformation



On applying KVL to mesh 1

$-3-3I_1-2(I_1-I_3)+1=0$

$-3-3I_1-2I_1+2I_3+1=0$

$-5I_1+2I_3-2=0$

$\boxed{5I_1-2I_3=-2}$

On applying KVL to mesh 2

$-1-2(I_2-I_3)-2I_2=0$

$-1-2I_2+2I_3-2I_2=$

$-4I_2+2I_3=1=0$

$\boxed{4I_2-2I_3=-1}$

On applying KVL to mesh 3

$-2(I_3-I_1)-2(I_3-I_2)=0$

$-2I_3+2I_1-2I_3+2I_2=0$

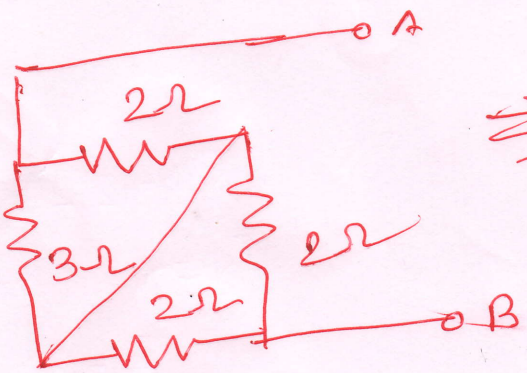
$\boxed{2I_1+2I_2-4I_3=0}$

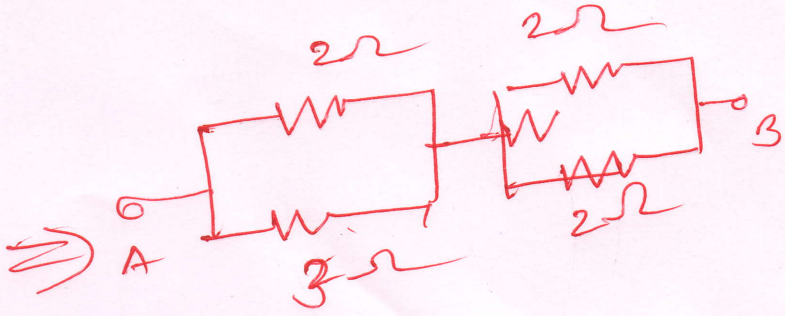
On solving $I_1=-0.64A$

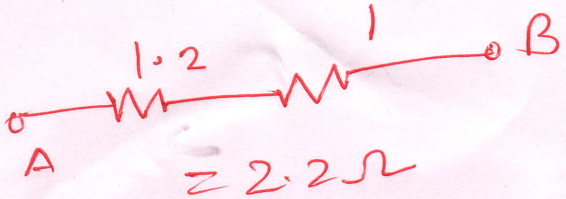
$I_2=-0.55A$

$I_N=I_3=-0.59A$

Calculation of R_N

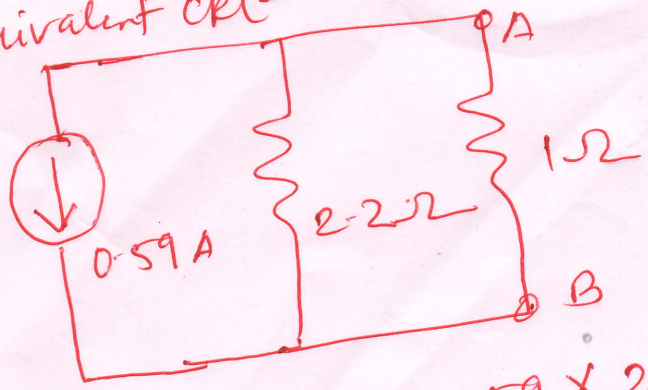






$= 2.2\Omega$

equivalent ckt-



$$I_L = 0.59 \times \frac{2.2}{1+2.2} = \boxed{0.41A}$$