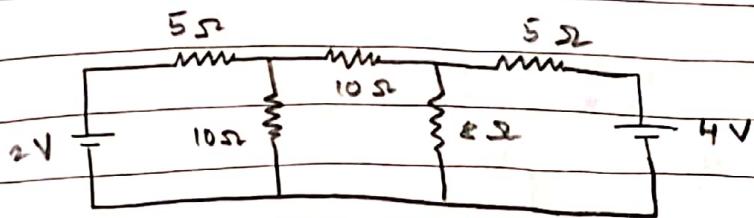
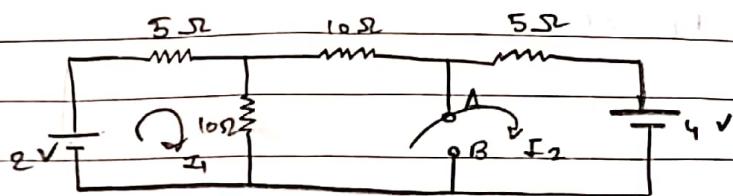


PEE Assignment 4.

(1)



$$R_L = 8\Omega$$



Mesh 1

$$2 - 5I_1 - 10(I_1 - I_2) = 0$$

$$2 - 15I_1 + 10I_2 = 0$$

$$15I_1 - 10I_2 = 2 \quad \text{---} \textcircled{1}$$

Supermesh:

$$-10I_2 - 5I_2 - 4 - 10(I_2 - I_1) = 0$$

$$10I_1 - 25I_2 = 4 \quad \text{---} \textcircled{2}$$

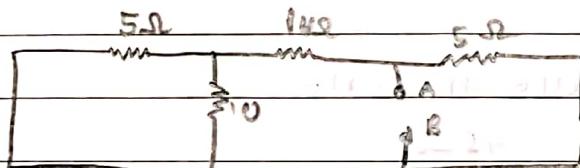
$$I_1 = 0.036, I_2 = -0.145$$

$$-10(I_2 - I_1) - 10I_2 = V_{TH}$$

$$-20I_2 + 10I_1 = V_{IM}$$

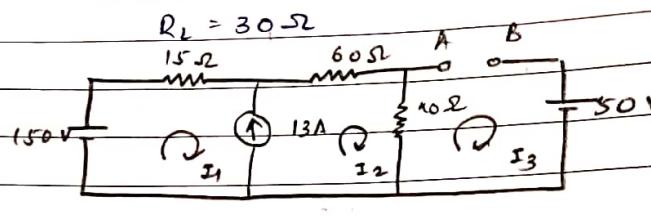
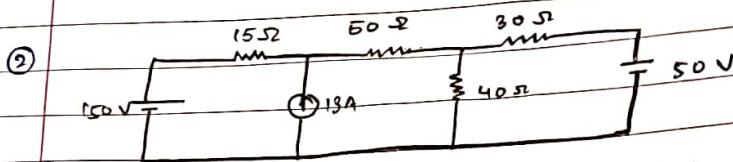
$$2.9 + 0.36 = V_{TH}$$

$$V_{TH} = 3.26$$

 R_{TH}

$$= 2.72$$

$$I_L = \frac{V_{TH}}{R_{TH} + R_L} = \frac{3.26}{2.72 + 8} = 0.3 \text{ A (down)}$$



Supermesh:

$$150 - 15I_1 - 60I_2 - 40(I_2 - I_3) = 0 \quad \text{--- (1)}$$

$$15I_1 + 100I_2 = 150 \quad \text{--- (1)}$$

$$I_2 - I_1 = 13 \quad \text{--- (2)}$$

$$I_1 = -10 \text{ A}, I_2 = 3 \text{ A}$$

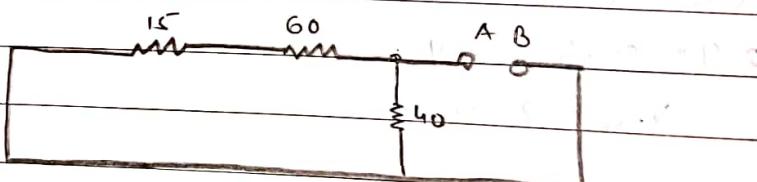
In mesh 3 :-

$$-40(I_3 - I_2) - V_{TH} - 50 = 0$$

$$120 - 50 = V_{TH}$$

$$V_{TH} = 70$$

R_{TH} :



15Ω & 60Ω are in series

$$R_x = 15 + 60 = 75 \Omega$$

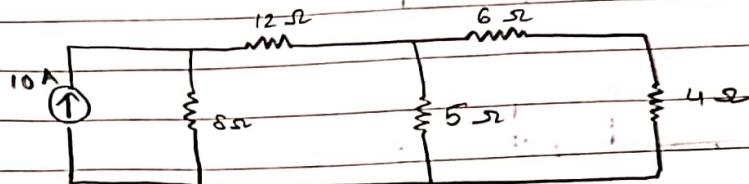
Now,

$$R_x || 40$$

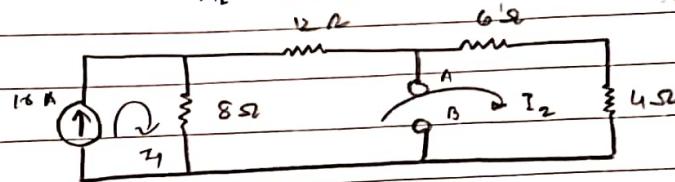
$$R_{TH} = \frac{75 \times 40}{75 + 40} = 26.08 \Omega$$

$$I_2 = \frac{V_{TH}}{R_L + R_{TH}} = \frac{70}{30 + 26.08} = 1.248 A (\rightarrow)$$

(4)



$$R_L = 2.5 \Omega$$



$$\text{Mesh 1: } I_1 = 10 A$$

Mesh 2:

$$-8(I_2 - I_1) - 12I_2 - 6I_2 - 4I_2 = 0$$

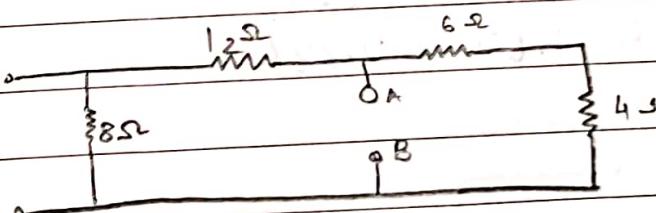
$$-30I_2 + 80 = 0$$

$$I_2 = \frac{80}{30} = 2.67 A$$

$$-8(I_2 - I_1) - 12I_2 = V_{TH}$$

$$58.6 - 32.04 = V_{TH}$$

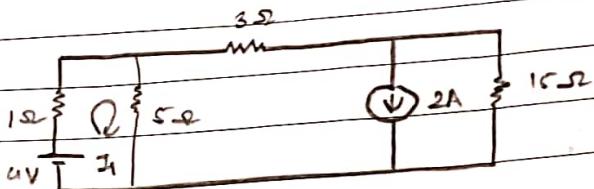
$$V_{TH} = 26.56$$

R_{TH}:

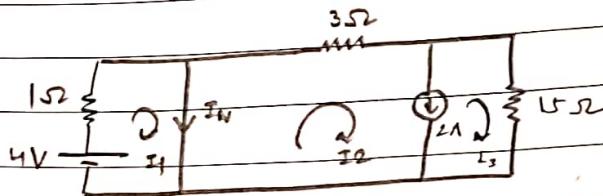
$$R_{TH} = 3.2 \Omega$$

$$I_L = \frac{V_{TH}}{R_{TH} + R_L} = \frac{265.6}{3.24 + 5} = 3.22 \text{ A.}$$

(5)



$$R_L = 5 \Omega$$



Mesh 1

$$I_1 = 4 \text{ A}$$

Supermesh

$$-3I_2 - 15I_3 = 0$$

$$I_2 = -5I_3$$

$$\text{Also, } I_2 - I_3 = 2$$

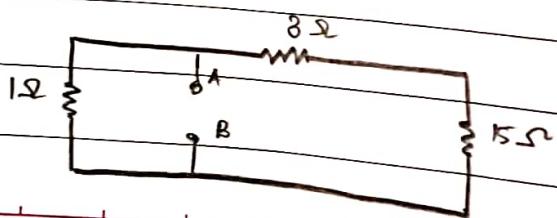
$$-5I_3 - I_3 = 2$$

$$I_3 = \frac{-1}{3} \approx -0.33 \text{ A.}$$

$$I_2 = 1.67 \text{ A}$$

$$I_N = I_1 - I_2 = 4 - 1.67 = 2.33 \text{ A}$$

R_{TH} .



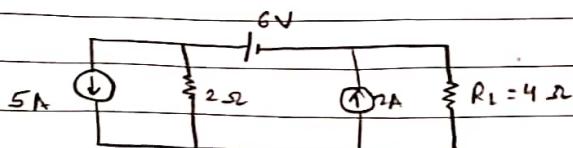
$$R_A = 15 + 3 = 18 \Omega$$

$$18 \Omega // 1 \Omega$$

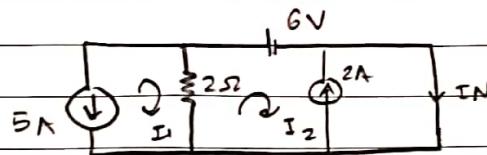
$$\frac{18}{19} = 0.9 \Omega$$

$$I_L = \frac{I_N R_N}{R_L + R_N} = \frac{2.33 \times 0.9}{0.9 + 5} = 0.36 A$$

(6)



$$R_L = 4 \Omega$$

Mesh 1

$$I_1 = 5A$$

$$I_2 - I_3 = -2$$

Supermesh

$$-2(I_2 - I_1) - 6 = 0$$

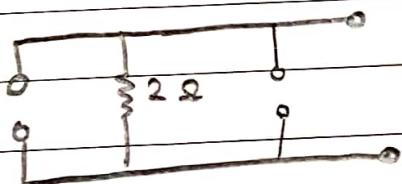
$$-2I_2 + 2(5) = 6$$

$$I_2 = 2A$$

$$2 - I_3 = -2$$

$$I_3 = 4A = I_N$$

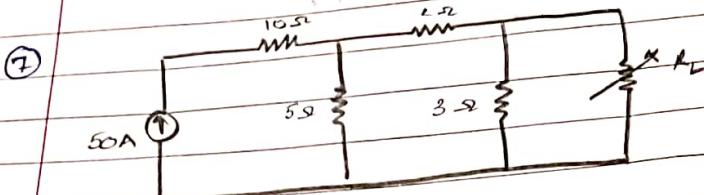
$$R_N =$$



$$R_N = 2 \Omega$$

$$I_1 = \frac{I_N R_N}{R_N + R_L} = \frac{4 \times 2}{4+2} = \frac{8}{6} = 1.33 \text{ A}$$

$$P_L = I_1^2 R_L = (1.33)^2 \times 4 = 7.07 \text{ W}$$



current in mesh 1

$$I_1 = 50 \text{ A}$$

current in mesh 2

$$-5(I_2 - I_1) - 2I_2 - 3I_2 = 0$$

$$-5I_2 + 5I_1 - 5I_2 = 0$$

$$-10I_2 = -5(50)$$

$$I_2 = 25 \text{ A}$$

$$V_{TH} = 3I_2 = 75 \text{ V}$$

$$R_L =$$

$$R_p = \frac{10 \times 5}{10+5} = \frac{50}{15} = \frac{10}{3} \Omega$$

$\frac{10}{3} \Omega$ and 2Ω are in series

$$R_s = \frac{10}{3} + 2 = \frac{16}{3} \Omega$$

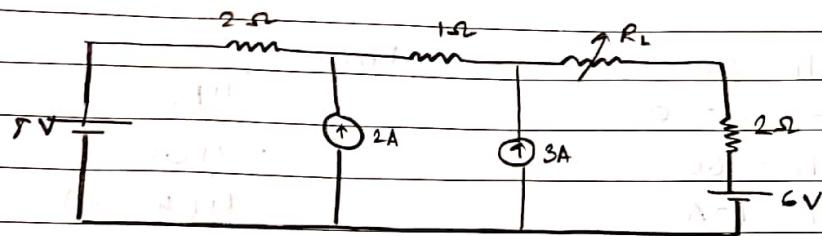
$$R_L = \frac{16}{3} \times 3 = \frac{16 \times 3}{25} = \frac{48}{25} = 1.92 \Omega$$

$$V_s = 75V$$

$$R_L = 1.92 \Omega$$

$$P_{max} = \frac{V_s^2}{4R_L} = \frac{(75)^2}{4 \times 1.92} = \frac{5625}{7.68} = 732.42 W$$

