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I'D : 6966

Program : B.Tech Elect

Subject/paper : Network Analysis 01

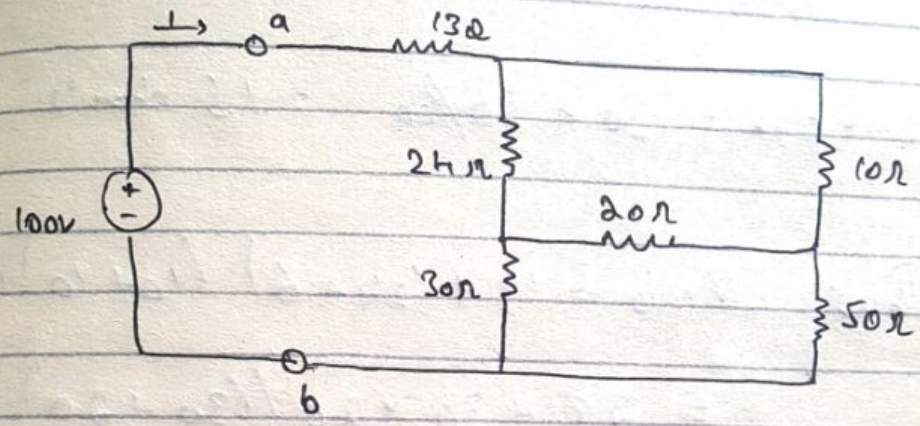
Submitted to Eng. Aamir Aman

6966

Question 01 Part (A).

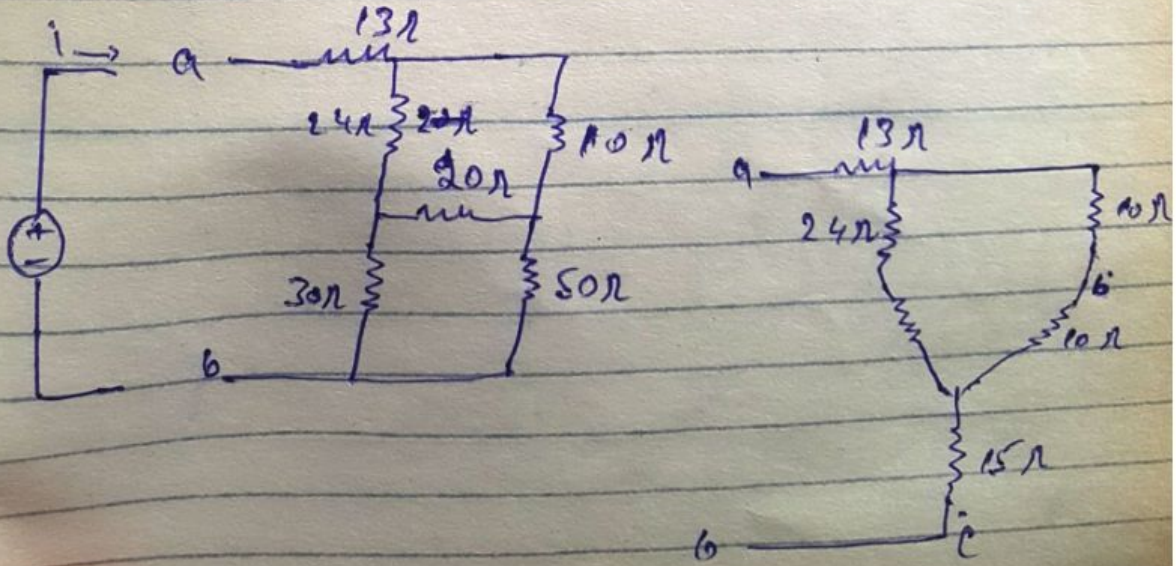
Q1/ For the bridge Network in the figure below.

a) Find R_{ab} and I.



Solution:

First find the equivalent resistance, R. we convert the delta Sub-networking to a wye connected from.



