Paper 1, TDC Part-1
Chapter– 3, Mesh and Node Analysis

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Mesh and Nodal Analysis in Passive Circuits

Problems on Mesh Analysis with current source and super mesh.

In the earlier classes we have looked few examples of Mesh analysis with voltage sources only.

In today's lecture we will discuss the problem of circuit theory base on mesh analysis with current sources or sources

analyze

To ~~solve~~ the circuit with current source using mesh analysis, there are two possible methods. First, we could assign an unknown voltage across the current source, then applying KVL around each

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methods. First, ~~[illegible]~~ unknown voltage across the current source, then applying KVL around each mesh as before and then ~~redraw~~ writing down the KVL eqn. for each of the meshes. This is generally more difficult approach.

A better approach is to create a kind of "supermesh" from the two meshes that have a current source as a common element; the current source is in the interior of the supermesh. We thus reduce the number of meshes by 1 for each current source present. If the current source lies on the perimeter of the circuit, then the single mesh in which

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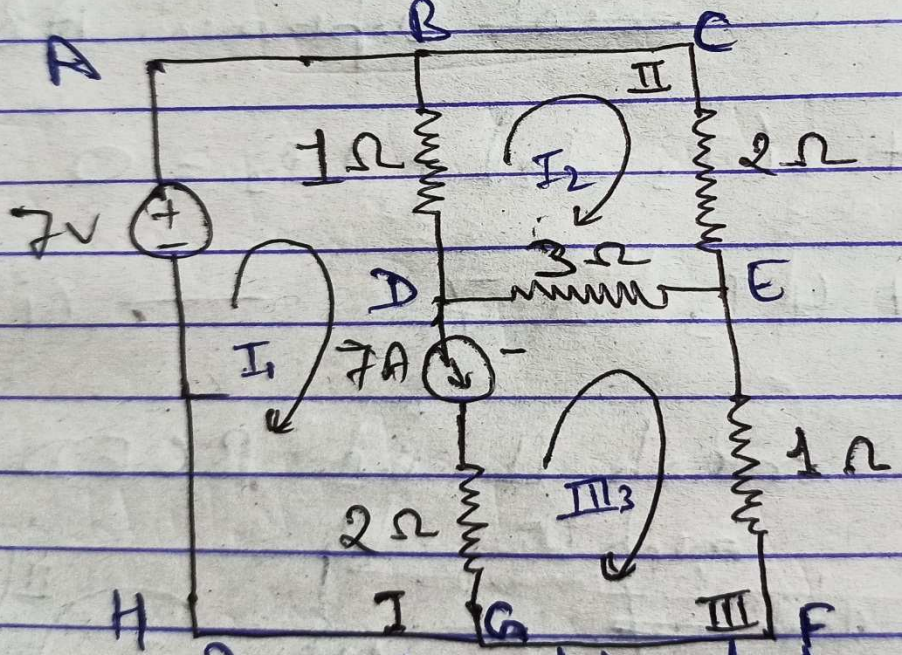
it is found is ignored. KVL is then applied only to those meshes or supermeshes in the reinterpreted network.

Ex.→ 1) Determine the three mesh currents in below ckt. shown



Since 7A isolated source is there

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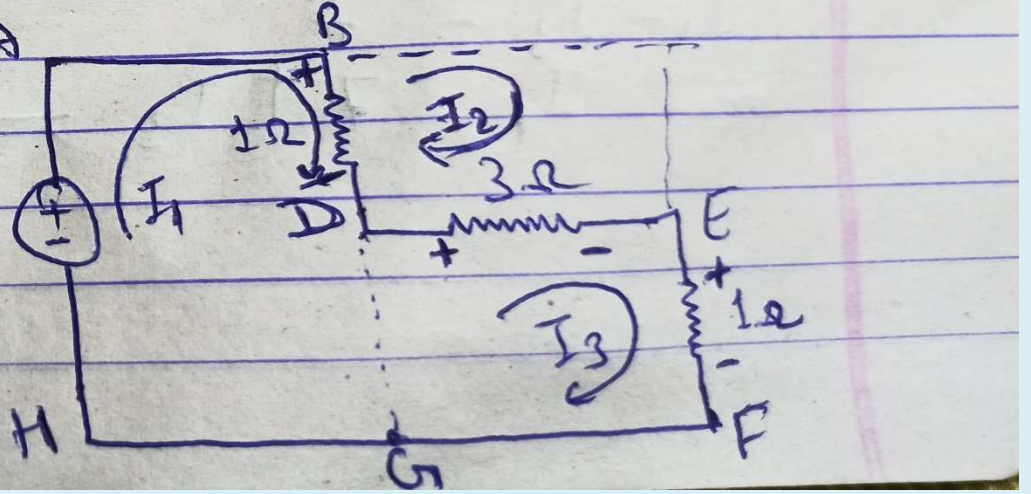
H — I — G — III — F