(8)



$$R_L = 2 + 1 + 2 = 5 \Omega$$

To find V_s

$$P_{max} = \frac{V^2}{4R_L}$$

In loop 1

$$8 - 2I_1 = 0$$

$$8 = 2I_1$$

$$I_1 = 4A$$

$$= \frac{64}{4 \times 5}$$

$$= 3.2V$$

$$I_1 - I_2 = 2A$$

$$4 - I_2 = 2$$

$$-I_2 = -2$$

$$I_2 = 2A$$

$$I_2 - I_3 = 3$$

$$2 - I_3 = 3$$

$$-I_3 = 1$$

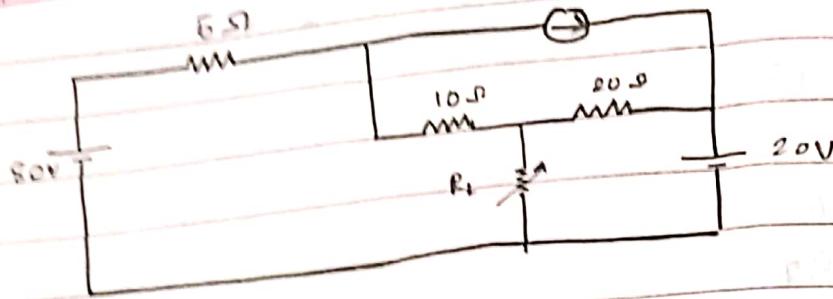
$$I_3 = 1A$$

$$V_s = 6 + 2I_3$$

$$= 6 + 2(1)$$

$$= 8V$$

Q3



$$R_L = 10 + 20 = 30\Omega$$

$$= \frac{30 \times 5}{30 + 5} = \frac{150}{35} = 4.28\Omega$$

$V_s =$

$$80 - 5I_1 - 20 = 0$$

$$60 - 5I_1 = 0$$

$$5I_1 = 60$$

$$I_1 = 12A$$

$$P_{max} = \frac{V^2}{4R_L}$$

$$= \underline{400}$$

$$4(4.28)$$

$$= 23.36W$$

$$80 - 5I_1 - 10I_2 - 20I_2 - 20 = 0$$

$$80 - 60 - 20 - 30I_2 = 0$$

$$30I_2 = 0$$

$$I_2 = 0$$

$$V_s = 20V$$

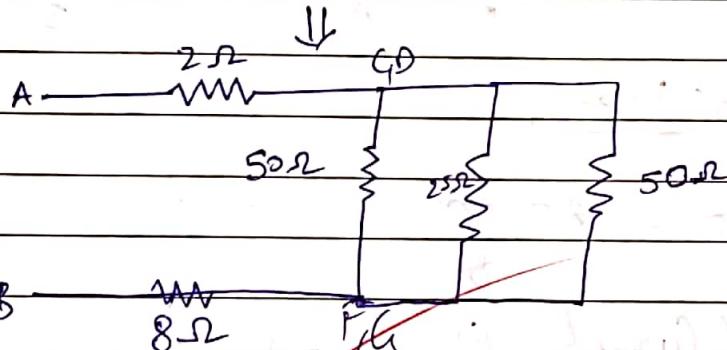
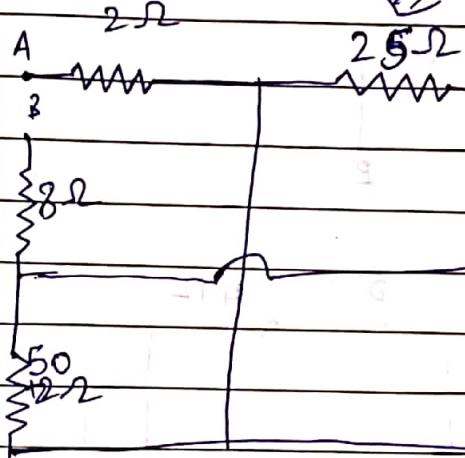
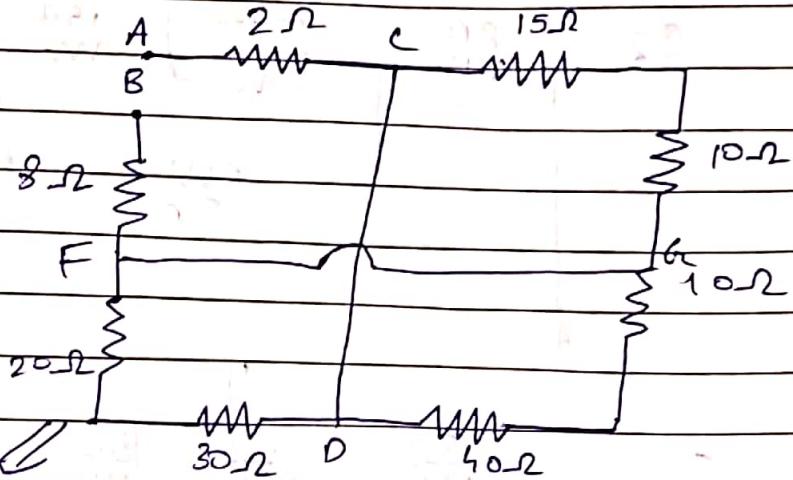
$$V_s = 20 + 20I_2$$

$$= 20 + 20(0)$$

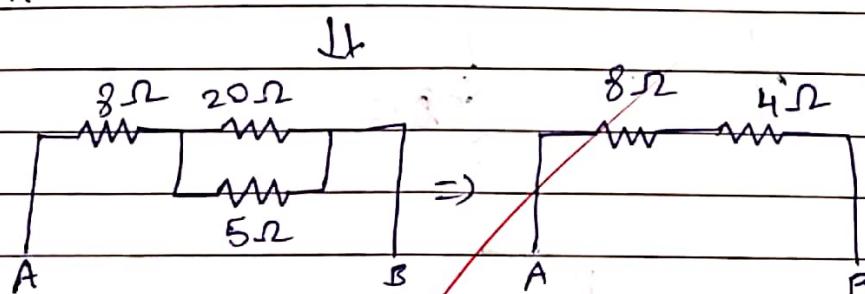
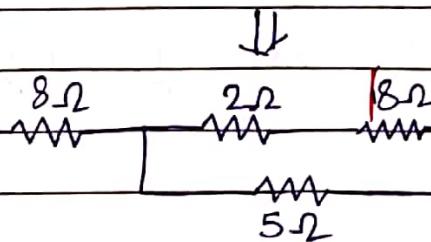
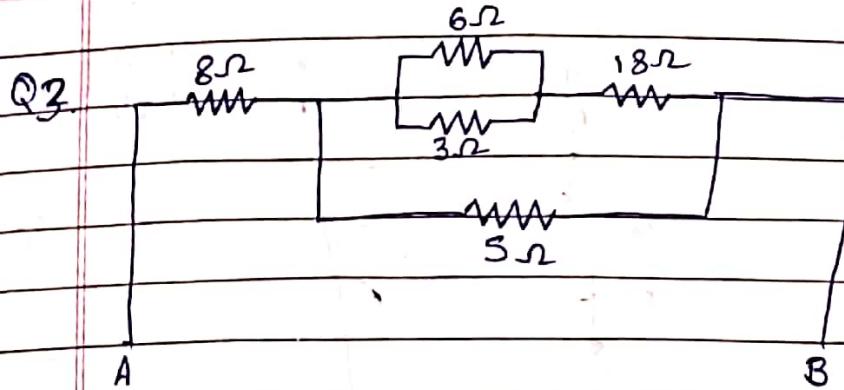
$$= 20V.$$

Assignment - 1

Q1



$$R_{AB} = 22.5 \Omega$$



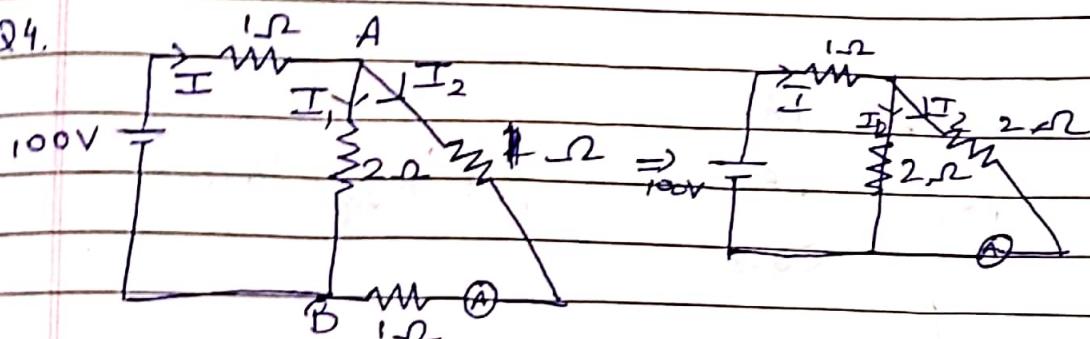
$$R_{AB} = 12\Omega$$

~~$$I_{8\Omega} = \frac{80}{8} = 10A$$~~

$$\text{Total Current} = \frac{60}{12} = 5A$$

$$\boxed{I_{8\Omega} = 5A}$$

Q4.

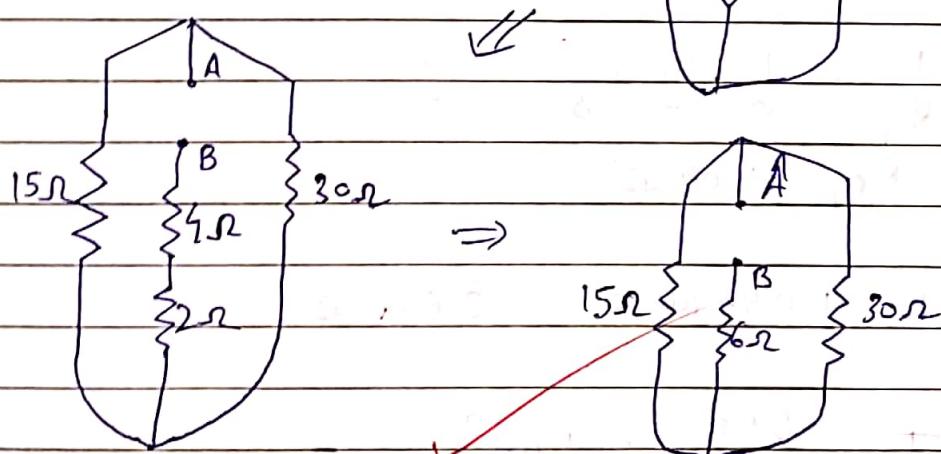
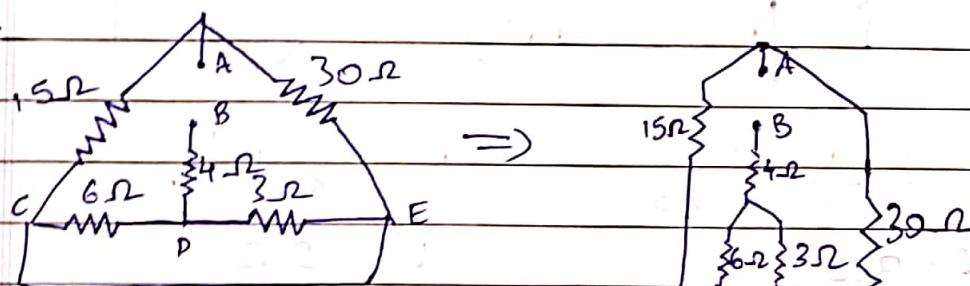


