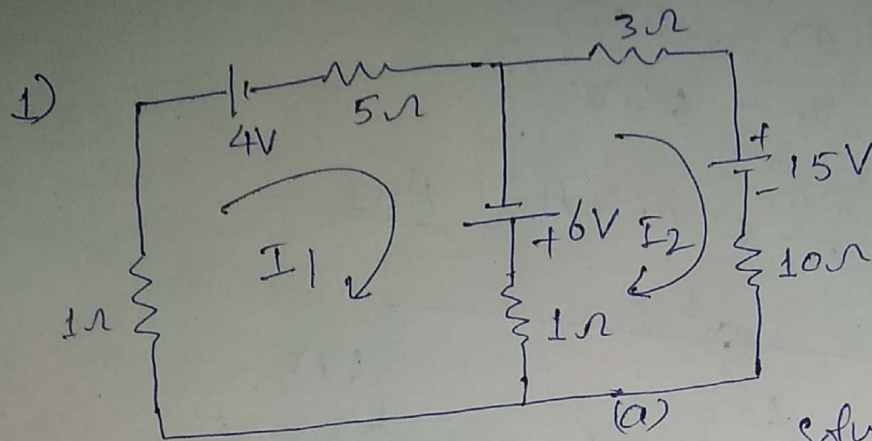


# Tutorial sheet No. 2



$$\begin{aligned} 7I_1 - I_2 &= -4 + 6 \\ 7I_1 - I_2 &= 2 \quad \text{--- (1)} \\ -I_1 + 14I_2 &= -6 - 15 \\ -I_1 + 14I_2 &= -21 \quad \text{--- (2)} \end{aligned}$$

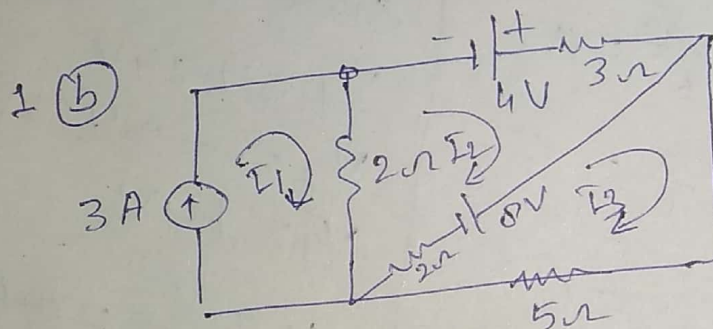
Solve eq<sup>n</sup> (1) and (2)

$$I_1 = 0.072 \text{ A}$$

$$I_2 = -1.494 \text{ A}$$

$$I_{5\Omega} = I_1 = 0.072 \text{ A}$$

Ans



$$I_1 = 3 \text{ A} \quad \text{--- (1)}$$

KVL in mesh (2)

$$-2I_1 + 7I_2 - 2I_3 = -4 \quad \text{--- (2)}$$

KVL in mesh (3)

$$0I_1 - 2I_2 + 7I_3 = 0 \quad \text{--- (3)}$$

Solve eq<sup>n</sup> (1), (2) and (3)

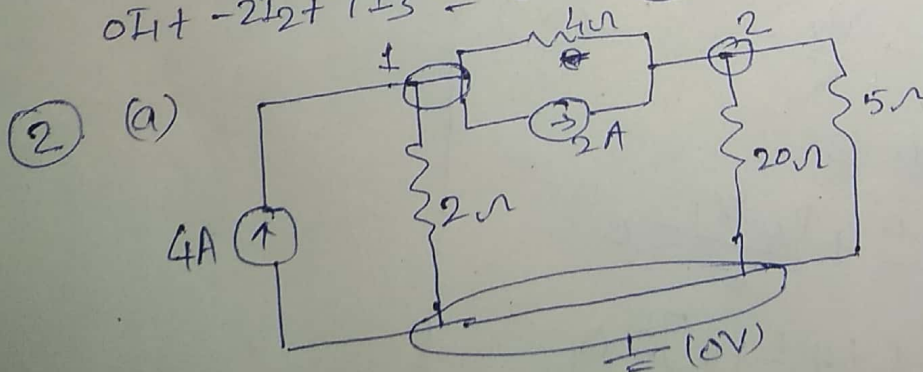
$$I_1 = 3 \text{ A}$$

$$I_2 = 0.667 \text{ A}$$

$$I_3 = 1.333 \text{ A}$$

$$I_{5\Omega} = I_3 = 1.333 \text{ A}$$

Ans



KCL at (1')

