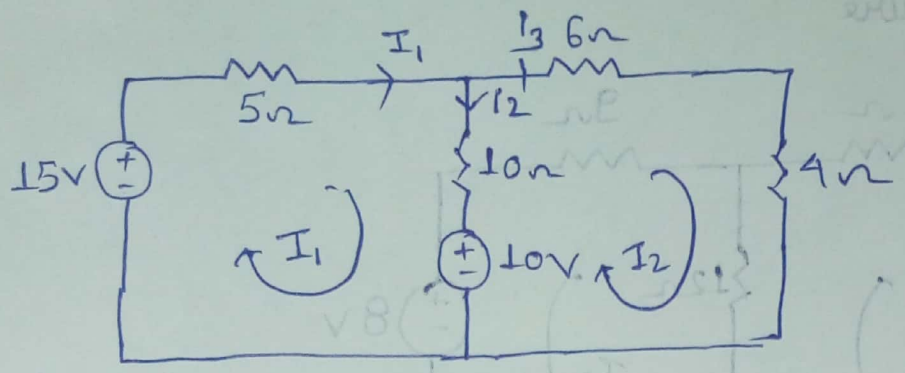
Lec. 05

15/2/2021

(Q)



Find the branch Current using mesh analysis

Apply KVL to mesh-1

$$5i_1 + 10(i_1 - i_2) = -10 + 15$$

$$5i_1 + 10i_1 - 10i_2 = 5$$

$$15i_1 - 10i_2 = 5$$

$$3i_1 - 2i_2 = 1 \quad -(1)$$

Apply KVL to mesh-2.