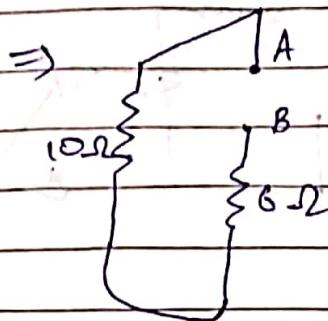
$$R_{eq} = 1 + \frac{2}{2} = 2\Omega$$

$$I = \frac{V}{R_{eq}} = \frac{100}{2} = 50A$$

$$I_2 = 50 \times \frac{2}{2+2} = \underline{\underline{25A}}$$

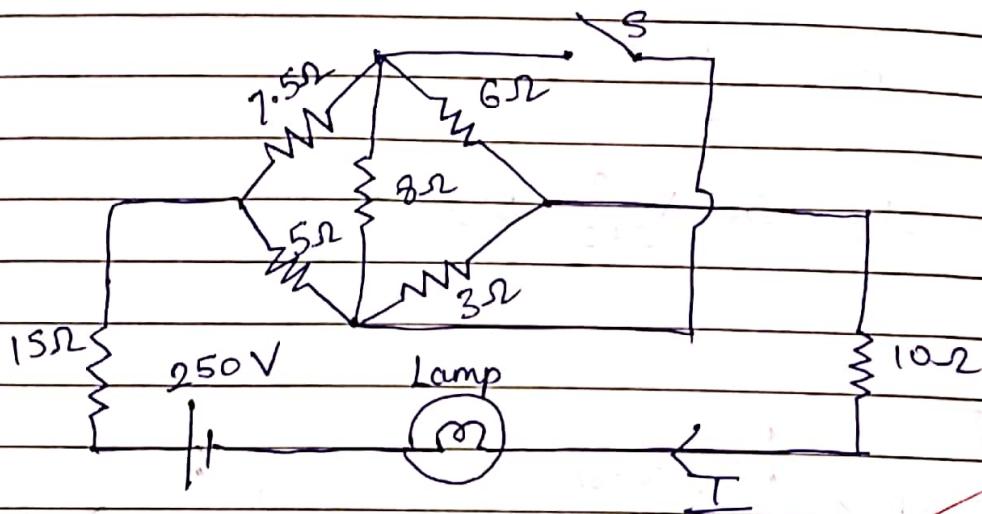
Q5.





$$R \in [R_{eq}] = 16 \Omega$$

Q2.



$$\frac{1}{R} = \frac{1}{5} + \frac{1}{7.5}$$

$$R = 3 \Omega$$

$$R' = \frac{1}{6} + \frac{1}{3}$$

$$R' = 2 \Omega$$

$$\frac{1}{R_{eq}} = \frac{1}{3} + \frac{1}{2} \left(\frac{1}{8} \right) = \frac{24}{23}$$

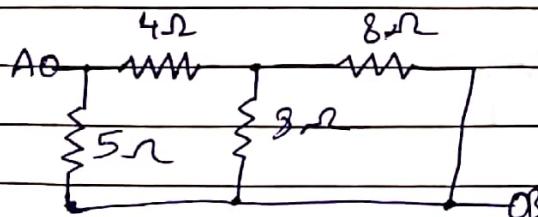
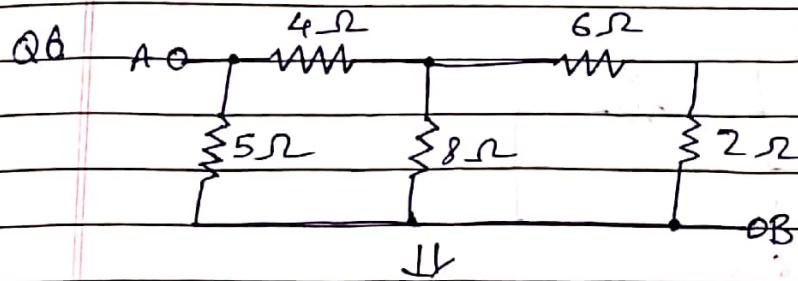
$$R_{eq} = 1.04 \Omega$$

$$R_T = 1.04 + 10 + 15 = 26.04 \Omega$$

$$I = \frac{250}{26.04} = 9.6 A$$

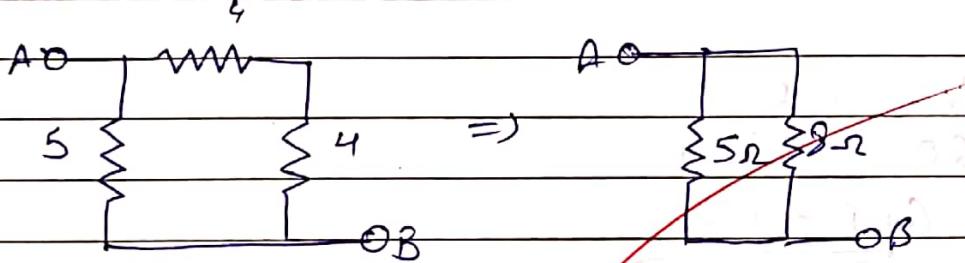
To Be Or Not To Be That's BIG QUESTION

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$$\frac{1}{R_{eq}} = \frac{1}{4} + \frac{1}{8} + \frac{1}{2} + \frac{1}{5} = \frac{19}{20}$$

$$R_{eq} = 1.42$$



$$R_{eq} = \frac{1}{5} + \frac{1}{8}$$

$$R_{eq} = 3.07 \Omega$$

Q7.

 12Ω 18Ω 36Ω W $60V$ \downarrow 6Ω W $60V$

$$P_{12} = 36W$$

$$P_6 = 18W$$

$$P = VI$$

$$18 = 60I$$

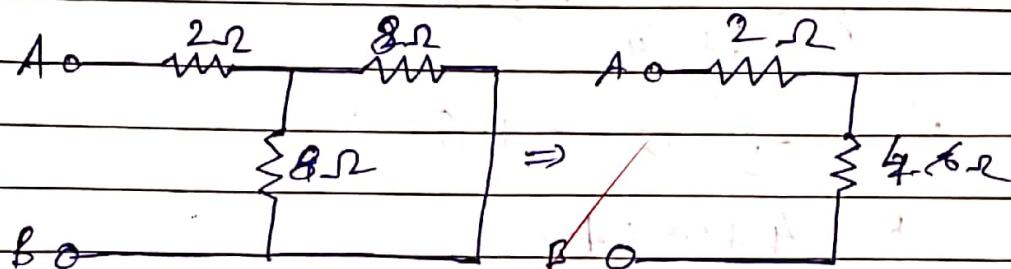
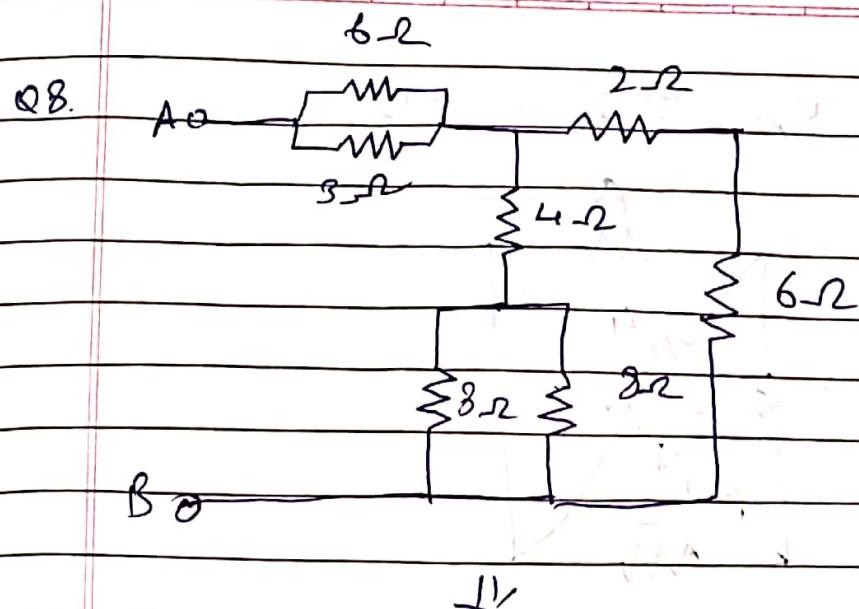
$$I = 0.3A$$

$$V = IR$$

$$60 = 0.3(6 + R)$$

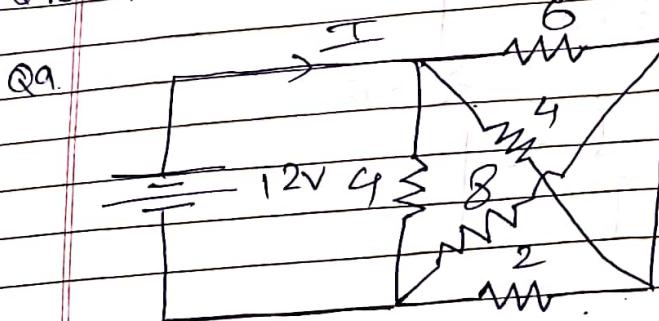
$$6 + R = 200$$

$$R = 194\Omega$$



$$R_{eq} = 6\ \Omega$$

Q90 $R_{AC} = 8\Omega$; $R_{ABF} = 12\Omega$; $R_{BC} = 12\Omega$



$$R' = \frac{1}{\frac{1}{6} + \frac{1}{4}} = 2.4$$

$$R'' = \frac{1}{\frac{1}{8} + \frac{1}{2}} = 1.6$$

$$R = \cancel{4} + 2.4 + \cancel{1.6} =$$

$$R = \frac{1}{\frac{1}{4}} + \frac{1}{\frac{1}{2}} = 2$$

$$V = IR$$

$$12 = I \times 2$$

$I = 6A$

Q10.

$$R' = \frac{1}{\frac{1}{6} + \frac{1}{8}} = 4\Omega$$

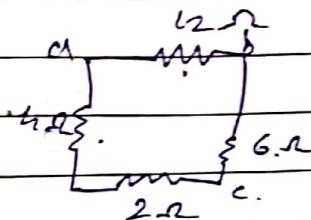
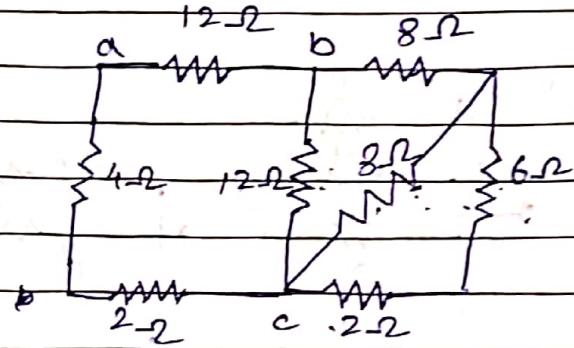
~~$$R'' = \frac{1}{\frac{1}{6} + \frac{1}{8} + \frac{1}{(2+6)}} = \frac{1}{\frac{1}{6} + \frac{1}{8} + \frac{1}{8}} = 4\Omega$$~~

$$R' = 6 \parallel 18$$

$$= 4\Omega$$

$$R'' = 4 + 8 = 12$$

$$R_{AB} = \left(\frac{1}{12} + \frac{1}{12} \right)^{-1} = [6\Omega]$$



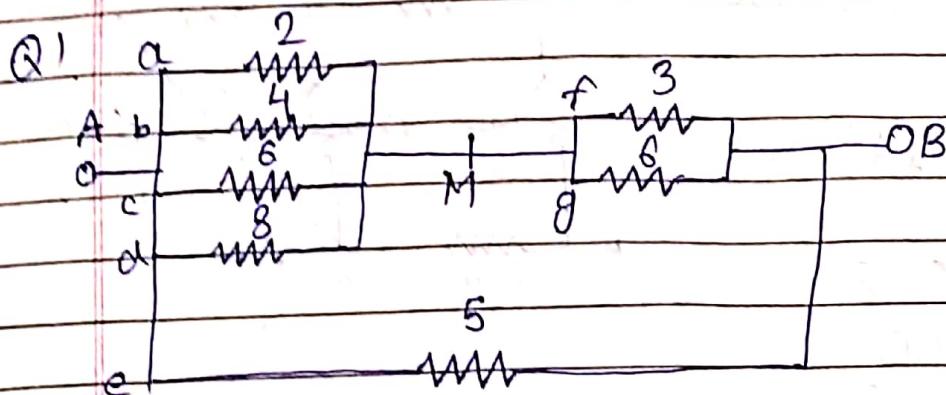
12 and 6 in series; 2, 6 in series

$$R_{BC} = R_{AC} = \left(\frac{1}{18} + \frac{1}{6} \right)^{-1}$$

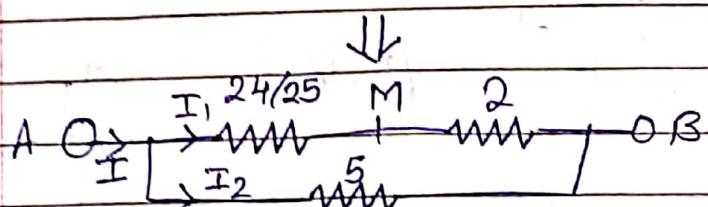
$$= [4.5\Omega]$$

~~D/F
26/08/2011~~

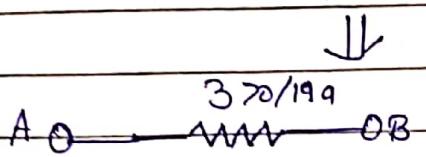
Assignment - 2



(A)