Since 7A independent source is there,

Sol:- Note → If we solve this problem by directly applying KVL in each of the 3 meshes I, II & III as shown above then it becomes difficult approach due to current source.

So we solve the ~~ab~~ above problem by taking supermesh whose interior is that of meshes I and III as ~~shown~~ named as A B D E F G H A

As shown below,



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Current through 1Ω resistor of branch BD is $(I_1 - I_2)$. Similarly current through 3Ω resistor of branch DE is $(I_3 - I_2)$ and current through 1Ω resistor of branch EF is I_3.

Applying KVL in supermesh ABDEFGHA

$$-7 + 1(I_1 - I_2) + 3(I_3 - I_2) + 1 I_3 = 0$$

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

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Applying KVL in mesh II i.e. BCEDB

Applying KVL in ~~this loop~~ mesh II

$-2I_2 + 3(I_2 - I_3) + 1(I_2 - I_1) = 0$

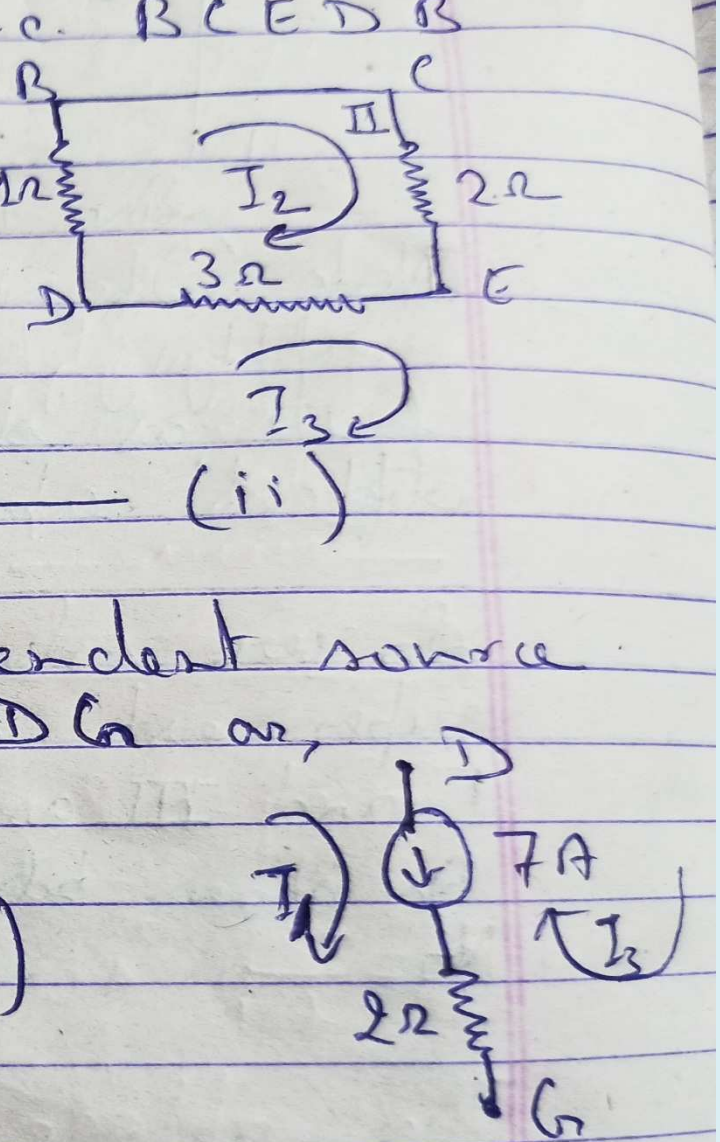
$-I_1 + 6I_2 - 3I_3 = 0$

or $I_1 - 6I_2 + 3I_3 = 0$ —— (ii)