$$6i_2 + 4i_2 + 10(i_2 - i_1) = 10$$

$$10i_2 + 10i_2 - 10i_1 = 10$$

$$-10i_1 + 20i_2 = 10$$

$$-i_1 + 2i_2 = 1 \quad -(2)$$

$I_1 = 1A, \quad I_2 = 1A$

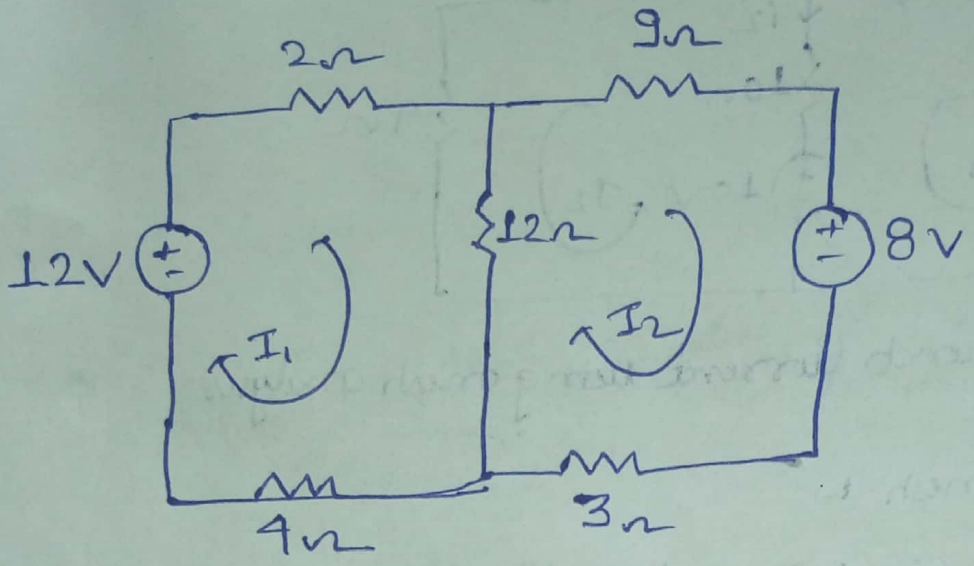
$i_1 = i_2 + i_3$

$I_1 = i_1 \Rightarrow 1A$

$i_2 = 0,$

$I_2 = i_3 \Rightarrow 1A$

(Q) Calculate the mesh current I_1 and I_2 in the ckt shown in figure



Sol. Applying KVL to mesh-1

$$2i_1 + 12(i_1 - i_2) + 4i_1 = 12$$

$$2i_1 + 12i_1 - 12i_2 + 4i_1 = 12$$

$$18i_1 - 12i_2 = 12$$

$$3i_1 - 2i_2 = 2 \quad -(1)$$

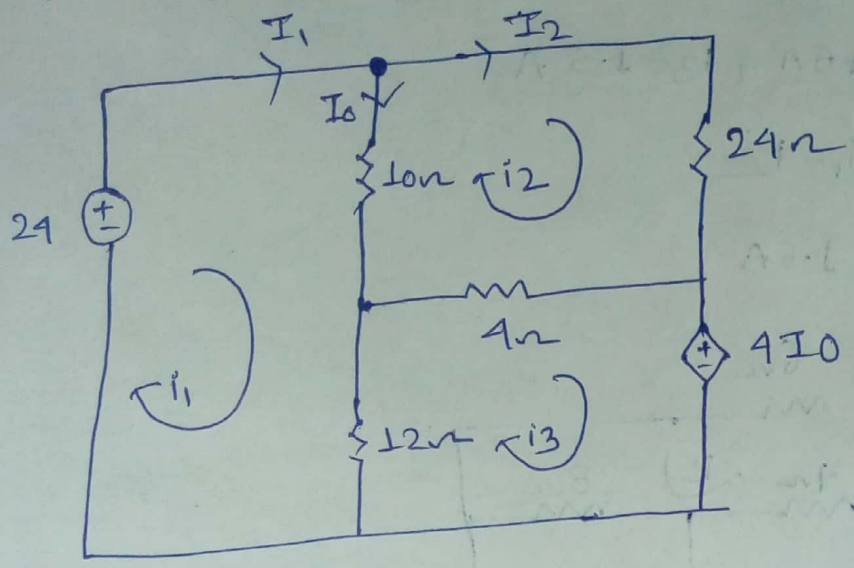
Applying KVL to mesh-2

$$9i_2 + 8 + 3i_2 + 12(i_2 - i_1) = 0$$

$$-12i_1 + 24i_2 = -8 \quad -(2)$$

$$i_1 = \frac{2}{3}, \quad i_2 = 0\,A$$

(Q)



Find I_o in the ckt.

Sol. Apply KVL to mesh i

$$10(i_1 - i_2) + 12(i_1 - i_3) = 24$$

$$10i_1 - 10i_2 + 12i_1 - 12i_3 = 24$$

$$22i_1 - 10i_2 - 12i_3 = 24$$

$$11i_1 - 5i_2 - 6i_3 = 12 \quad -(1)$$

Apply KVL to mesh-2

$$24i_2 + 4(i_2 - i_3) + 10(i_2 - i_1) = 0$$

$$24i_2 + 4i_2 - 4i_3 + 10i_2 - 10i_1 = 0$$

$$-10i_1 + 38i_2 - 4i_3 = 0$$

$$-5i_1 + 19i_2 - 2i_3 = 0$$

or

$$5i_1 - 19i_2 + 2i_3 = 0 \quad -(2)$$

Apply KVL to mesh-3.

$$4(i_3 - i_2) + 4I_o + 12(i_3 - i_1) = 0$$

$$I_o = i_1 - i_2$$

$$4i_3 - 4i_2 + 4(i_1 - i_2) + 12i_3 - 12i_1 = 0$$

$$-8i_1 - 8i_2 + 16i_3 = 0$$

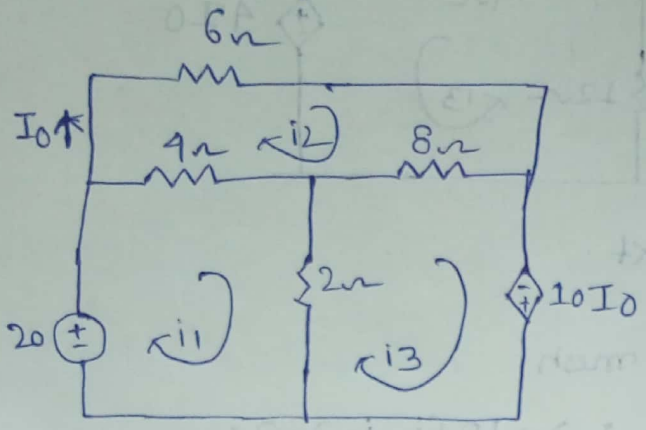
$i_1 = 2.25\,A$

$I_2 = 0.75\,A$, $I_3 = 1.5\,A$

$I_0 = i_1 - I_2$

$I_0 = 1.5\,A$

(Q)



Apply KVL to mesh-1,

$4(i_1 - i_2) + 2(i_1 - I_3) = 20$

$3i_1 - 2i_2 - I_3 = 10$ - (1)

Apply KVL to M-2

$6I_2 + 8(i_2 - i_3) + 4(i_2 - i_1) = 0$

$6i_2 + 8I_2 - 8I_3 + 4i_2 - 4i_1 = 0$

$-2i_1 + 9I_2 - 4i_3 = 0$ - (2)

(M-3)