(B)



(C)

$$R_{AB} = 370/199$$

$$V_{AB} : I_{AB} = \frac{370}{199}$$

$$I_{AB} = \frac{370}{199 \times 20} = [10.76 \text{ A}] \quad [\text{Total Current}]$$

$$I_1 = I_{AB} \left(\frac{5}{5 + \frac{24}{25} \times 2} \right) \quad [\text{From (B)}]$$

$$= 10.76 \left(\frac{5}{5 + 24.25} \right)$$

$$= 10.76 \left(\frac{5}{29.25} \right)$$

$$\boxed{I_1 = 6.76 \text{ A}}$$

$$I_{AB} = I_1 + I_2$$

$$I_2 = I_{AB} - I_1$$

$$= 10.76 - 6.76$$

$$\boxed{I_2 = 4A}$$

$$I_f = I_1 \left(\frac{6}{8+6} \right) = 6.76 \left(\frac{6}{14} \right)$$

$$\boxed{I_f = 2.25A} \quad \boxed{I_f = 4.51A}$$

$$I_g = I_1 \left(\frac{3}{8+6} \right) = 6.76 \left(\frac{3}{14} \right)$$

$$\boxed{I_g = 2.25A}$$

$$V_{AM} = I_1 \cdot 24/25$$

$$\boxed{V_{AM} = 6.48A}$$

$$I_a = V_{AM}/R_a = 3.24A$$

$$I_b = V_{AM}/R_b = 1.62A$$

$$I_c = V_{AM}/R_c = 1.08A$$

$$I_d = V_{AM}/R_d = 0.81A$$

~~$$I_e = V_{AM}/R_e = 4$$~~

~~$$I_e = V/R_e = 20/5 = 4A$$~~

$$P_a = I_a^2 R_a = 21W$$

$$P_b = I_b^2 R_b = 10.4W$$

~~$$P_c = I_c^2 R_c = 7W$$~~

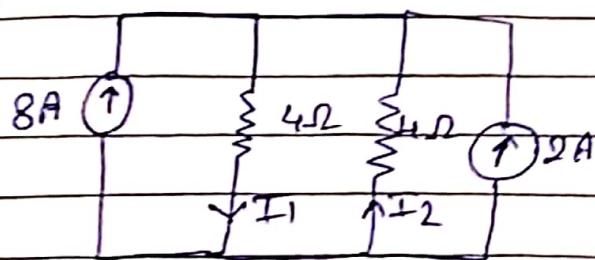
~~$$P_d = I_d^2 R_d = 5.25W$$~~

~~$$P_e = I_e^2 R_e = 80W$$~~

~~$$P_f = I_f^2 R_f = 61W$$~~

$$P_g = I_g^2 R_g = 80.4W$$

Q3.



(1)

$$R = \left(4^{-1} + 4^{-1}\right)^{-1} = 2$$

$$V = IR = 20V$$

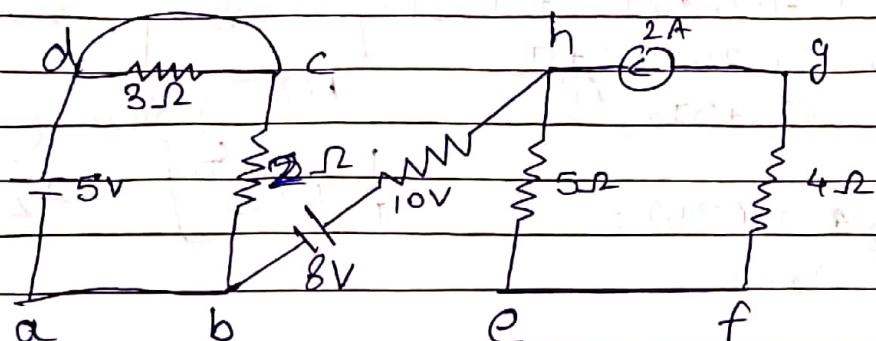
$$\begin{aligned} (2) \quad I_1 &= 10 \times \frac{4}{4+4} = I \left(\frac{R_2}{R_1+R_2}\right) \\ &= 10 \times \frac{4}{8} \end{aligned}$$

$$I_1 = 5A$$

$$\begin{aligned} (3) \quad I_2 &= I \left(\frac{R_1}{R_1+R_2}\right) \quad [\because \text{Opp Dir}] \\ &= -10 \left(\frac{4}{8}\right) \end{aligned}$$

$$I_2 = -5A$$

Q4



In loop abcd

$$V_i = I_1 R_1$$

$$5 = I_1 \cdot 8 \Omega$$

$$\boxed{I_1 = 2.5 \text{ A}}$$

$$\boxed{I_2 = 2 \text{ A}}$$

$$-V_E + 5I_2 - 8 + 2I_1 + V_C = 0$$

$$-V_E + 10 - 8 + 5 + V_C = 0$$

$$V_C - V_E = ->$$

$$\boxed{V_E - V_C = > V}$$

$$[V_E \text{ w.r.t } V_C]$$

Final Eq

Q5. Loop - 1

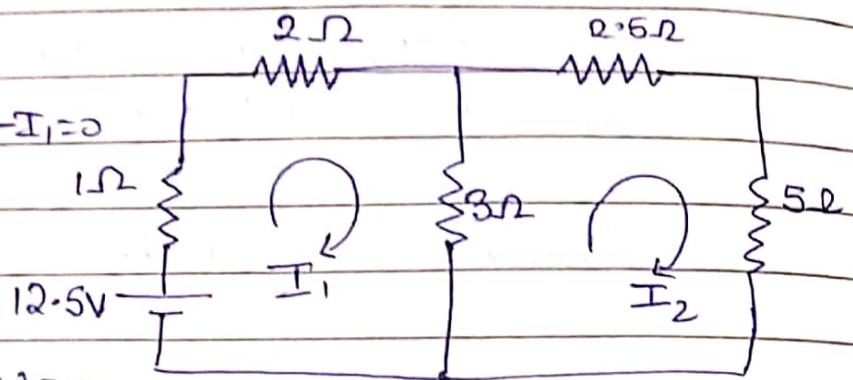
$$-2I_1 - 3(I_1 - I_2) + 12.5 - I_1 = 0$$

$$12.5 = 6I_1 - 3I_2 \quad \textcircled{1}$$

Loop - 2

$$-2.5I_2 - 5I_2 - 3(I_2 - I_1) = 0$$

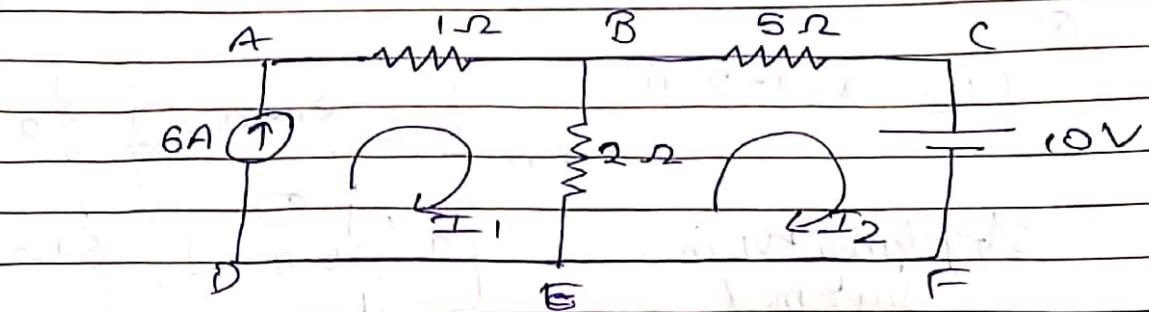
$$3I_1 - 10I_2 = 0 \quad \textcircled{2}$$



$$I_1 = +2.43 \text{ A}$$

[From $\textcircled{1}$ n $\textcircled{2}$]

Q6.



$$\boxed{I_1 = 6A} \quad \textcircled{1}$$

In loop BC F E B

$$-5I_2 - 10 - 2(I_2 - I_1) = 0$$

$$10 = 2I_1 - 2I_2 \quad \textcircled{2}$$

From ① and ②

$$\boxed{I_2 = 0.2837 A}$$

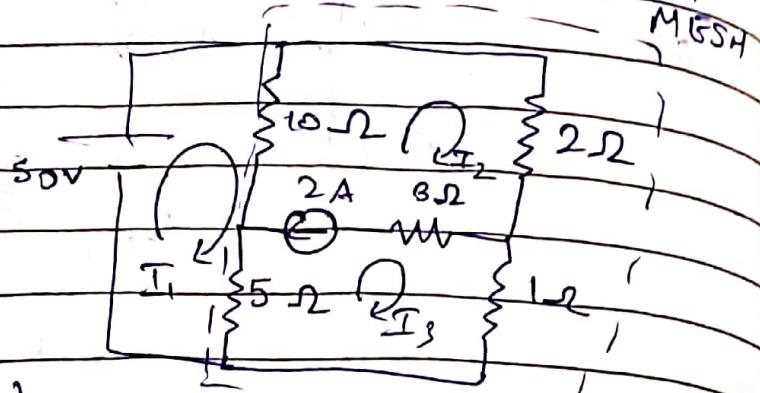
$$I_{D2} = (I_1 - I_2) = \boxed{5.71 A} \downarrow \text{down}$$

SUPER

M15SH

Q7

$$(I_2 - I_3) = 2 \quad (1)$$



Applying KVL in
supermesh

$$-2I_2 - I_3 - 5(I_3 - I_1)$$

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

$$15I_1 - 12I_2 + 6I_3 = 0 \quad (2)$$

Applying KVL in loop 1

$$-10(I_1 - I_2) - 5(I_1 - I_3) + 50 = 0$$

$$-15I_1 + 10I_2 + 5I_3 = -50 \quad (3)$$

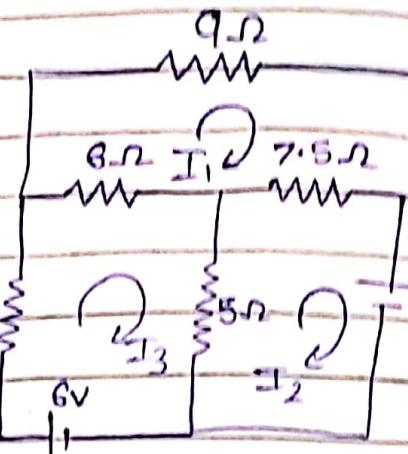
$$I_1 = 20A \quad I_2 = 17.33A \quad I_3 = 15.33A$$

$$I_{5\Omega} = I_1 - I_3 = 4.67A \downarrow$$

Q8. In loop 1

$$-9I_1 - 6(I_1 - I_3) - 7.5(I_1 - I_2) = 0 \quad (1)$$

$$-22.5I_1 + 7.5I_2 + 6I_3 = 0 \quad (1)$$



In loop 2

$$-7.5(I_2 - I_1) - 30 - 5(I_2 - I_3) = 0$$

$$30 = 7.5I_1 - 12.5I_2 + 5I_3 \quad (2)$$

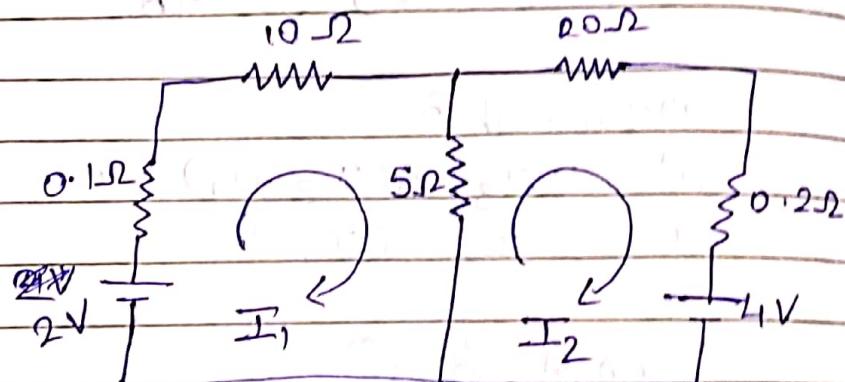
In loop 3

$$-6 - 5(I_3 - I_2) - 1.5I_3 - 6(I_3 - I_1) = 0$$

$$6 = -6I_1 + 5I_2 + 12.5I_3 \quad (3)$$

$$\boxed{I_{1.3} = -2.5 \text{ A} \quad [\text{Downward}]}$$

Q9.



