D: 14/11/20

North East University Bangladesh

Department of CSE

Assignment - 1

Program : B. Sc. (Engg.) in CSE

Course : CSE 121 (Basic Electrical Engineering)

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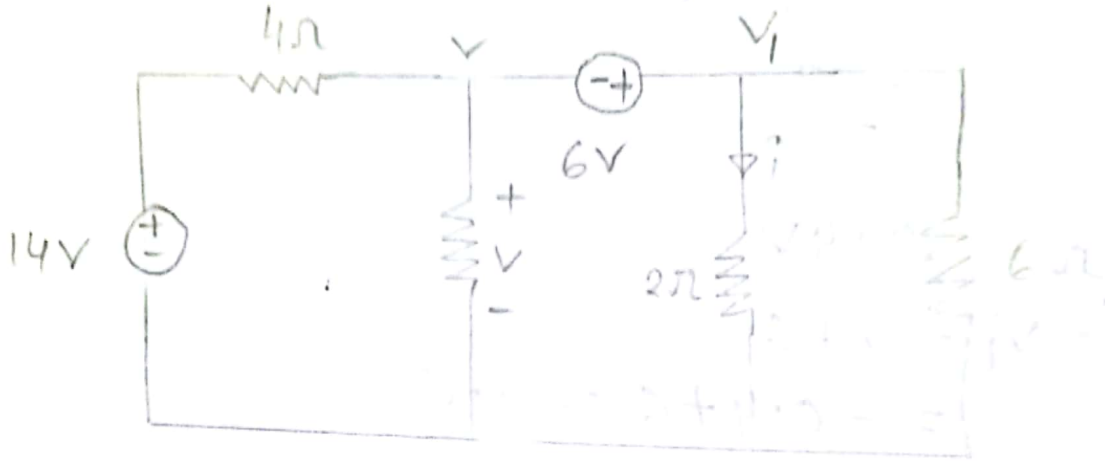
Answer to the question no: 01



Solution: Supernode, apply KCL

$$\frac{14-V}{4} = \frac{V}{3} + \frac{V_1}{2} + \frac{V_1}{6}$$

$$\Rightarrow \frac{14-V}{4} = \frac{2V+3V_1+V_1}{6}$$

$$\Rightarrow 84-6V = (2V+4V_1)4$$

$$\Rightarrow 84-6V = 8V+16V_1$$

$$\Rightarrow 84 = 14V+16V_1 \quad \text{——(i)}$$

Apply KVL →

$$-V-6+V_1 = 0$$

$$\Rightarrow V_1 = V+6 \quad \text{— (2)}$$

(1) no →

$$84 = 14V+16\times(V+6)$$

$$= 14V+16V+96$$

$$= 30V+96$$

p.T.O

$\Rightarrow 84 - 96 = 30V$

$\Rightarrow -12 = 30V$

$V = \frac{-12}{30}$

$= -0.4V$

$\therefore V_1 = V + 6$

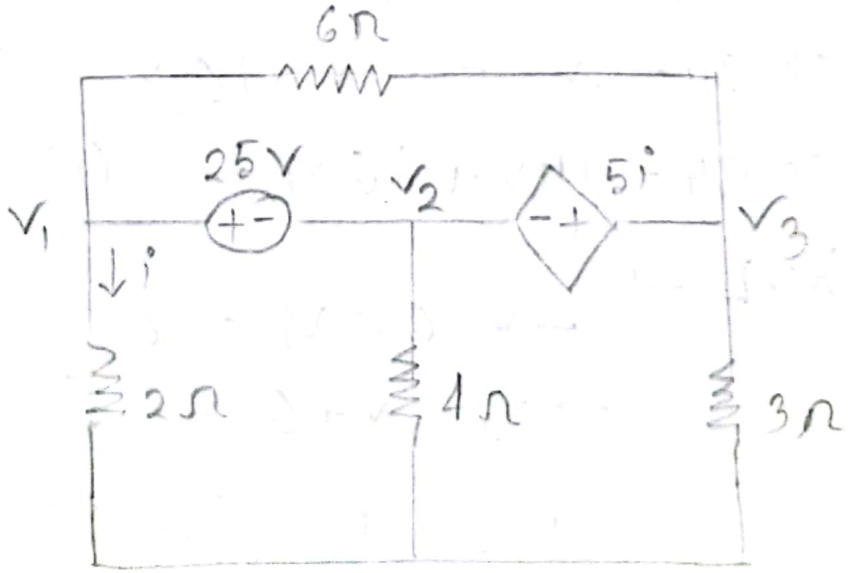
$= -0.4 + 6 = 5.6$

$\therefore i = \frac{V_1}{2} = \frac{5.6}{2} = 2.8A$

Ans: $V = -0.4V$, $V_1 = 5.6V$

or $i = 2.8A$

Answer to the question no: 2



Solution: Apply KCL in both supernode

$$\frac{V_1}{2} + \frac{V_1 - V_3}{6} + \frac{V_2}{4} + \frac{V_3 - V_1}{6} + \frac{V_3}{3} = 0$$