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

$$V_1 \left[ \frac{1}{2} + \frac{1}{4} \right] - \frac{V_2}{4} = 4 - 2$$

$$\frac{3}{4}V_1 - \frac{V_2}{4} = 2 \quad \text{--- (1)}$$

KCL at (2')

$$\frac{V_2}{20} + \frac{V_2}{5} + \frac{V_2 - V_1}{4} = 2$$

$$-\frac{V_1}{4} + \left( \frac{1}{20} + \frac{1}{5} + \frac{1}{4} \right) V_2 = 2$$

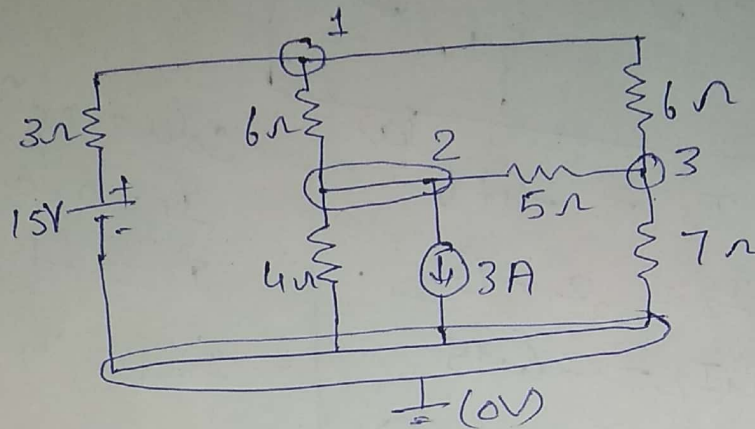
$$-\frac{V_1}{4} + \frac{10}{20} V_2 = 2 \quad \text{--- (2)}$$

Solve eq<sup>n</sup> ① and ②

$$V_1 = 4.8V, V_2 = 6.4V$$

$$I_{4\Omega} = \frac{V_2 - V_1}{4} = 0.4A \quad \underline{\text{Ans}}$$

② → ⑥



KCL at '1'

$$\frac{V_1 - 15}{3} + \frac{V_1 - V_2}{6} + \frac{V_1 - V_3}{6} = 0$$

$$V_1 \left[ \frac{1}{3} + \frac{1}{6} + \frac{1}{6} \right] - \frac{V_2}{6} - \frac{V_3}{6} = 5$$

$$\frac{2}{3}V_1 - \frac{V_2}{6} - \frac{V_3}{6} = 5 \quad \text{--- ①}$$

KCL at node '2'

$$\frac{V_2 - V_1}{6} + \frac{V_2 - 0}{4} + 3 + \frac{V_2 - V_3}{5} = 0$$

$$-\frac{V_1}{6} + V_2 \left[ \frac{1}{6} + \frac{1}{4} + \frac{1}{5} \right] - \frac{V_3}{5} = -3$$

$$-\frac{V_1}{6} + \frac{37}{60}V_2 - \frac{V_3}{5} = -3 \quad \text{--- ②}$$

KCL at node (3)

$$\frac{V_3 - V_2}{5} + \frac{V_3 - 0}{7} + \frac{V_3 - V_1}{6} = 0$$

$$-\frac{V_1}{6} - \frac{V_2}{5} + V_3 \left[ \frac{1}{5} + \frac{1}{7} + \frac{1}{6} \right] = 0$$

$$-\frac{V_1}{6} - \frac{V_2}{5} + V_3 \frac{107}{210} = 0 \quad \text{--- ③}$$

Solve eq<sup>n</sup> ①, ② and ③

$$V_1 = 7.24V$$

$$V_2 = -2.453V$$

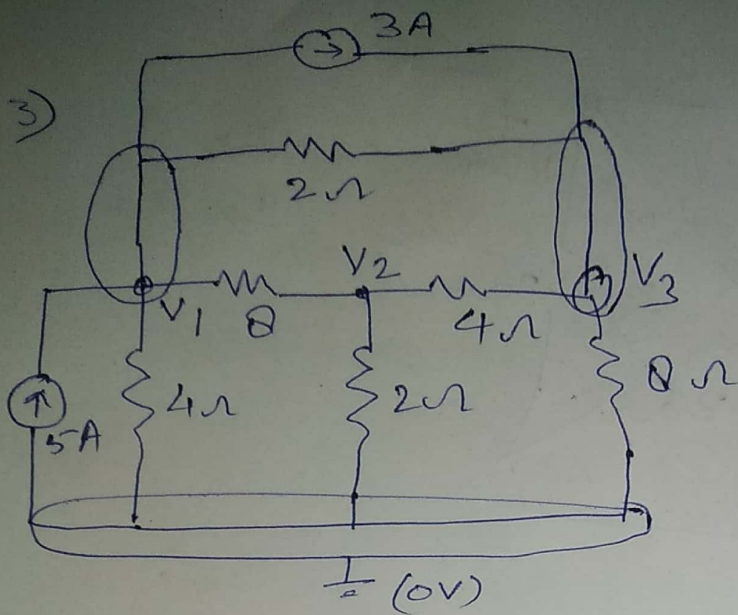
$$V_3 = 1.4V$$

$$I_4 = \frac{V_2}{4} = 0.61A$$

Bottom to top

Ans





KCL at node (1)