In loop 1

$$-0.1I_1 - 10I_1 - 5(I_1 - I_2) + 2 = 0$$

$$2 = -15.1I_1 + 5I_2$$

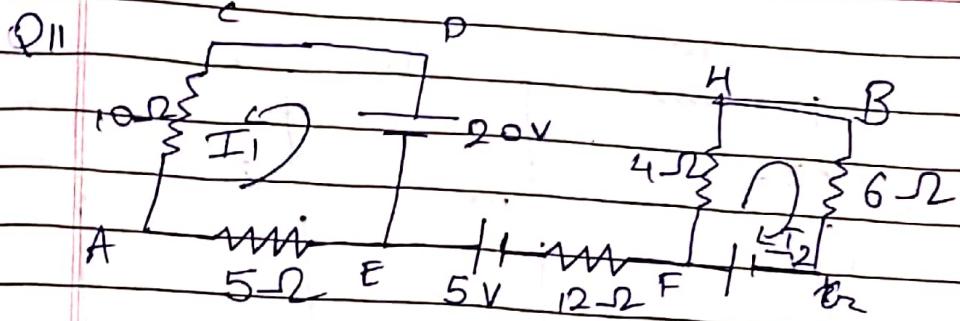
In loop 2

$$-0.2I_2 - 20I_2 - 5(I_2 - I_1) - 4 = 0$$

$$4 = -25.2I_2 + 5I_1$$

$$\boxed{I_1 = -0.19 \quad I_2 = -0.19}$$

$$\boxed{I_1 = 0.085 \quad I_2 = 0.141}$$



KVL in mesh AEDEA ACDEA

$$-10I_1 - 5I_1 + 20 = 0$$

$$I_1 = 1.33A$$

KVL in mesh BG₂FHB

$$-6I_2 + 15 - 4I_2 = 0$$

$$I_2 = \frac{20}{15} = 1.33A$$

$$V_{AB} = V_A - V_B$$

$$V_A - 5I_1 - 5 - 15 + 6I_2 - V_B = 0$$

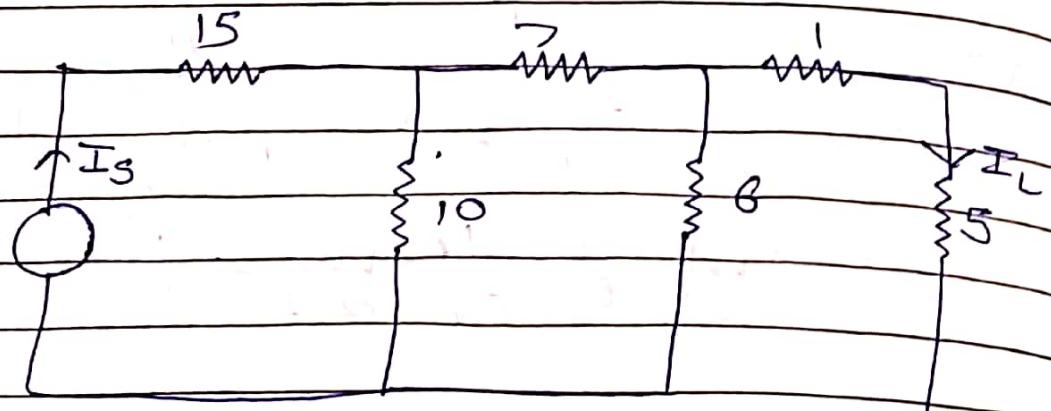
$$V_A - V_B = 5I_1 + 20 - 6I_2$$

$$V_A - V_B = 5(1.33) + 20 - 6(1.33)$$

$$V_{AB} = 12.65V$$

~~28/08/2019~~

Q2.

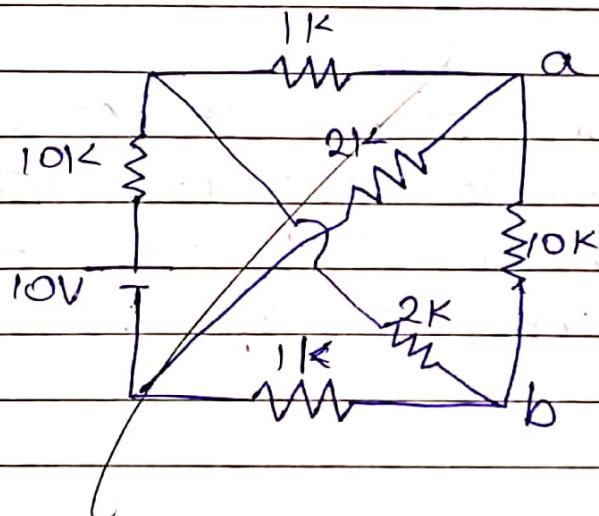


$$I_L = I_S \times \frac{5}{5+6+10}$$

$$I_L = I_S \times \frac{5}{21}$$

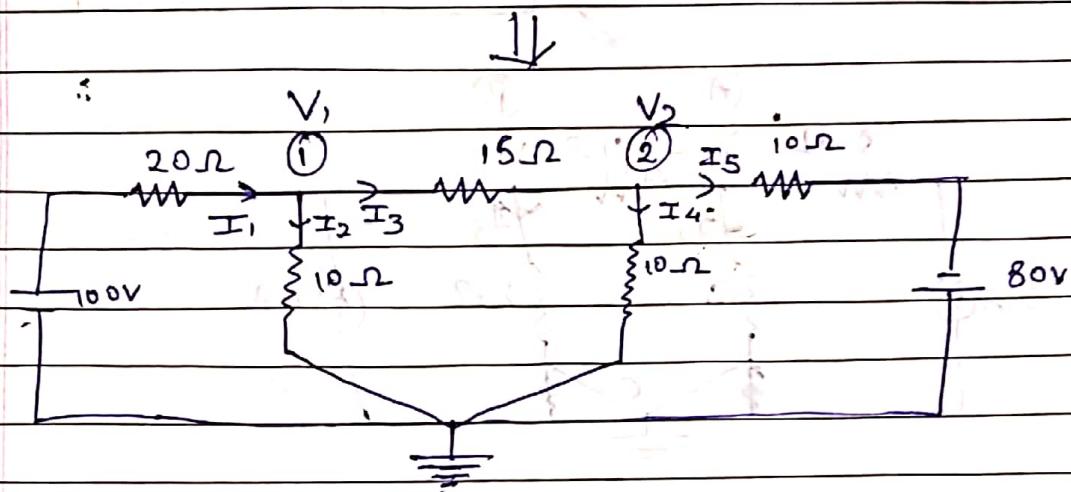
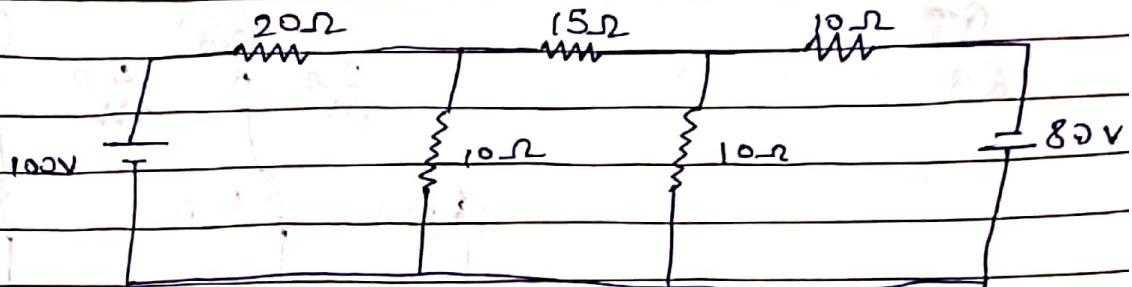
$$\frac{I_L}{I_S} = 0.24$$

Q10.



Assignment -3

Q1.



KCL in node 1

$$I_1 = I_2 + I_3$$

$$\frac{100 - V_1}{20} = \frac{V_1 - 0}{10} + \frac{V_1 - V_2}{15}$$

$$30V - 4V_2 = 300 \quad \text{(1)}$$

KCL in node 2

$$I_3 = I_4 + I_5$$

$$\frac{V_1 - V_2}{15} = \frac{V_1 - 0}{10} + \frac{V_2 - (-80)}{15}$$

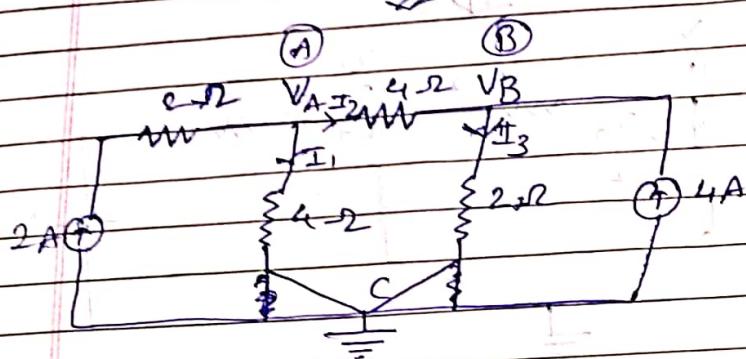
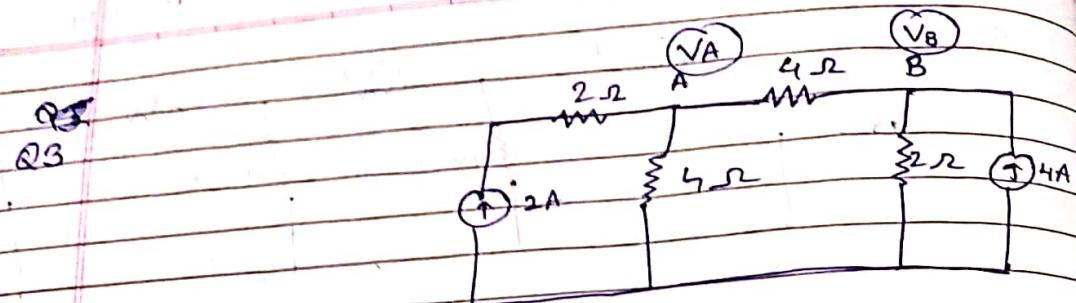
$$V_1 - 4V_2 = 120 \quad \text{(2)}$$

$$V_1 = 15V$$

$$V_2 = -26.25V$$

$$I_{15\Omega} = I_3 = \frac{V_1 - V_2}{15} = \frac{15 + 26.25}{15} = 2.25$$

Q3



KCL at node 1

$$2 = I_1 + I_2$$

$$2 = \frac{V_A - 0}{4} + \frac{V_A - V_B}{4}$$

$$2V_A - V_B = 8 \quad \text{---(1)}$$

$$V_A = 8V$$

$$V_B = 8V$$

KCL at node 2

$$I_2 + 4 = I_3$$

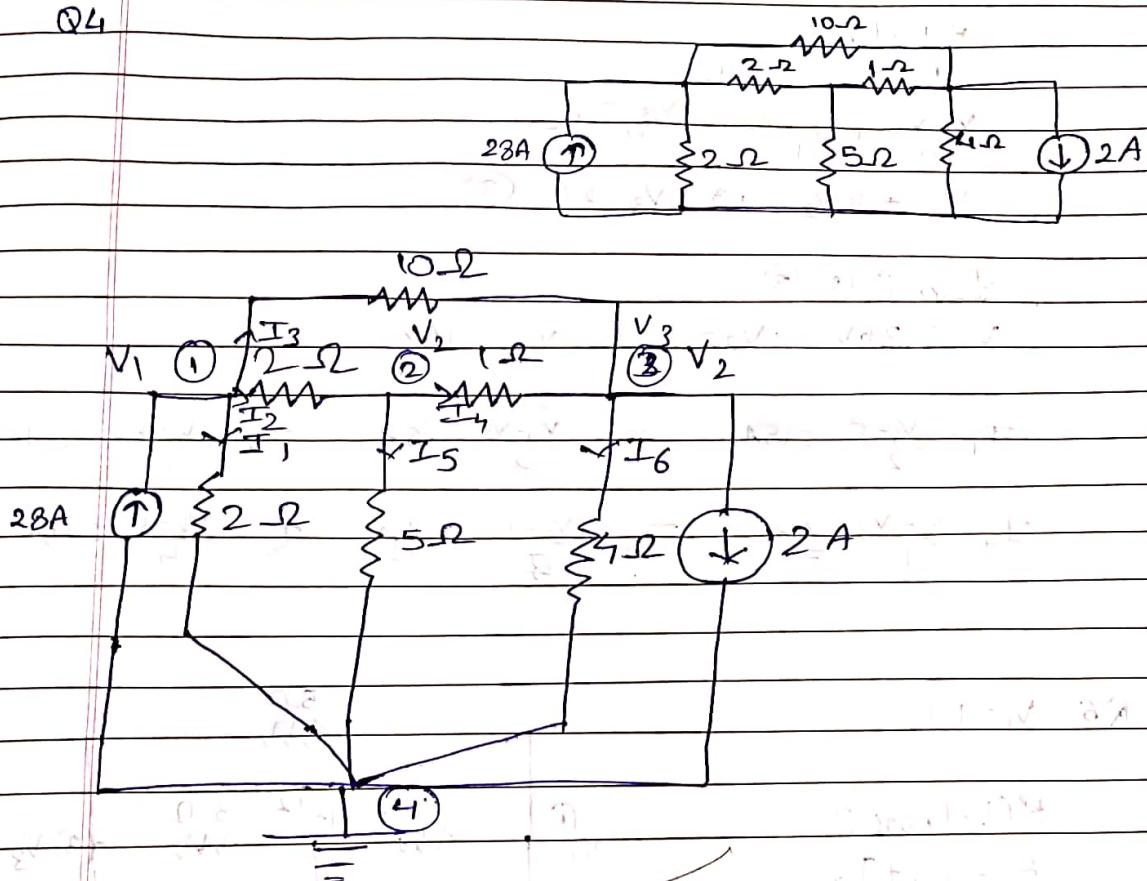
$$\frac{V_A - V_B}{4} + 4 = \frac{V_B - 0}{2}$$