I'D = 6966

* $R_{ain} = 20 \times 30 / [20 + 30 + 50]$

$= 6$ ohms

* $R_{bin} = 20 \times 50 / 100 = 10$ ohms

$R_{cin} = 30 \times 50 / 100 = 15$ ohms

Thus $R_{ab} = 13 + (24 + 6) \| (10 + 10) + 15$

$= 28 + 30 \times 20 / (30 + 20)$

$= 40$ ohms

$I = 100 / R_{ab} = 100 / 40 = \underline{2.5 \text{ amp.}}$

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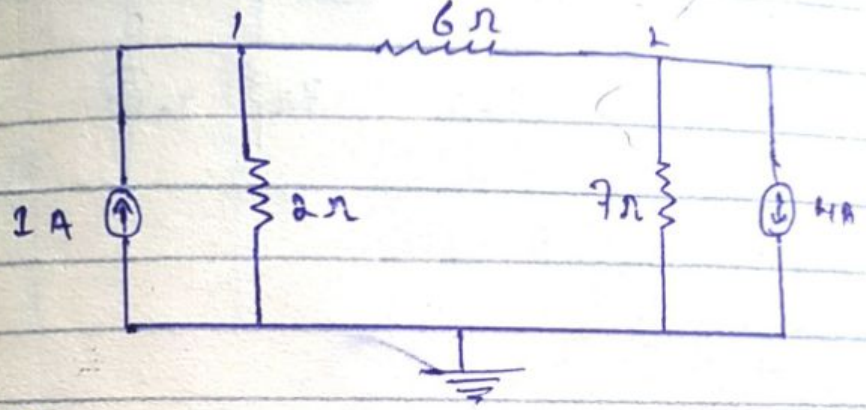
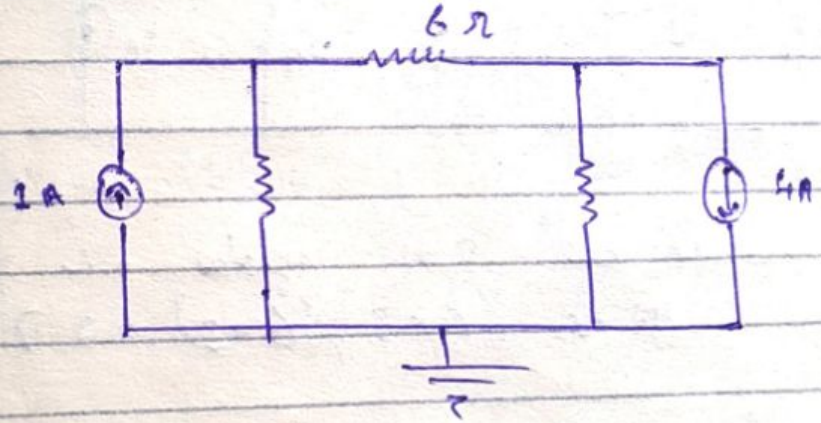
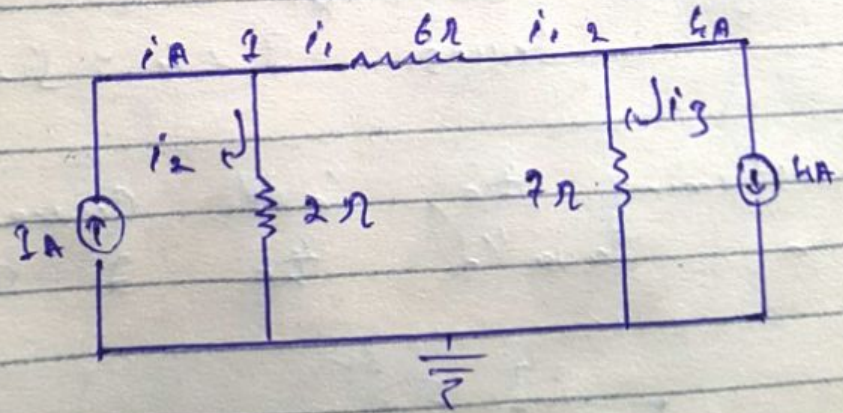
Question = 2 Part (A) (B)

Obtain the node voltages in the circuit given below.