As we can relate the independent source current of 7A of branch DG as,

$I_1 - I_3 = 7$

or $I_1 = 7 + I_3$ —— (iii)



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From eqn. (iii) putting value of I_1 in eqn. (i) & (ii)

$$7 + I_3 - 4I_2 + 4I_3 = 7 \quad \text{——(i)}$$

$$-4I_2 + 5I_3 = 0 \quad \text{——(iv)}$$

and eqn. (iii) can be written as,

$$7 + I_3 - 6I_2 + 3I_3 = 0 \quad \text{——(ii)}$$

$$-6I_2 + 4I_3 = -7 \quad \text{——(v)}$$

Now 3 × eqn (iv) — 2 × eqn. (v) results as,

$$-12I_2 + 15I_3 = 0$$

$$-12I_2 + 8I_3 = -14$$

$$7I_3 = 14 \Rightarrow I_3 = 2\ A$$

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$7I_3 = 14 \Rightarrow I_3 = 2\ A$

$I_1 = 7 + I_3 = (7+2)\ A$

$= 9\ A$

and $-4I_2 + 5 \times 2 = 0$

$4I_2 = 10 \Rightarrow I_2 = 2.5\ A$

The three mesh current are,

$I_1 = 9A$, $I_2 = 2.5A$, & $I_3 = 9A$.

Hence using supermesh method we solve the problem easily. But it was difficult to solve the

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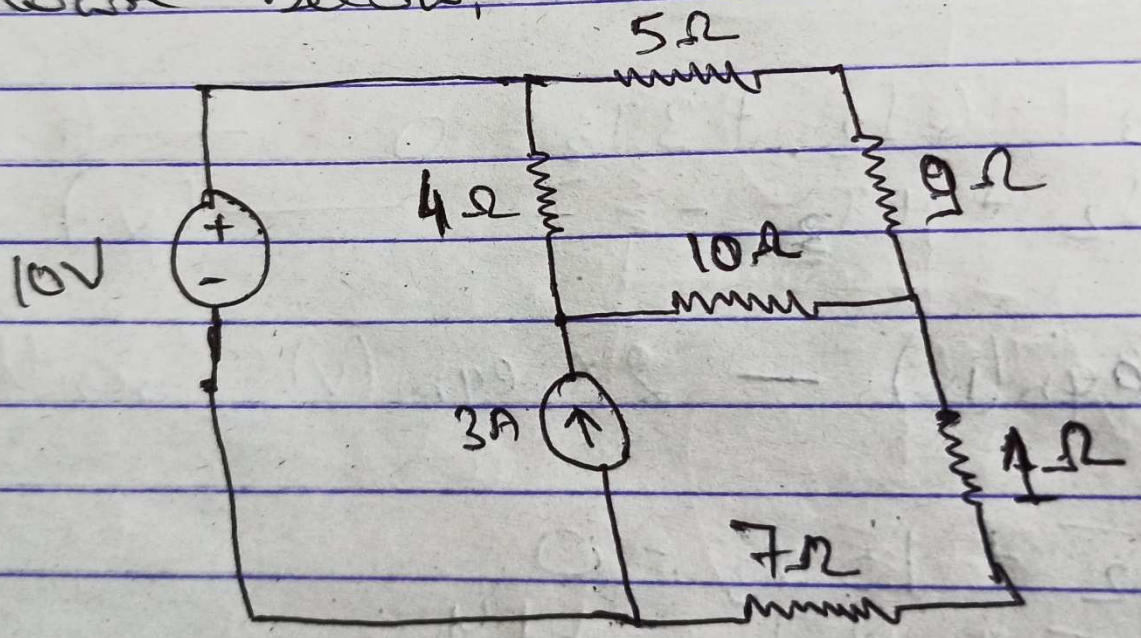
problem is we apply the ~~mesh~~ KVL to all the 3 loops I, II & III.