$$V_A - 3V_B = -16 \quad \text{---(2)}$$

Special case $V_A = 16V$

$$V_A = 16V \quad V_B = 8V$$

Q4



KCL at node 1

$$28 = I_1 + I_2 + I_3$$

$$28 = \frac{V_1 - 0}{2} + \frac{V_1 - V_2}{2} + \frac{V_1 - V_3}{10}$$

$$11V_1 - 5V_2 - V_3 = 280 \quad \textcircled{1}$$

KCL at node 2

$$I_2 = I_4 + I_5$$

$$\frac{V_1 - V_2}{2} = \frac{V_2 - V_3}{1} + \frac{V_2 - 0}{5}$$

$$5V_1 - 17V_2 + 10V_3 = 0 \quad \textcircled{2}$$

KCL at node 3

$$I_3 + I_4 = I_6 + 2$$

$$\frac{V_1 - V_3}{10} + \frac{V_2 - V_3}{1} = \frac{V_3 - 0}{4} + 2$$

$$V_1 + 10V_2 - 13.5V_3 = 20 \quad (3)$$

From (1) (2), (3)

$$V_1 = 36V; V_2 = 20V; V_3 = 16V$$

$$I_1 = \frac{V_1 - 0}{2} = 18A$$

$$I_2 = \frac{V_1 - V_2}{2} = 8A$$

$$I_3 = \frac{V_1 - V_3}{10} = 2A$$

$$I_4 = \frac{V_2 - V_3}{4} = 4A$$

$$I_5 = \frac{V_2 - 0}{3} = 4A$$

$$I_6 = \frac{V_3 - 0}{5} = 4A$$

$$Q6 \quad V_1 = 10$$

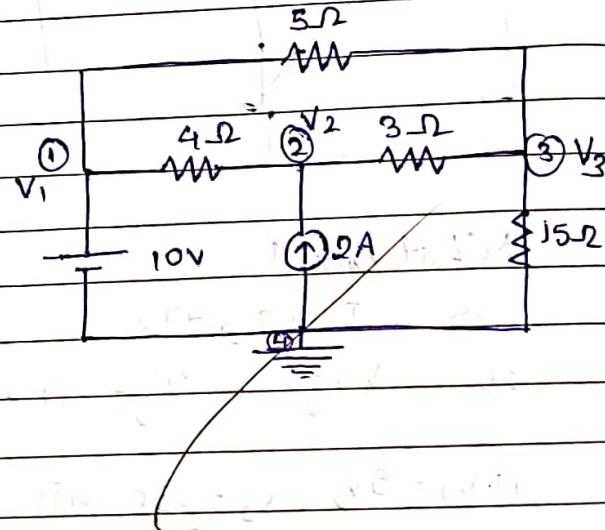
KCL at node 2

$$2 = I_1 + I_2$$

$$2 = \frac{V_2 - 10}{4} + \frac{V_2 - V_3}{3}$$

$$7V_2 - 9V_3 = 30 \quad (1)$$

$$7V_2 - 4V_3 = 54 \quad (2)$$



KCL at node ② 3

$$I_2 + I_3 = I_4$$

$$\frac{10 - V_3}{5} + \frac{V_2 - V_3}{3} = \frac{V_3 - 0}{15}$$

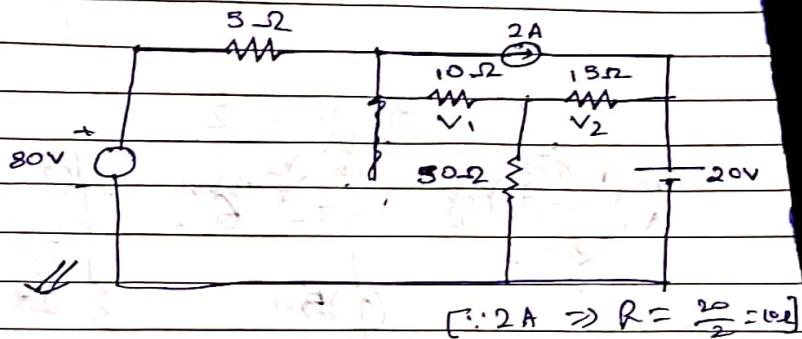
$$5V_2 - 9V_3 = -30 \quad (2)$$

$$V_2 = 14.09V \quad V_3 = 11.16V$$

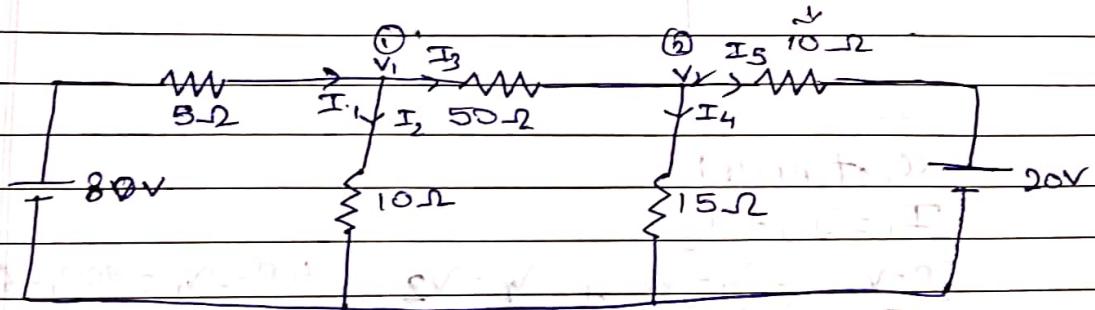
$$I_{3,2} = \frac{V_2 - V_3}{3} = \underline{0.98A}$$

$$I_{4,2} = \frac{V_2 - 10}{4} = \underline{1.02A}$$

Q2



$$[\because 2A \Rightarrow R = \frac{20}{2} = 10\Omega]$$



KCL at node 1

$$I_1 = I_2 + I_3$$

$$\frac{80 - V_1}{5} - \frac{V_1}{10} + \frac{V_1 - V_2}{50}$$

$$\therefore V_1 - 5V_2 = 80 - ①$$

KCL at node 2

$$I_3 = I_4 + I_5$$

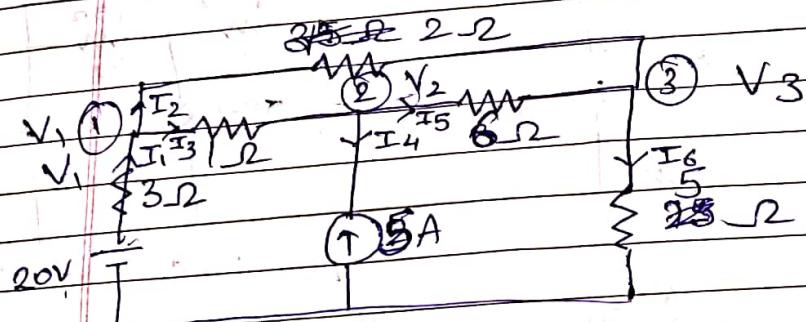
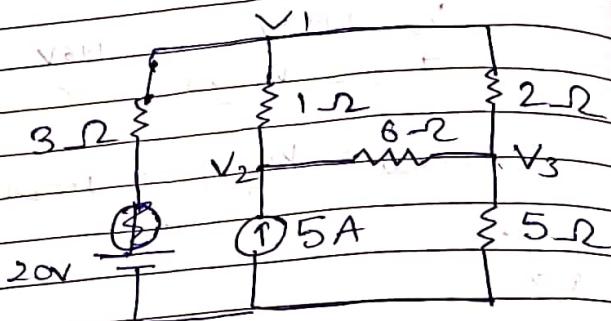
$$\frac{V_1 - V_2}{50} = \frac{V_2}{15} + \frac{20 - V_2}{10}$$

$$2V_2 + 3V_1 = 300 - ②$$

$$V_1 = \underline{27.06V}$$

$$V_2 = \underline{109.41V}$$

Q5



$\Sigma I = 0$,
KCL at node 1

$$I_1 = I_2 + I_3$$

$$\frac{20 - V_1}{3} = \frac{V_1 - V_3}{2} + \frac{V_1 - V_2}{1} \Rightarrow 40 - 2V_1 = 9V_2 - 6V_3 - 5V_1$$

$$11V_1 - 6V_2 - 3V_3 = 40 \quad \text{---(1)}$$

KCL at node 2

$$I_3 = I_4 + I_5$$

$$\frac{V_1 - V_2}{1} = (-5) + \frac{V_2 - V_5}{6}$$

$$6V_1 - 6V_2 = -30 + V_2 - V_5$$

$$6V_1 - 7V_2 + V_5 = -30 \quad \text{---(2)}$$

KCL at node 3

$$I_2 + I_5 = I_6$$

$$\frac{V_1 - V_3}{2} + \frac{V_2 - V_3}{6} = \frac{V_3 - 0}{5}$$

$$1.5V_1 - 2.0V_3 + 5V_2 = 6V_3$$

$$15V_1 - 26V_3 + 5V_2 = 0 \quad (3)$$

From (1), (2), (3)

$$V_1 = 25V \quad V_2 = 25V \quad V_3 = 55V$$

Power by 6-2

$$P = I^2 R$$

$$= \left(\frac{V_2 - V_3}{6} \right)^2 6$$

$$P = 150W$$

$$V_1 = V_2 + 20$$

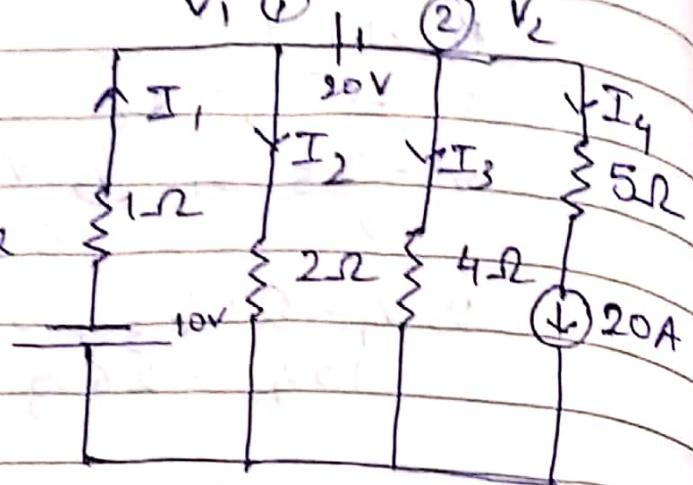
$$V_1 - V_2 = 20 \quad \textcircled{1}$$

Consider \textcircled{1} n \textcircled{2} as single node

$$I_1 = I_2 + I_3 + I_4$$

$$\frac{-10 - V_1}{\Delta 1} = \frac{V_1}{2} + \frac{V_2}{4} + 20$$

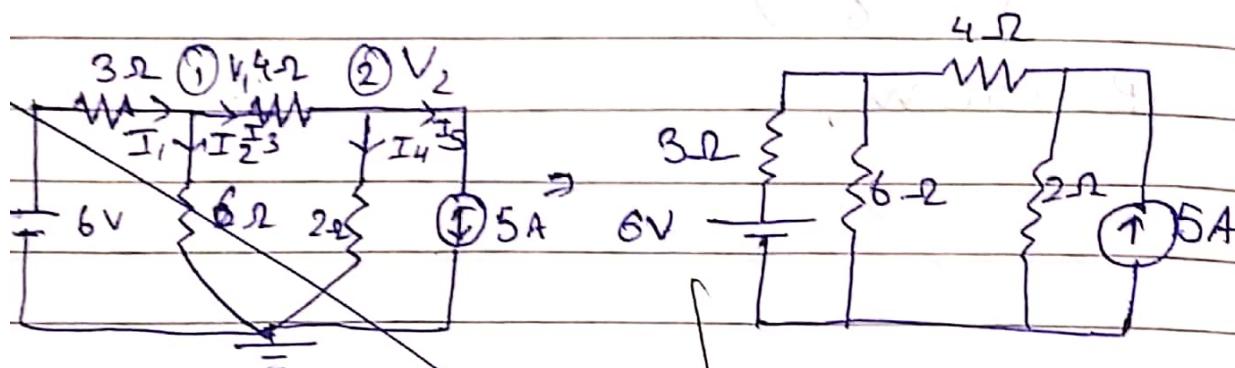
$$-30 = 1.5V_1 + 0.25V_2 \quad \textcircled{2}$$



From \textcircled{1} and \textcircled{2}

$$\underline{V_1 = -14.28 \text{ V}}$$

$$\underline{V_2 = -34.29 \text{ V}}$$



KCL in node 1

$$I_1 = I_2 + I_3$$

$$\frac{6 - V_1}{3} = \frac{V_1 - 0}{6} + \frac{V_1 - V_2}{4}$$

$$3V_1 - V_2 = -1 \quad \textcircled{1}$$

KCL in Node 2

$$I_3 = I_4 + I_5$$

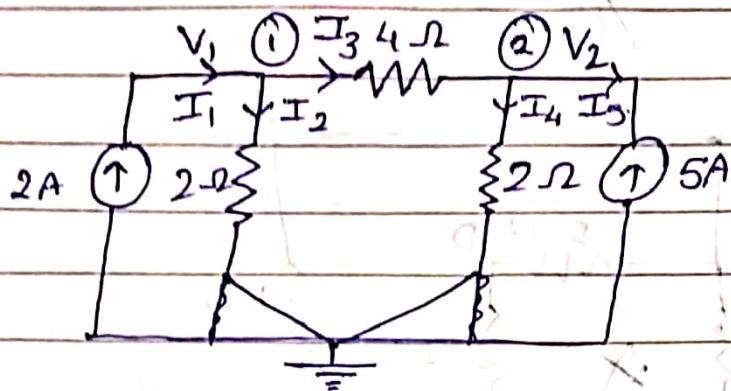
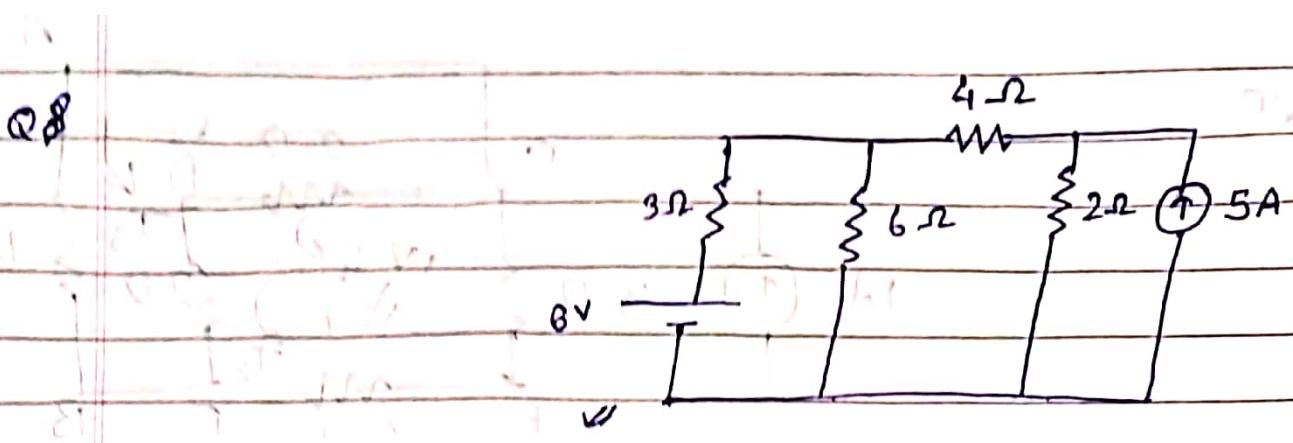
$$\frac{V_1 - V_2}{4} = \frac{V_2 - 0}{2} - 5$$

$$2V_1 - 6V_2 = -40 \quad \textcircled{2}$$

$$V_1 = 5.12 \text{ V}$$

$$V_2 = 8.3$$

$$I = \frac{5.12 - 8.3}{4} = -0.795 \text{ A}$$



KCL at node 1

$$I_1 = I_2 + I_3$$

$$2 = \frac{v_1 - 0}{2} + \frac{v_1 - v_2}{4}$$

$$8 = 2v_1 + v_1 - v_2$$

$$8 = 3v_1 - v_2 \quad \text{---(1)}$$

$$V_1 = 6.5 V$$

$$I_3 = \frac{V_1 - V_2}{4} = \underline{-1.25A}$$

\propto CL at node 2

$$I_3 = I_4 + I_5$$

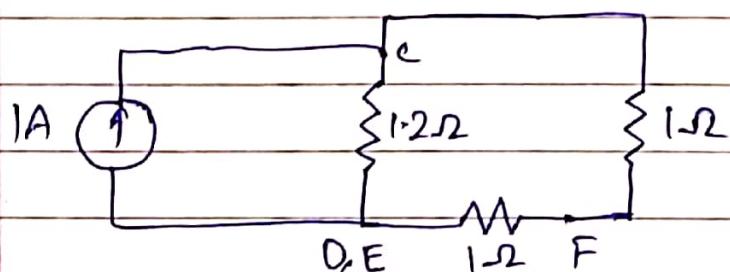
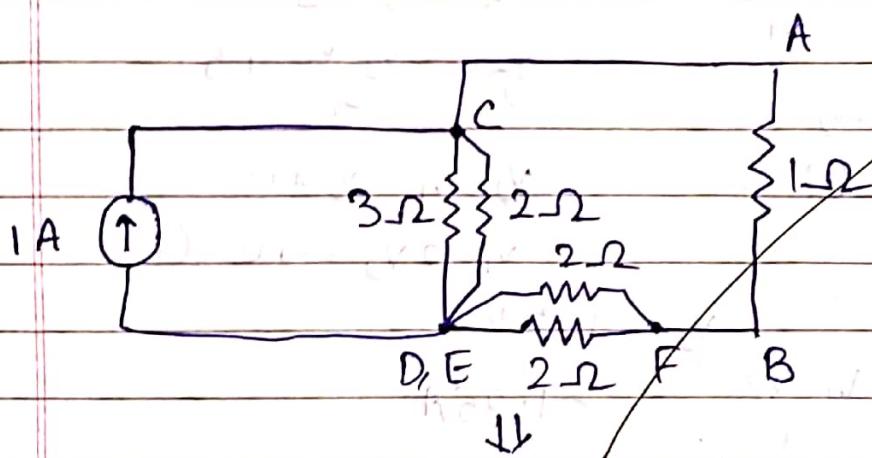
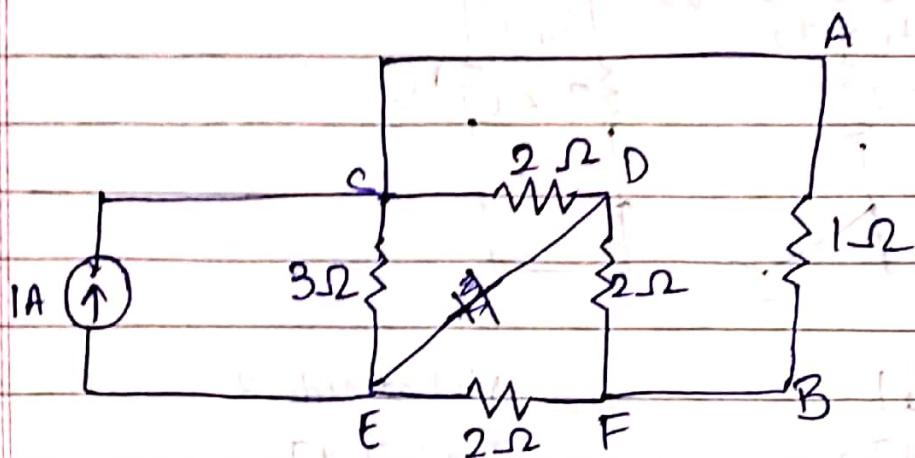
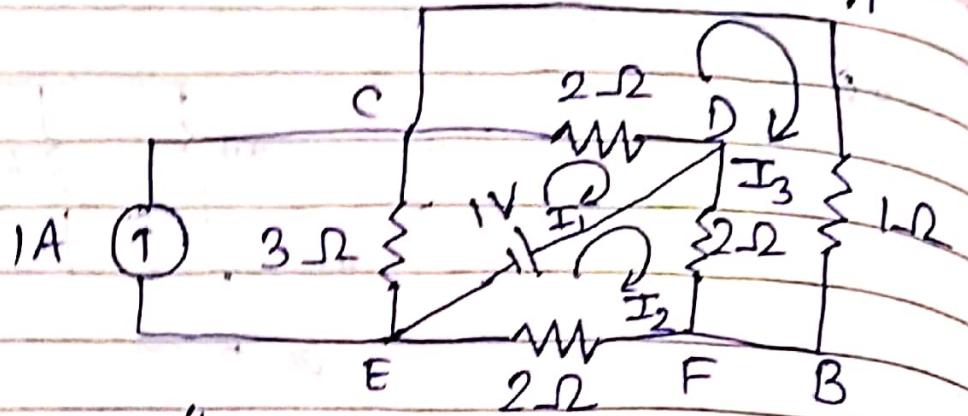
$$I_4 = I_3 - I_5$$

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

$$V_2 = V_1 - V_2 + 10$$

$$v_1 - 2v_2 = -10 \quad \text{---(2)}$$

Q10.



$$I_{AB} = \frac{V_{12}}{1.2 + (1+1)} = \underline{\underline{0.375 A}}$$

KVL in Mesh 1

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

$$5I_1 - 2I_3 = -1 \quad \textcircled{1}$$

KVL in Mesh 2

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

$$2I_1 + 2I_2 - 5I_3 = 0 \quad \textcircled{2}$$

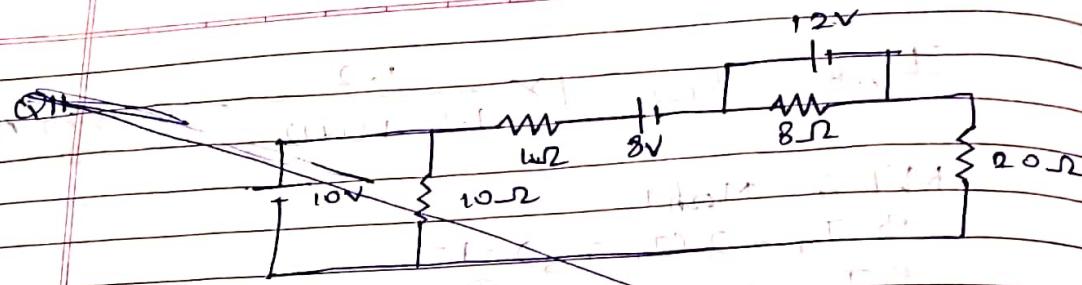
KVL in Mesh 3

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

$$2I_1 + 2I_2 - 5I_3 = 0 \quad \textcircled{3}$$

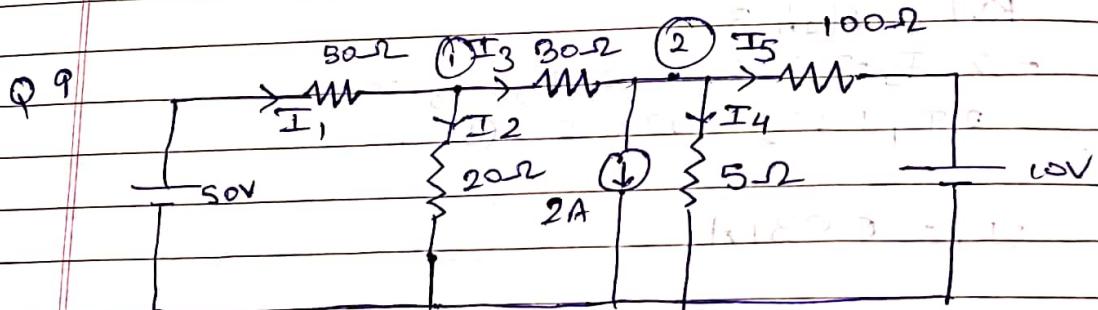
$$I_1 = 0.031 A$$

$$I_{AB} = 0.375 + 0.031 = \underline{\underline{0.406 A}}$$



Q12

S-I: Consider 10V source alone so 8-2 gets short



KCL at node 1

$$I_1 = I_2 + I_3$$

$$\frac{50 - V_1}{50} = \frac{V_2 - 0}{20} + \frac{V_1 - V_2}{30}$$

$$3V_1 - 10V_2 = 300 \quad \textcircled{1}$$

KCL at node 2

$$I_3 = I_4 + 2 + I_5$$

$$\frac{V_1 - V_2}{30} = \frac{V_2}{5} + 2 + \frac{10V_2}{100}$$

$$10V_1 - 65V_2 = 650 \quad \textcircled{2}$$

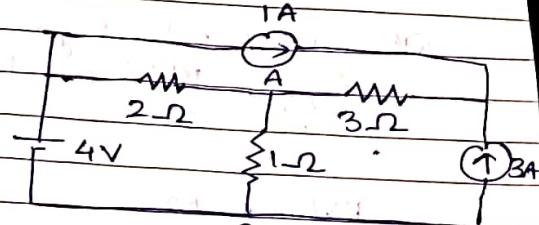
From $\textcircled{1}$ and $\textcircled{2}$

$$V_1 = 6.98 \text{ V}$$

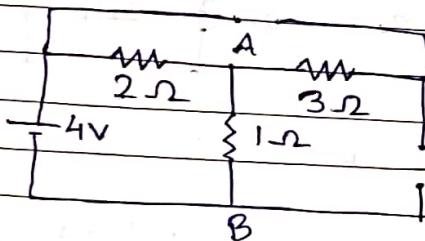
$$V_2 = -8.36 \text{ V}$$

$$I_5 = \frac{10V_2}{100} = \frac{18.36}{100} = 0.18 \text{ A}$$

Q12



S-1

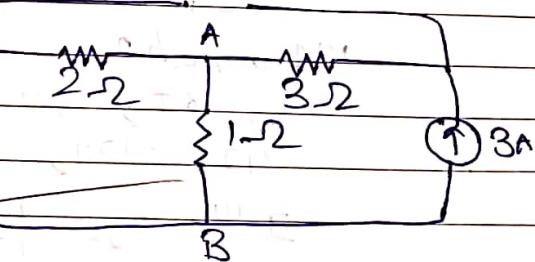


$$I_{AB} = \frac{4}{2+1} = 1.33A$$

S-2

$$I_{3\Omega} = 3A$$

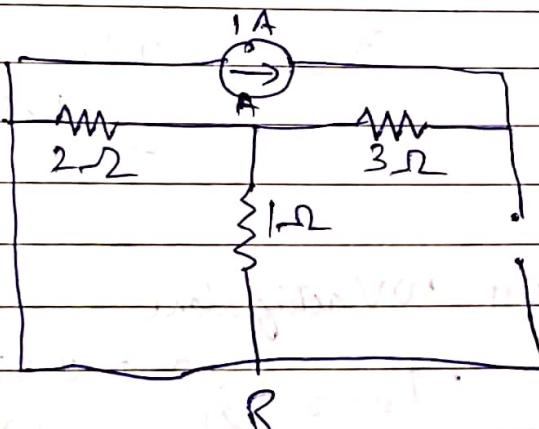
$$I_{AB} = 3 \times \frac{2}{2+1} = 2A$$



$$I_{3\Omega} = 1A$$

$$I_{AB} = 1 \times \frac{2}{2+1}$$

$$\therefore 0.67A$$



$$I_{AB} = I_{1\Omega} = 1.33 + 2 + 0.67 \\ \boxed{= 4A}$$

Q4. CASE-1: 2A acting alone
Applying KVL in mesh 1

$$I_1 = 2A$$

KVL in mesh 2

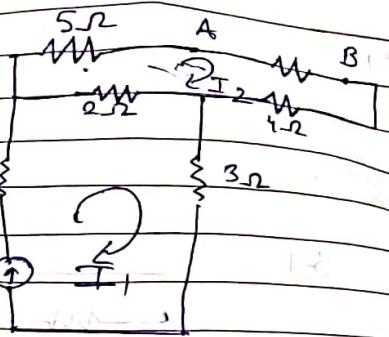
$$-2I_2 + 2I_1 - 5I_2 - 6I_2 - 4I_2 = 0$$

$$2I_1 - 17I_2 = 0$$

$$12I_2 = 4$$

$$I_2 = 0.235A = I'$$

CASE-2: When 10V acting alone



$$I'' = 0A$$

CASE-3: When 4A acting alone

Applying KVL in mesh 1

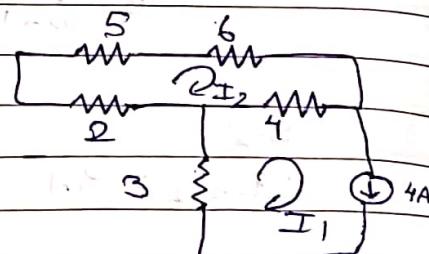
$$I_1 = 4A$$

KVL in mesh 2

$$-5I_2 - 6I_2 - 4I_2 + 4I_1 - 2I_2 = 0$$

$$4I_1 - 17I_2 = 0$$

$$I''' = I_2 = \frac{16}{17} = 0.94A$$



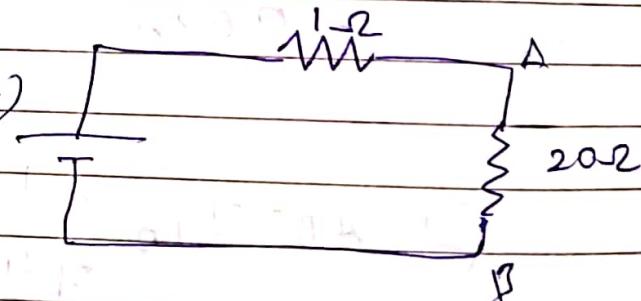
$$I_{6\Omega} = I' + I'' + I'''$$

$$\therefore = 1.176A$$

Q11 10V acting alone

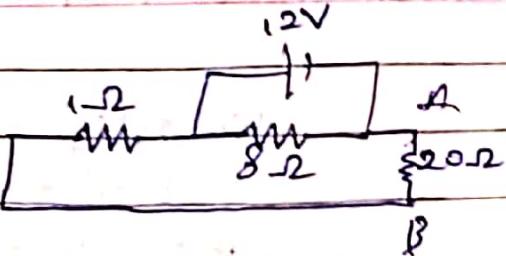
$$I_{20\Omega} = \frac{10}{21} = 0.476A$$

(Ans)



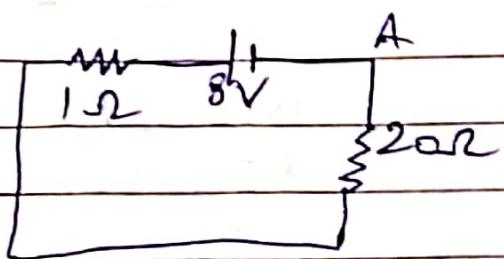
12V acting alone

$$I_{202} = \frac{12}{21} = 0.571 A (\uparrow)$$



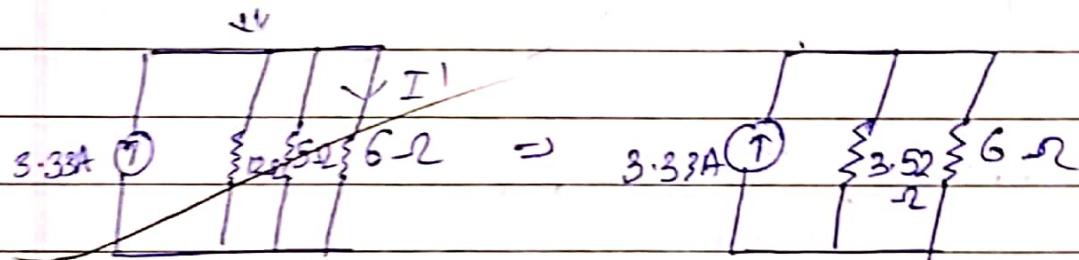
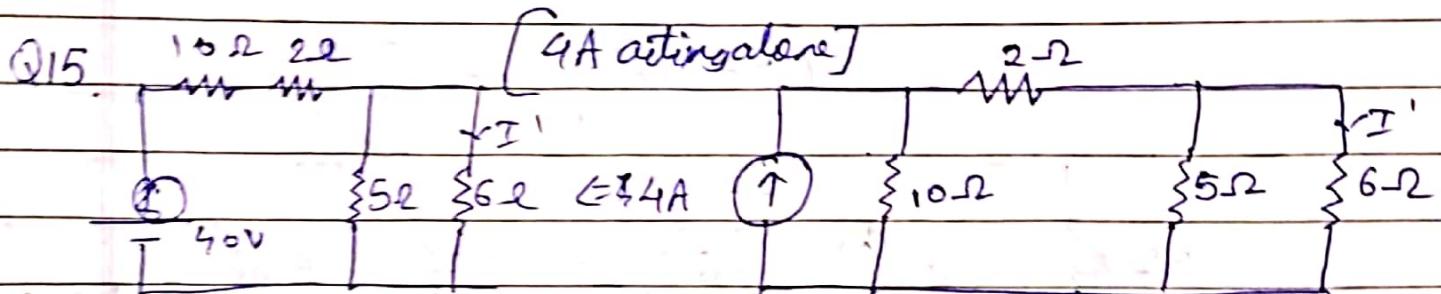
8V acting alone

$$I_{202} = \frac{8}{21} = 0.381 A (\uparrow)$$



$$I_{AB} = 0.476 (\downarrow) + 0.571 (\uparrow) + 0.381 (\uparrow)$$

$$= 0.476 (\uparrow)$$



$$I^1 = \frac{3.52}{6+3.52} \times 3.33$$

$$= \underline{\underline{1.233 A}}$$

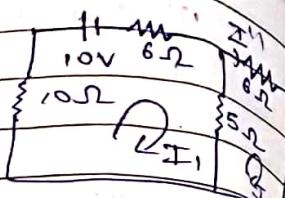
(1) V acting alone

KVL acting alone

KVL on mesh 1

$$-10I_1 - 10 - 6I_1 - 5I_1 + 5I_2 = 0$$

$$12I_1 - 5I_2 = 10 \quad (1)$$



Q1.

2.

KVL in mesh 2

$$5I_1 - 5I_2 - 6I_2 = 0$$

$$-5I_1 + 11I_2 = 0 \quad (2)$$

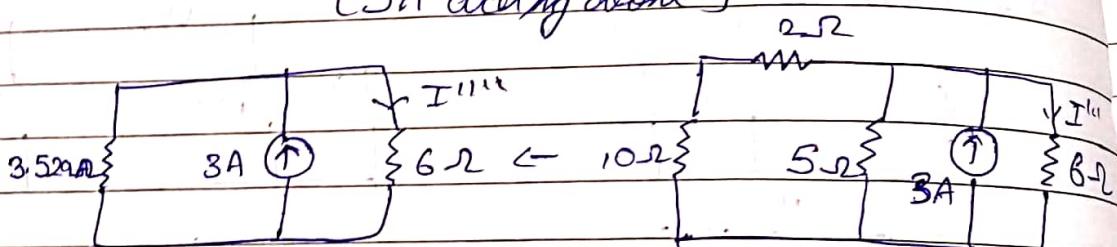
Eqs. (1) & (2)

$$I_1 = -0.676A$$

$$I^{'''} = I_2 = -0.3086A$$

$$I_2 = -0.3086A$$

[3A acting alone]



$$I''' = \frac{3.529}{6+3.529} \times 3$$

$$= 1.11A$$

$$I_{6\Omega} = 2. I^1 + I''' + I^{'''} \\ = 2.035A$$

D8/
08/10/2017