Solution =>





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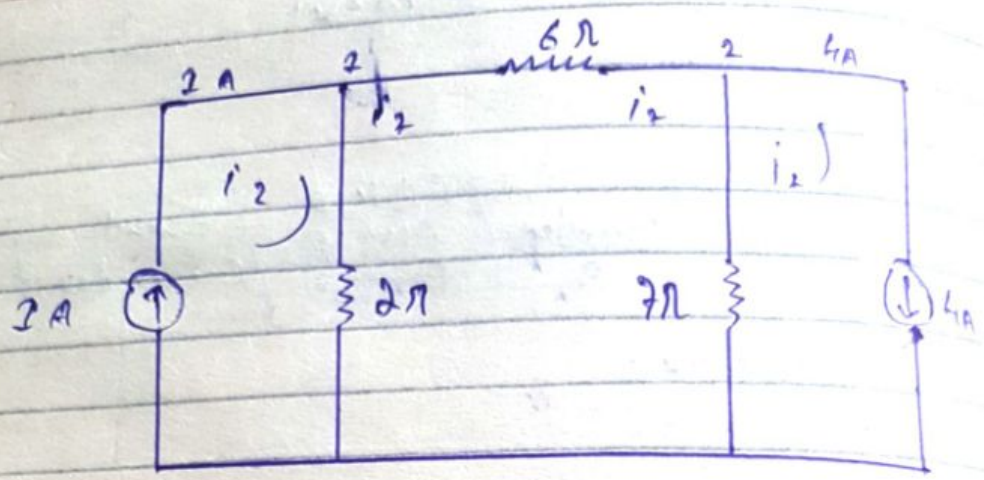


at node 1:

$$1 = i_1 + i_2 \longrightarrow 1 = \frac{V_1 - V_2}{6} + \frac{V_1 - 0}{2}$$

$$\text{or} \quad 6 = 4V_1 - V_2 \quad (1)$$

Node 2

$$i_2 = 4 + i_1 \longrightarrow \frac{V_1 - V_2}{6} = 4 + \frac{V_2 - 0}{7}$$

$$\text{or} \quad 168 = 7V_1 - 13V_2 \quad (2)$$

$$V_1 = 2V, \qquad V_2 = -4V.$$

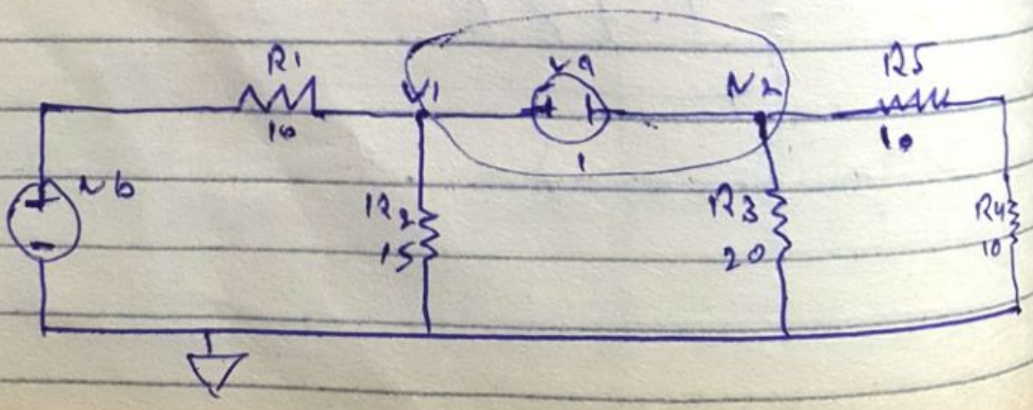
Question: 02 Part (A)

Answer:

Supernode.

A Supernode is a theoretical construct that can be used to solve a circuit. This is done by treating a voltage source on a wire as a point source voltage in relation to other point voltages located at various nodes in the ckt relative to a ground node assigned a zero or negative charge.

A super node is often used where voltage source are in awkward place e.g: where the Va source, without using a supernode, it would be difficult to do nodal analysis bcs you have no way of knowing what current is coming from Va.