$$\Rightarrow \frac{V_1}{2} + \frac{V_1}{6} - \frac{V_3}{6} + \frac{V_2}{4} + \frac{V_3}{6} - \frac{V_1}{6} + \frac{V_3}{3} = 0$$

$$\Rightarrow \frac{V_1}{2} + \frac{V_2}{4} + \frac{V_3}{3} = 0$$

$$\Rightarrow \frac{6V_1 + 3V_2 + 4V_3}{12} = 0$$

$$\Rightarrow 6V_1 + 3V_2 + 4V_3 = 0 \quad \text{——— (1)}$$

Apply KVL →

$$-V_1 + 25 - V_2 = 0$$

$$\Rightarrow V_1 + V_2 = 25 \quad \text{——— (2)}$$

$$-V_2 - 5i + V_3 = 0$$

$$\Rightarrow -V_2 + V_3 = 5i$$

$$\Rightarrow -V_2 + V_3 = 5 \times \frac{V_1}{2} \quad \left[i = \frac{V_1}{2}\right]$$

$$\Rightarrow 2V_3 - 2V_2 = 5V_1$$

$$\Rightarrow 5V_1 - 2V_2 + 2V_3 = 0 \quad \text{——— (3)}$$

Using Cramer's rule,

$$\begin{bmatrix} 6 & 3 & 4 \\ 1 & 1 & 0 \\ 5 & -2 & 2 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 25 \\ 0 \end{bmatrix}$$

$V_1 = 15.909V$

$V_2 = 9.09V$

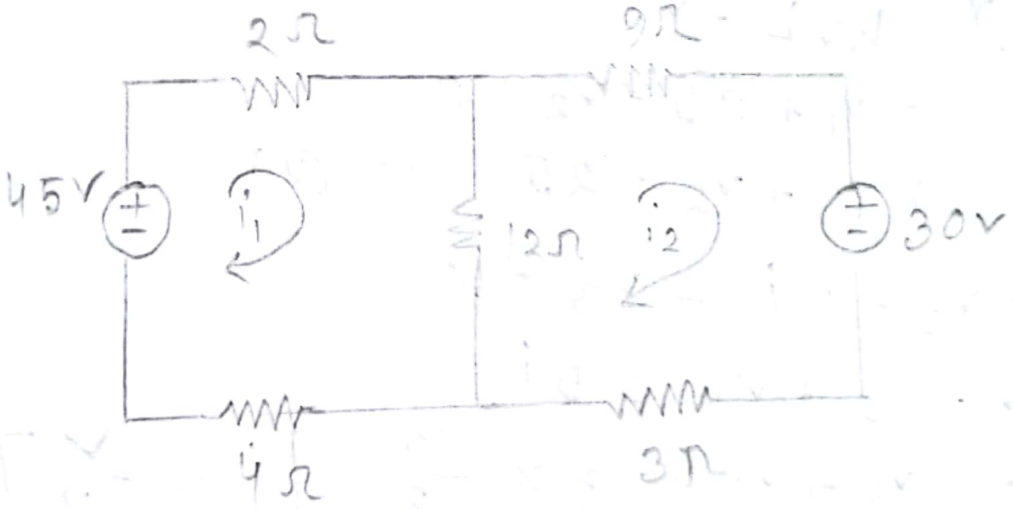
$V_3 = -30.68V$

Ans: $V_1 = 15.909V$

$V_2 = 9.09V$

$V_3 = -30.68V$

Ans. to the Q.NO :03



Solution; Apply KVL to Mesh-1:

$-45 + 18i_1 - 12i_2 = 0$

$\Rightarrow -15 + 6i_1 - 4i_2 = 0$

$\Rightarrow 6i_1 - 4i_2 = 15$ ——(i)