$$\frac{V_1}{4} + \frac{V_1 - V_2}{8} + \frac{V_1 - V_3}{2} + 3 = 5$$

$$V_1 \left[ \frac{1}{4} + \frac{1}{8} + \frac{1}{2} \right] - \frac{V_2}{8} - \frac{V_3}{2} = 2$$

$$\frac{7V_1}{8} - \frac{V_2}{8} - \frac{V_3}{2} = 2 \quad \text{--- (1)}$$

KCL at node (2)

$$\frac{V_2 - V_1}{8} + \frac{V_2 - 0}{2} + \frac{V_2 - V_3}{4} = 0$$

$$-\frac{V_1}{8} + V_2 \left[ \frac{1}{8} + \frac{1}{2} + \frac{1}{4} \right] - \frac{V_3}{4} = 0$$

$$-\frac{V_1}{8} + \frac{7V_2}{8} - \frac{V_3}{4} = 0 \quad \text{--- (2)}$$

KCL at node (3)

$$\frac{V_3 - 12}{8} + \frac{V_3 - V_2}{4} + \frac{V_3 - V_1}{2} = 3$$

$$-\frac{V_1}{2} - \frac{V_2}{4} + V_3 \left[ \frac{1}{8} + \frac{1}{4} + \frac{1}{2} \right] = 3 + 1.5$$

$$-\frac{V_1}{2} - \frac{V_2}{4} + \frac{7V_3}{8} = 4.5 \quad \text{--- (3)}$$

Solve eq<sup>n</sup> (1) (2) and (3)

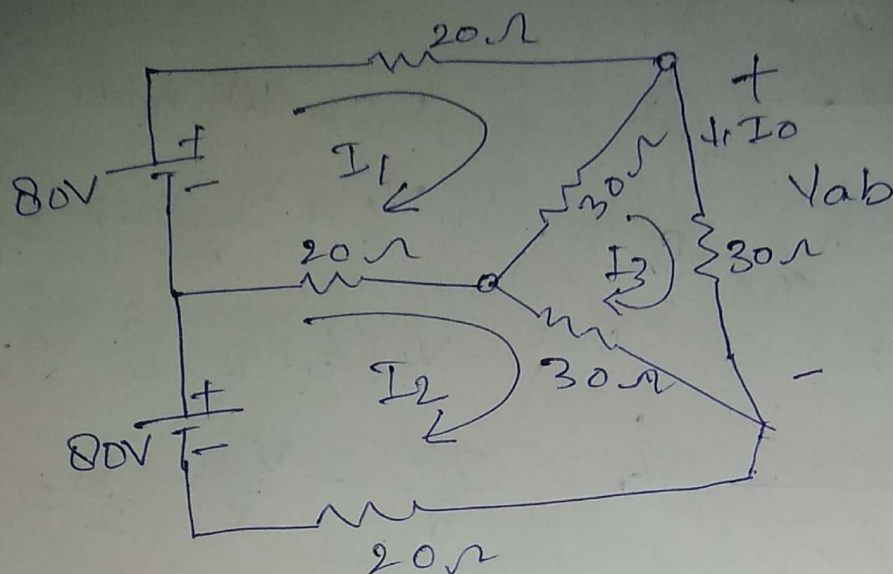
$$V_1 = 10V$$

$$V_2 = 4.933V$$

$$V_3 = 12.267V$$

Ans

4)



$V_{ab} ?$   
 $I_0 ?$

KVL in mesh ①

$$-70I_1 - 20I_2 - 30I_3 = 80 \quad \text{--- ①}$$

KVL in mesh ②

$$-20I_1 + 70I_2 - 30I_3 = 80 \quad \text{--- ②}$$

KVL in mesh ③

$$-30I_1 - 30I_2 + 90I_3 = 0 \quad \text{--- ③}$$

Solve eq<sup>n</sup> ①, ② and ③

$$I_1 = 2.667 \text{ A}$$

$$I_2 = 2.667 \text{ A}$$

$$I_3 = 1.7778 \text{ A}$$

$$I_0 = I_3 = 1.7778 \text{ A} \quad \underline{\text{Ans}}$$

$$V_0 = 30I_0 = 53.33 \text{ V} \quad \underline{\text{Ans}}$$