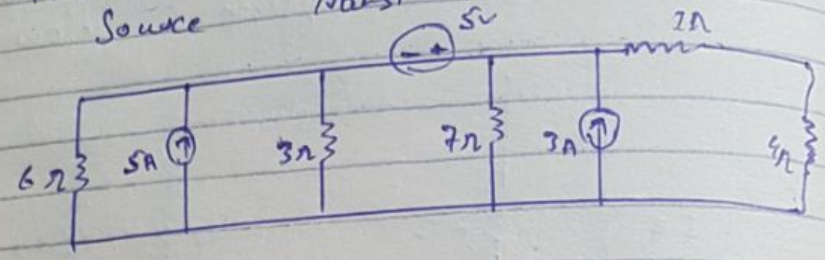


6966

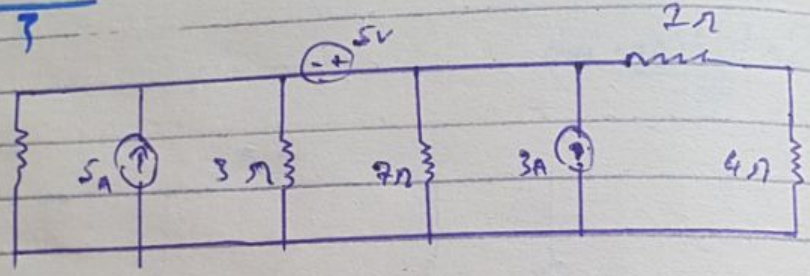
Page: 05

Question = 02 Part (B)

(a) Find i_o in the clct shown below using source transformation.



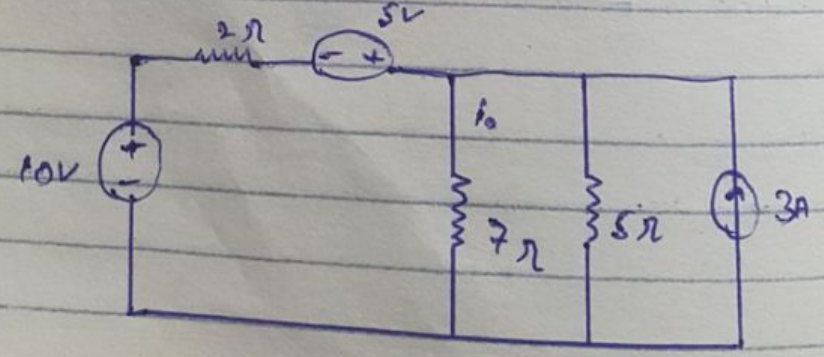
Solution



6Ω and 3Ω resistor in parallel gives $(6\times3)/(6+3) = 2\Omega$

Adding the 2-Ω & 4-Ω resistors in series $2+4 = 5\Omega$

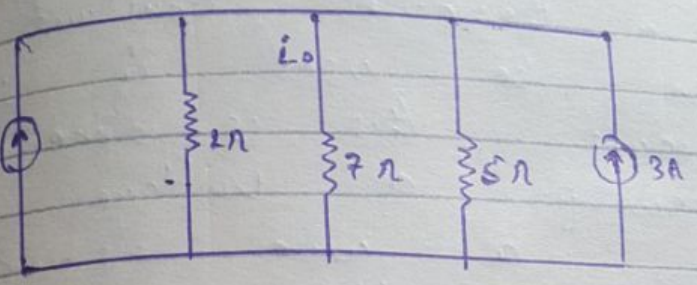
Transforming the 6A current source in parallel the 2-Ω resistor.



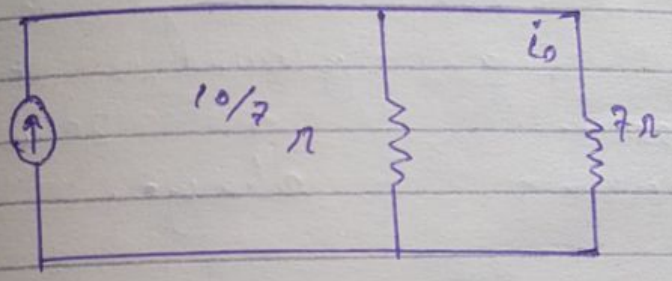
6966

Adding the 10-V & 5-V voltage Source a 15-V voltage Source

Transforming the 15-V voltage Source series with the 2-Ω resistor.



Two Ckt Current Source 2-Ω and the 5-Ω resistor load Ckt



Ckt Device

$$i_0 = \frac{\frac{10}{7}}{\frac{10}{7} + 7}(10.5) = 1.78A$$

$$= 1.78A$$

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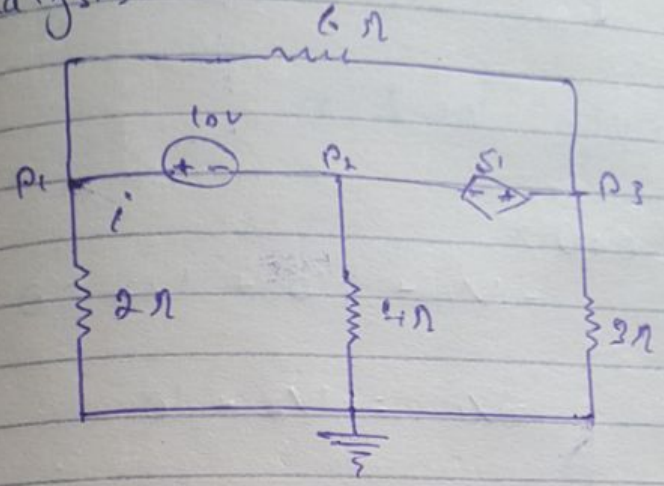
Page :07

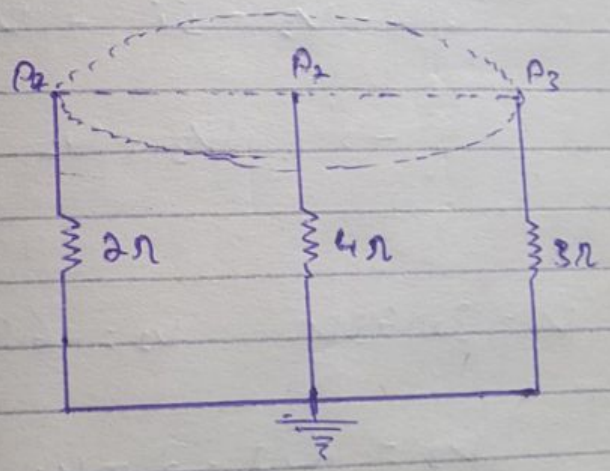
6966

Question = 03. Part (A)

Find V_1, V_2 and V_3 in the circuit given using nodal analysis.



Solution:-

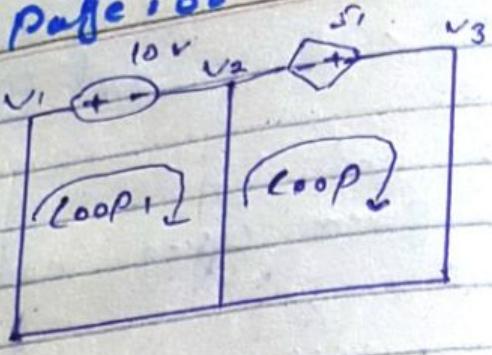


(*) Applying KCL.

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

$$6V_1 + 3V_2 + 4V_3 = 0$$

120 66 6966



Apply KVL =>

Loop 1

$$-V_1 + 10 + V_2 = 0$$

$$V_1 = V_2 + 10 \quad (1)$$

Loop 2

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

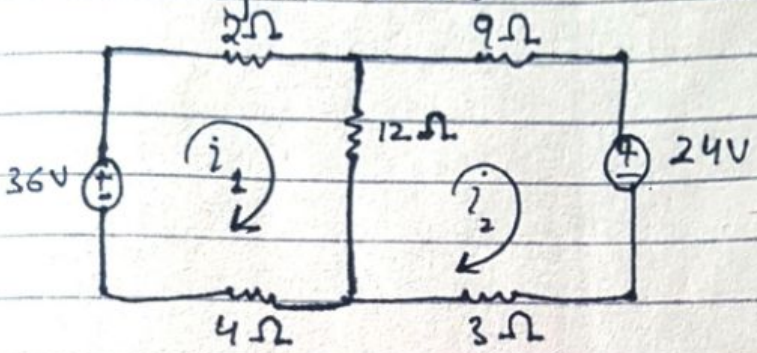
$$\rightarrow \quad V_3 = V_2 + 5i \quad (3)$$

$V_1 = 3.043\,V$. $V_2 = -6.956\,V$.

$V_3 = 652.2\,mV$.

Question = 03 Part (B)

Q3:(B) Calculate the mesh currents i_1 and i_2 of the circuit given below.