in Mesh-2: $30 + 24i_2 - 12i_1 = 0$

$\Rightarrow -2i_1 + 4i_2 = -5 \quad -(2)$

(1)+(2) →

$6i_1 - 2i_1 = 10$

$\Rightarrow 4i_1 = 10$

$\Rightarrow i_1 = \frac{10}{4} = \frac{5}{2} = 2.54$

$= 2500\,mA$

$\therefore i_1 = 2500\,mA$

$6i_1 - 4i_2 = 15$

$\Rightarrow 6 \times (2.5) - 4i_2 = 15$

$\Rightarrow -4i_2 + 15 = 15$

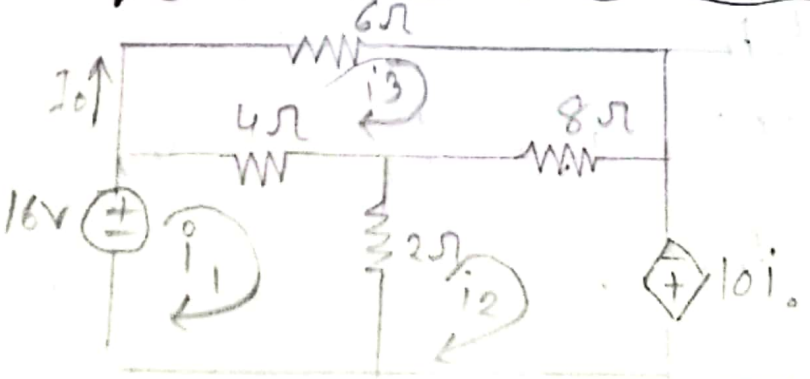
$\Rightarrow -4i_2 = 0$

$\therefore i_2 = 0$

Ans: $i_1 = 2500\,mA$

$i_2 = 0A$

Ans. to the Q. NO : 04



Solution: Apply KVL to mesh-1:

$$-16 + 6i_1 - 2i_2 - 4i_3 = 0$$

$$\Rightarrow 3i_1 - i_2 - 2i_3 = 8 \quad \text{---(1)}$$

Mesh-2: $-10i_o - 2i_1 + 10i_2 - 8i_3 = 0$

$$\Rightarrow -2i_1 + 10i_2 - 18i_3 = 0 \quad [i_o = i_3]$$

$$\Rightarrow -i_1 + 5i_2 - 9i_3 = 0 \quad \text{---(2)}$$

Mesh-3: $18i_3 - 4i_1 - 8i_2 = 0 \quad \text{---(3)}$

Using Cramer's rule:

$$\begin{bmatrix} 3 & -1 & -2 \\ -1 & 5 & -9 \\ -2 & -4 & 9 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 8 \\ 0 \\ 0 \end{bmatrix}$$

$\therefore i_1 = -\frac{18}{7} = -2.57A$

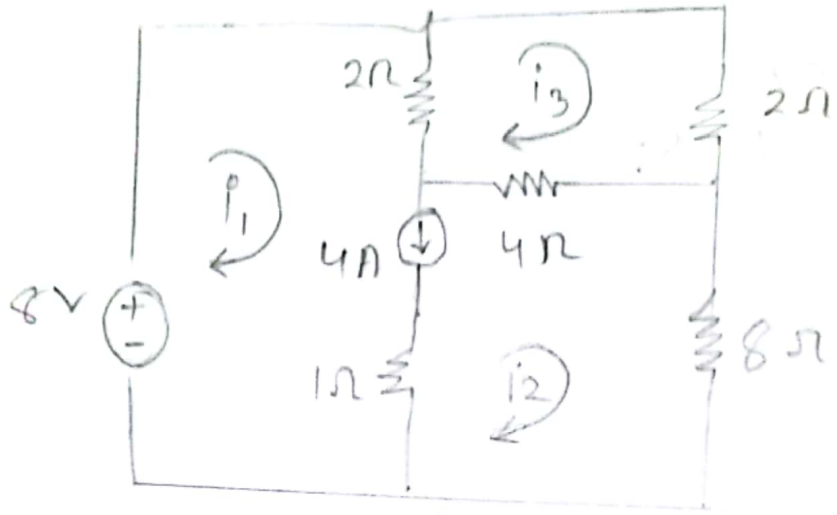
$\therefore i_2 = -\frac{54}{7} = -7.41A$

$\therefore i_3 = -4A$

we know, $i_o = i_3 = -4A$

Ans: $i_o = -4A$

Ans. to the Q.NO :05



Solution: Apply KVL to mesh-1:

$$-8 + 2i_1 - 2i_3 + 4 = 0$$

$$\Rightarrow 2i_1 - 2i_3 = 4$$

$$\Rightarrow i_1 - i_3 = 2 \quad \text{---(1)}$$

Mesh-2: $8i_3 - 4i_2 - 4 = 0$

$$\Rightarrow -i_2 + 2i_3 = 1 \quad \text{---(2)}$$

Mesh-3: $-2i_1 - 4i_2 + 8i_3 = 0$

$$\Rightarrow -i_1 - 2i_2 + 4i_3 = 0 \quad \text{---(3)}$$

using Cramer's rule:

$$\begin{bmatrix} 1 & 0 & -1 \\ 0 & -1 & +2 \\ -1 & -2 & +4 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$$

$\therefore i_1 = 2A$

$\therefore i_2 = -1A$

$\therefore i_3 = 0A$

Ans: