NOTES – CLASS 11

Mesh Analysis in the networks with current sources:
We cannot write a KVL in the mesh containing current sources since voltage across an ideal current source is unknown. Hence, there is a slight change in step 3 of the Mesh Analysis in the networks with current sources.
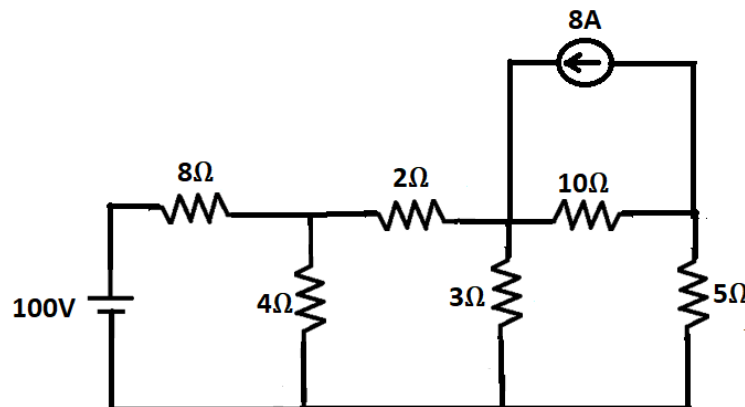**Steps to apply Mesh Analysis in the networks with current sources:**
Step 1: Identify the number of meshes in the network.
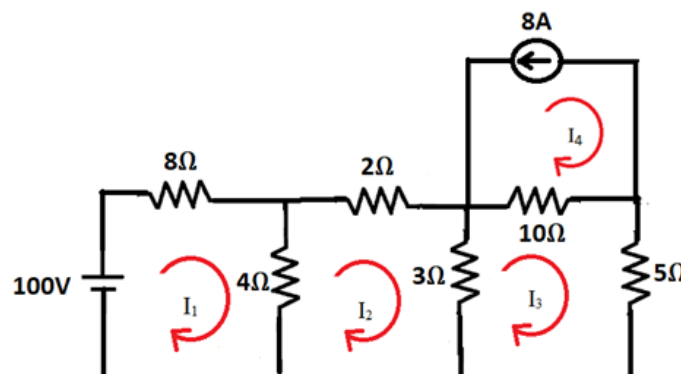Step 2: Assign one mesh current in each mesh preferably in the same   direction.
Step 3: Write KVL in the meshes without current sources. Write Current   Equation in the Meshes with current sources.
Step 4: Solve simultaneous equations to obtain Mesh currents.
Numerical Example 1: Obtain current through 4Ω resistor using Mesh Analysis.

Solution: Number of Meshes = 4

Meshes 1 , 2 & 3 do not have current sources. Hence, write KVLs in these meshes.

KVL (Mesh 1) : $12I_1-4I_2-0I_3-0I_4 = 100$ ---- (1)
KVL (Mesh 2) : $-4I_1+9I_2-3I_3-0I_4 = 0$ ---- (2)
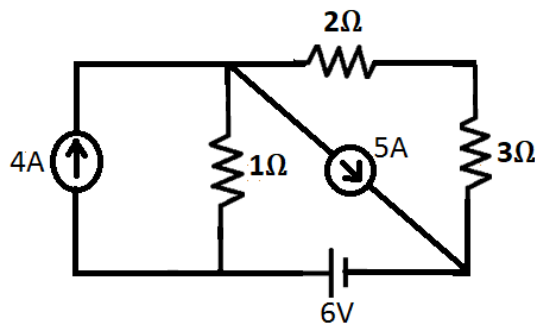KVL (Mesh 3) : $0I_1-3I_2+18I_3-10I_4 = 0$ ---- (3)

Since Mesh 4 has a current source, we can not write KVL in that mesh. Instead write current equation in that mesh.

Current Equation (Mesh 4) : $I_4 = -8$ ---- (4) (Negative because current   source direction is opposite to mesh current direction.)

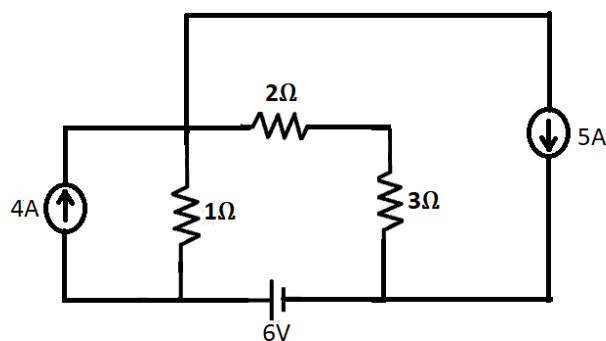Solving (1), (2), (3) & (4), $I_1 = 9.26A$; $I_2 = 2.79A$; $I_3 = -3.97A$

Current through 4Ω resistor = $(I_1\sim I_2) = (I_1-I_2) = 6.47A$

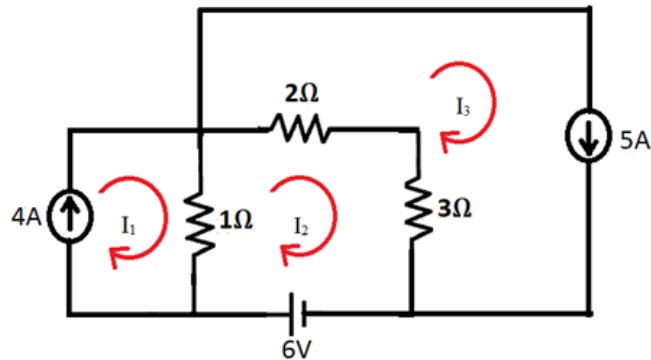**Numerical Example 2: Obtain voltage across 3Ω resistor using Mesh Analysis.**

Solution:

In this network, 5A current source is common to two meshes. Rearrange the network such that this common current source is confined to only one mesh before applying Mesh Analysis in such networks.

Now, after rearranging the network, 5A current source is confined to only one mesh.

Current Equation (Mesh 1) : $I_1 = 4$ ---- (1)
KVL (Mesh 2) : $-I_1 + 6I_2 - 5I_3 - = 6$ ---- (2)
Current Equation (Mesh 3) : $I_3 = 5$ ---- (3)
Solving (1), (2) & (3), $I_2 = 5.83A$
Current through 3Ω resistor = $(I_2 \sim I_3) = (I_2 - I_3) = 0.83A$
Voltage across 3Ω resistor = 2.49V