Solution:

Applying KVL

$$-36 + 18i_1 - 12i_2 = 0$$

Mesh 1 $\longrightarrow$ $3i_1 - 2i_2 = 6$ (1)

$$24 + 24i_2 - 12i = 0$$

Mesh 2 $\longrightarrow$ $-3i_2 + 6i_2 = -6$ (2)

From (1) and (2) we get

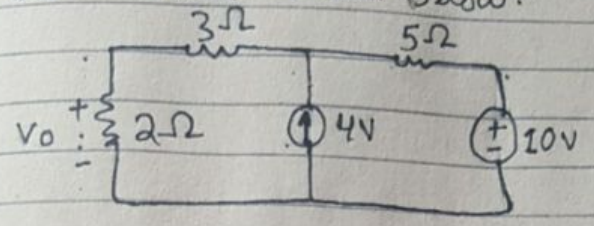
$i_1 = \boxed{2A}$

$i_2 = \boxed{0A}$

6966

Q4 (A) **Question = 04 (Part (A)**

Use the superposition Theorem to find v_o in the circuit shown Below.

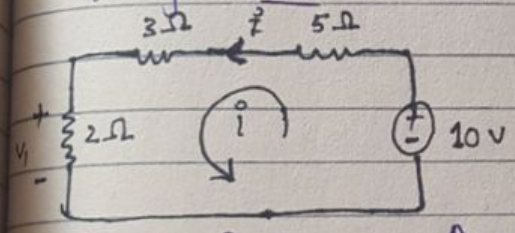


Solution:

Let $V_o = V_1 + V_2$

Where V_1 and V_2 are contributions to the 10V and 4A respectively.

To get V_1, consider the circuit in Fig:



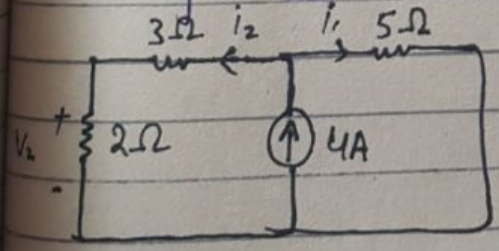
Apply Ohm's Law

$(2+3+5)i = 10$

$\longrightarrow i = 10/(10) = 1A$

$V_1 = 2i = 2V$

To get V_2 consider the circuit:



$i_1 = i_2 = 2A$, $V_2 = 2i_2 = 4V$

Thus,

$V = V_1 + V_2$

$V = 2 + 4$

$V = \underline{6V}$

Q4(B): Question (4) part (B)

What is Thevenin's Theorem:?

THEVENIN'S THEOREM:

Thevenin's theorem states that "any complicated network across its load terminals can be substituted by a voltage source with one resistance in series."

This theorem helps in the study of the variation of current in a particular branch when the resistance of the branch is varied while the remaining network remains the same.

For example:
In Designing electrical and electronic circuit.

* This theorem was derived By Leon Charles Thevenin in 1833.

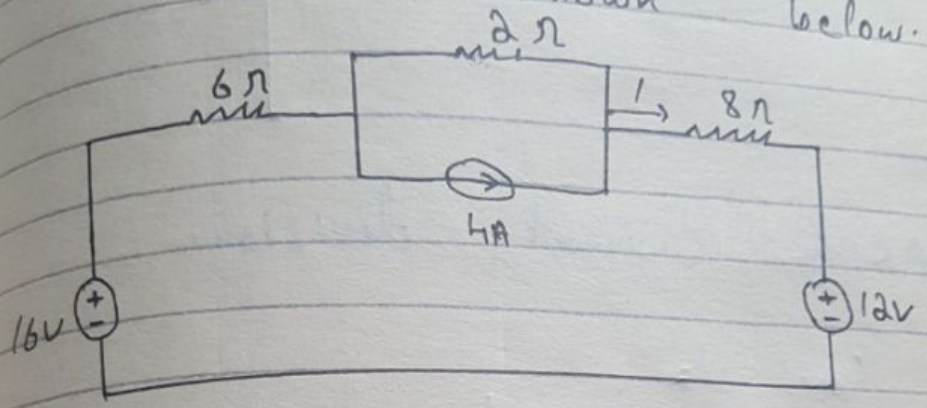
* Thevenin's theorem is widely used when it's it is not possible to simplify a circuit using Kirchoff's law, Ohm's law etc.

