CSE-250

Assignment-01

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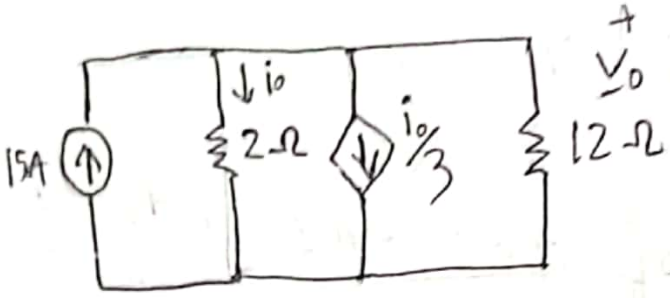
Sec: 07

Slide-3

Problem 5

Ans:



We can write from the circuit that,

$$15 = i_o + i_o/3 + \frac{V_o}{12}$$

$$\Rightarrow 15 = \frac{4}{3} i_o + \frac{V_o}{12} \quad \text{——} \quad (1)$$

in the equation,

$$V_o = 2i_o$$

$$\therefore 2i_o - V_o = 0 \quad \text{——} \quad (11)$$

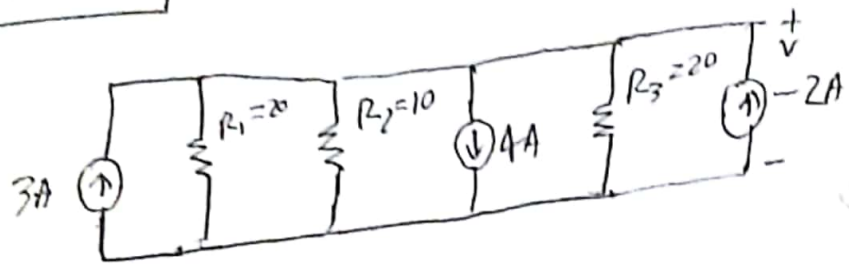
Solving eq (1) and (11) we get,

$$i_o = 10\,A$$

$$V_o = 20\,V \quad (Ans)$$

Slide - 3

Problem 6



Here,

$$\frac{1}{R_{12}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$= \frac{1}{20} + \frac{1}{10}$$

$$\Rightarrow R_{12} = \frac{20}{3}\ \Omega$$

Again,

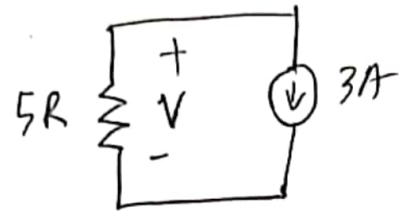
$$\frac{1}{R_{123}} = \frac{1}{R_{12}} + \frac{1}{R_3}$$

$$= \frac{3}{20} + \frac{1}{20}$$

$$\Rightarrow R_{123} = 5\Omega$$

Net electricity flow in the circuit, is $3A - 4A - 2A = -3A$ ← means downward

So, the circuit can be drawn now as,



$$V = -3 \times 5$$
$$= -15V$$

For getting the I we need to count the ~~next~~ net electricity flow of the right portion of the circuit.

Here, supplied current I equivalent to,

~~$I = 4A$~~ R_3

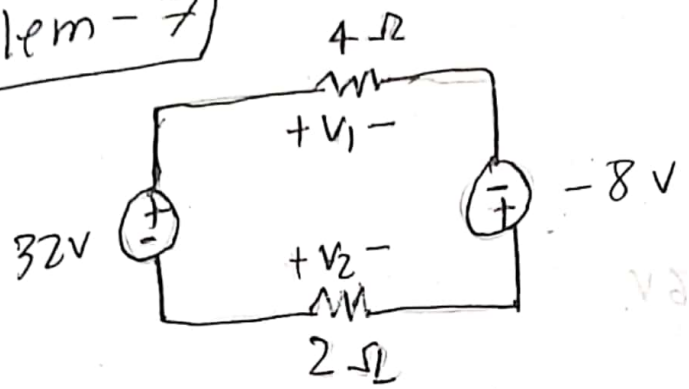
$$I = 4A - \frac{15}{R_3} + 2A$$

$$\Rightarrow I = 4 - \frac{15}{20} + 2$$

$$= 5.25A$$

slide-3

Problem-7)



From the circuit we can write the KVL equation →

$$-32 + 4i + 8 + 2i = 0$$

$$\Rightarrow 6i = 24$$

$$\therefore i = 4A$$

Now, $V_1 = +(4 \times 4)$

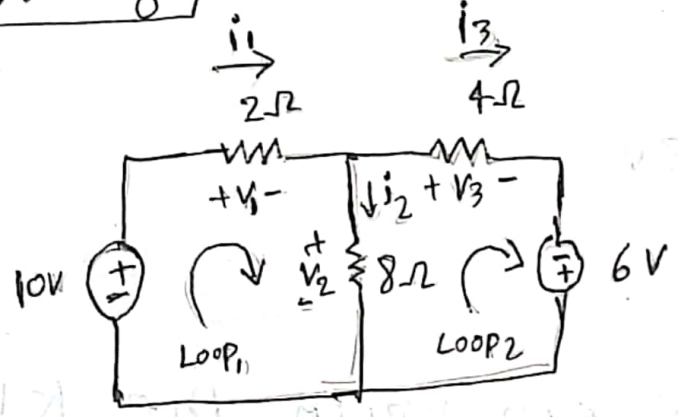
$$= 16V$$

$$V_2 = -(2 \times 4)$$

$$= -8V$$

Slide-3

Problem 8



From the circuit we get, for the First Loop KVL

$$\Rightarrow -10 + 2i_1 + 8i_2 = 0 \quad \text{——— (1)}$$

we get for the second Loop

$$\Rightarrow 4i_3 - 6 - 8i_2 = 0 \quad \text{——— (1)}$$

As we can say from the circuit that, $i_1 = i_2 + i_3$

∴ equation ① will be,

$$-10 + 2(i_2 + i_3) + 8i_2 = 0$$

$$\Rightarrow -10 + 2i_3 + 10i_2 = 0 \quad \text{——— (III)}$$

By solving equation (II) and (III) we get,

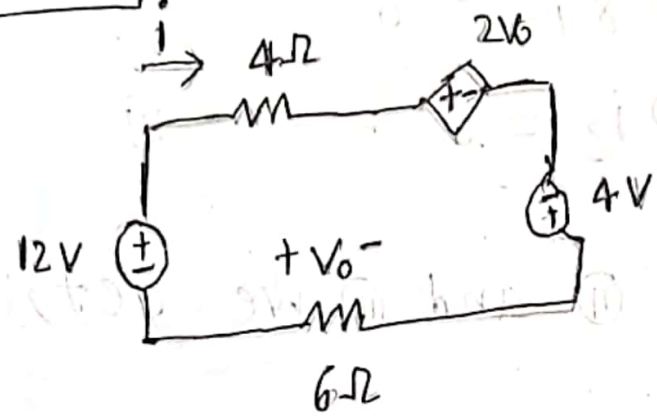
$$i_2 = \frac{1}{2} A$$

$$i_3 = \frac{5}{2} A$$

$$i_1 = i_2 + i_3 = \frac{1}{2} + \frac{5}{2} = 3A$$

Slide 3

Problem 9



we get the KVL equation for the circuit

$$\Rightarrow -12 + 4i + 2V_0 - 4 + 6i = 0$$

$$\Rightarrow 10i - 16 + 2V_0 = 0$$

$$\Rightarrow i = \frac{16 - 2V_0}{16}$$

From the circuit we can also write,

$$\Rightarrow -V_0 = i \times 6$$

$$\Rightarrow -V_0 = \frac{16 - 2V_0}{10} \times 6$$

$$\Rightarrow -V_0 \times \frac{5}{3} = 16 - 2V_0$$

$$\Rightarrow \frac{1}{3} V_o = 16$$

$$\therefore V_o = 16 \times 3$$

$$= 48 \text{ V}$$

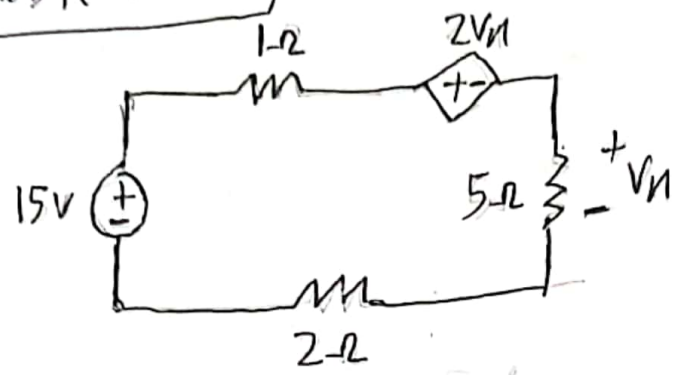
Again,

$$6i = -48 \text{ A} \quad [-V_o = 6i]$$

$$\Rightarrow i = -8 \text{ A}$$

slide-3

Problem -10



we can write the KVL equation for the circuit,

$\Rightarrow -15 + i + 2V_A + 5i + 2i = 0$

$\Rightarrow 8i = 15 - 2V_A$

$\Rightarrow i = \frac{15 - 2V_A}{8}$ — ①

From the circuit we can also write,

$\Rightarrow V_A = iR$

$\Rightarrow V_A = \frac{15 - 2V_A}{8} \times 5$ [From eq ①]