$8(i_3 - i_2) - 10\,I_0 + 2(i_3 - i_1) = 0$

$I_0 = I_2$

$8i_3 - 8i_2 - 10i_2 + 2i_3 - 2i_1 = 0$

$-2i_1 - 18i_2 + 10i_3 = 0$

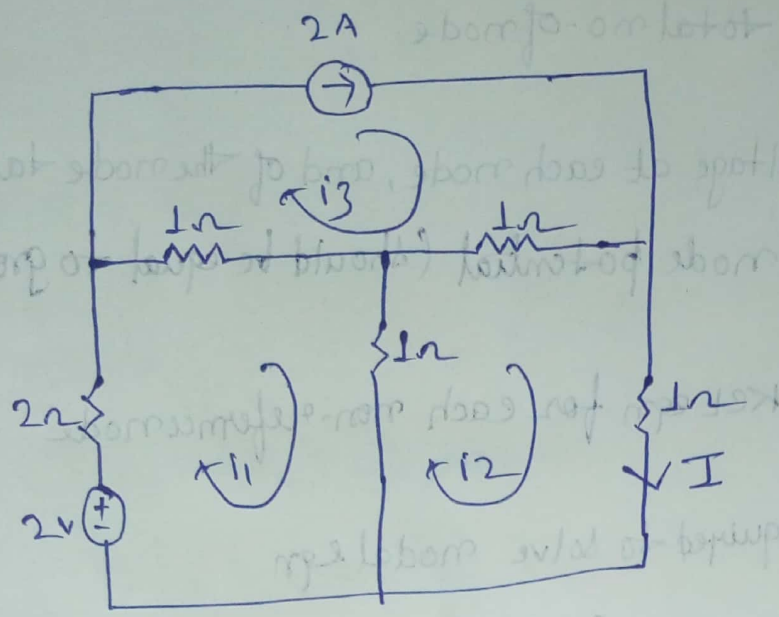
$-i_1 - 9i_2 + 5i_3 = 0$

$i_1 = -3.21\,A$ $\qquad I_0 = I_2$

$i_2 = -5$ $\qquad I_0 = -5$

$i_3 = -9.6$

(Q) Find the Value of I in n/w.



Apply KVL in Mesh 1

$$-2+2i_1+(I_1-I_3)+(I_1-I_2)=0.$$

$$4i_1-I_2-I_3=2 \quad -①$$

Apply KVL in mesh ②

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

$$-I_1+3I_2-I_3=0 \quad -②$$

$$I_3=2 \quad -③$$

Put eqn ③ in eqn ① & eqn ②

$$4I_1-I_2=4 \quad -④$$

$$-I_1+3I_2=2 \quad -⑤$$

$$I_2=\frac{12}{11}$$

$$I_2\ I_2=\frac{12}{11}A$$

Nodal analysis → Procedure → Planar and non-planar nlw

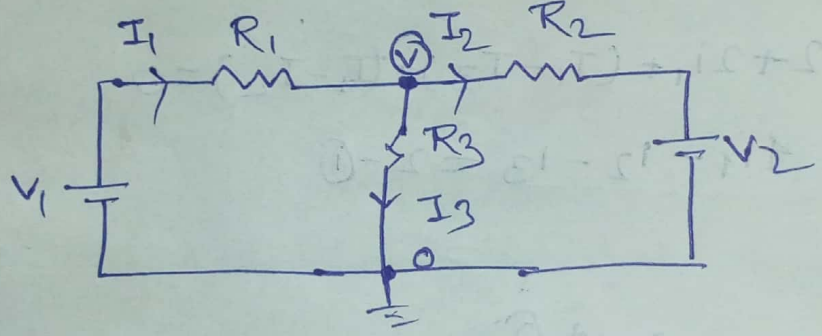
(i) Identify total no-of node

(ii) Assign, Voltage at each node, and of the node taken as reference node potential (should be equal to ground potential)

(iii) Develop KCL eqn for each non-reference node

(iv) eqn, required to solve nodal eqn

$e_2 N-1$



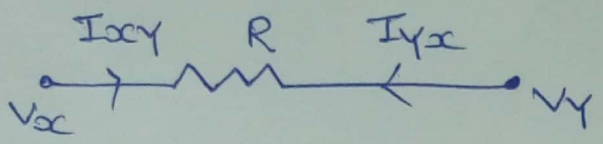
Apply KCL

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

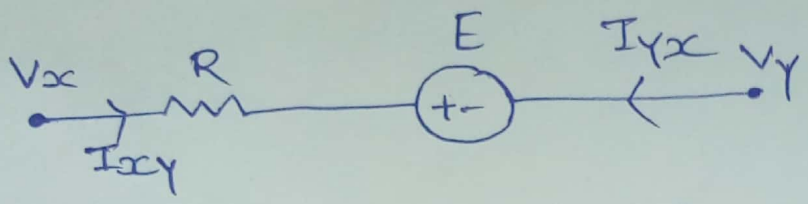
$$\frac{V-V_1}{R_1} + \frac{V}{R_3} + \frac{V-V_2}{R_2} = 0$$

$$I_2 = \frac{V_1 - V}{R_1}, \quad I_2 = \frac{V-V_2}{R_2}$$

$$I_3 = \frac{V}{R_3}$$



$$I_{xy} = \frac{V_x - V_y}{R}, \quad I_{yx} = \frac{V_y - V_x}{R}$$



$$-V_x + I_x R + E + V_y = 0$$

$$I_{xy} = \frac{(V_x - V_y) - E}{R}$$

$$I_{yx} = \frac{V_y - V_x + E}{R}$$