Theorem also states that
"Any linear circuit with any number of voltage source and resistors can be replaced with a single voltage source in series with a resistance connected across a load".

Page: 12

Question: 05

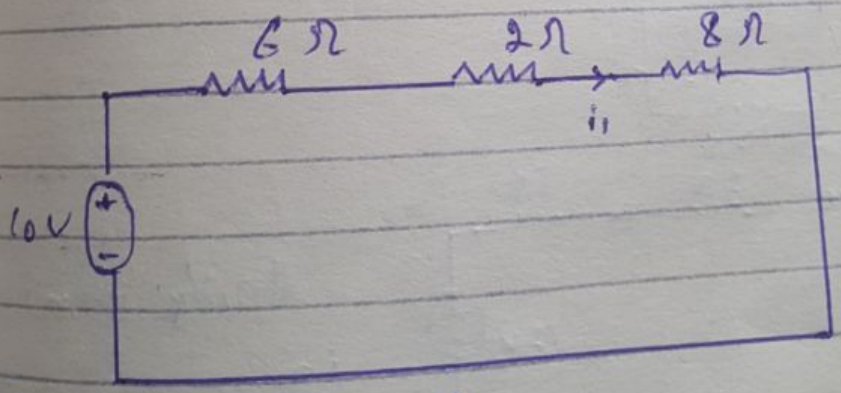
Use the Superposition Principal to find I in the Circuit shown below.



Solution:

Let $i = i_1 + i_2 + i_3$

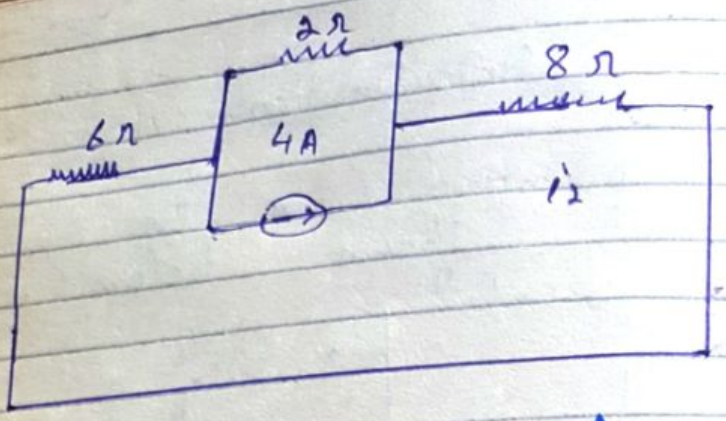
Where i_1, i_2 and i_3 are contribution due to 16V, 4A, 12V source respectively.



Apply OHM's Law.

i_2

$$i_1 = \frac{16}{6 + 2 + 8} = 1A$$

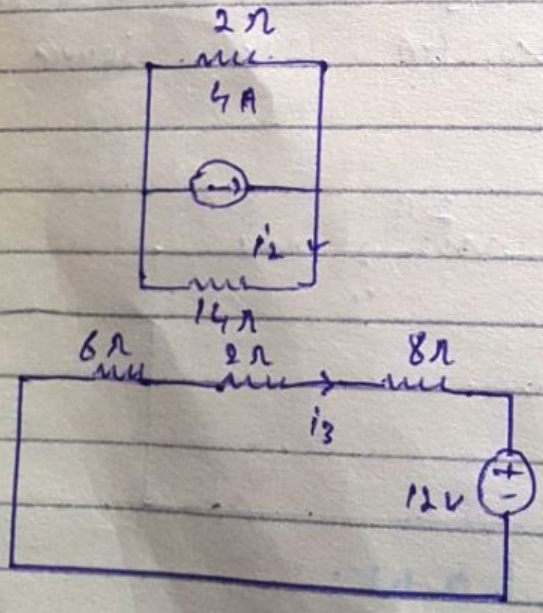


Apply Current division

For i_2

By Current division :

$$i_2 = \frac{2}{2+14}(4) = 0.5$$



Apply OHm's Law

$i_3 =$

$$i_3 = \frac{-12}{16} = 0.75A$$

thus $i = i_1 + i_2 + i_3$

$= 1 + 0.5 - 0.75$

$= 750mA.$