Question for practice.

Q Determine the current i_1 in the circuit shown below.



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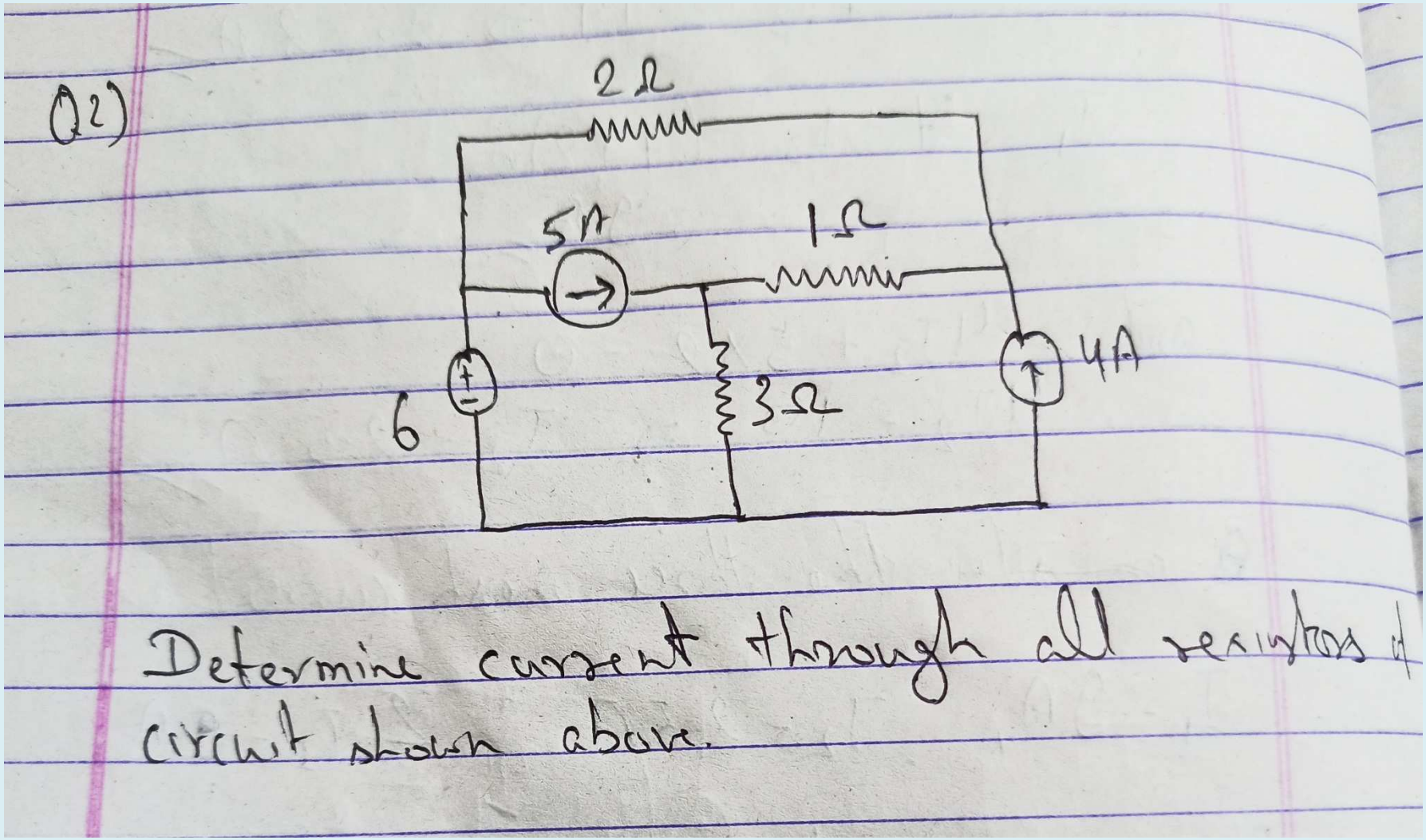

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For any query contact- 9771474020

Thank You