$\Rightarrow \frac{8}{5} V_A = 15 - 2V_A$

$$\Rightarrow \frac{18}{5} V_n = 15$$

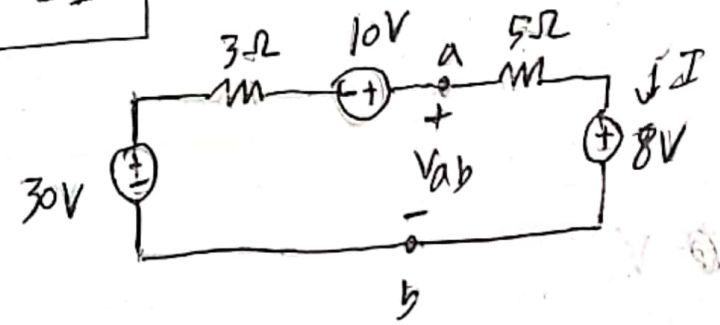
$$\Rightarrow V_n = \frac{5}{18} \times 15$$

$$= 4.167 \text{ V}$$

(Ans)

Slide - 3

Problem 11



From the equation we can write the KVL equation,

$\Rightarrow -30 + 3i - 10 + 5i + 8 = 0$ ——— (1)

$\Rightarrow 8i = 48$

$\therefore i = 4A$

We can modify the eq (1) into,

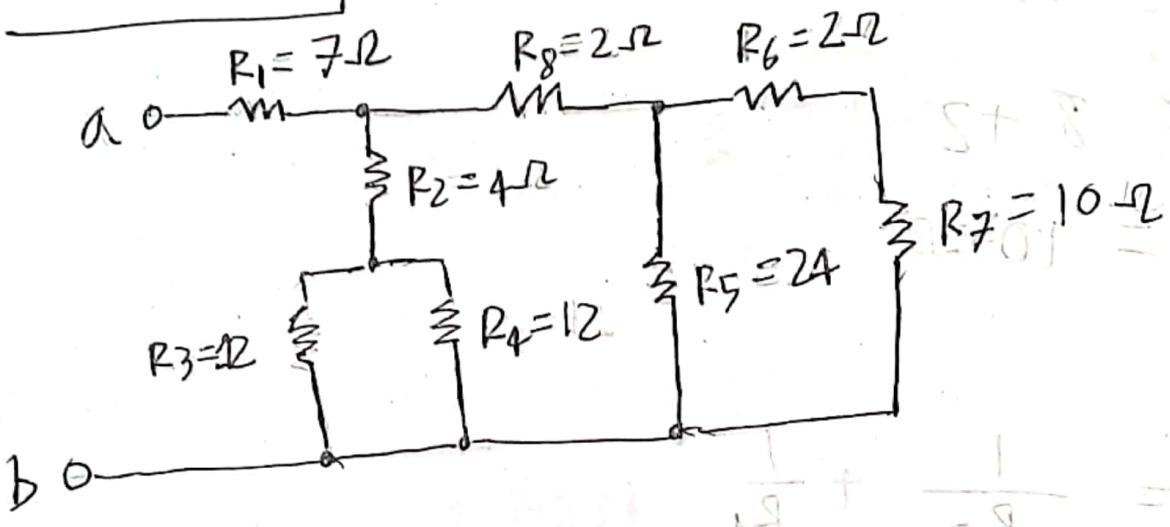
$\Rightarrow -30 + 3i - 10 + V_{ab} = 0$

$\Rightarrow -30 + 3 \times 4 - 10 + V_{ab} = 0 \quad [i = 4A]$

$\Rightarrow V_{ab} = 28\,V$ (Ans)

Slide-4

Problem 3



From the circuit we can write

$$R_{67} = R_6 + R_7 = 2 + 10 = 12\Omega$$

~~R_{567}~~ Also,

$$\frac{1}{R_{567}} = \frac{1}{R_5} + \frac{1}{R_{67}}$$

$$= \frac{1}{24} + \frac{1}{12}$$

$$\therefore R_{567} = 8\Omega$$

$R_{2567} =$

$R_{5678} = R_{567} + R_8$

$= 8 + 2$

$= 10\ \Omega$

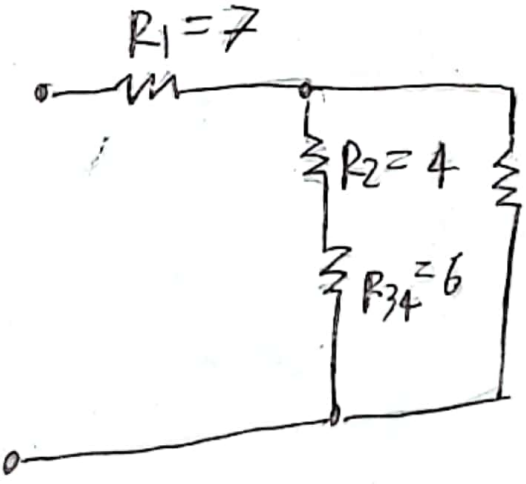
Also,

$\frac{1}{R_{34}} = \frac{1}{R_3} + \frac{1}{R_4}$

$= \frac{1}{12} + \frac{1}{12}$

$= 6\ \Omega$

Now the circuit Looks,



$R_{234} = R_2 + R_{34} = 4 + 6 = 10\ \Omega$

Now,

$$\frac{1}{R_{234567}} = \frac{1}{R_{234}} + \frac{1}{R_{5678}}$$

$$\Rightarrow \frac{1}{R_{234567}} = \frac{1}{10} + \frac{1}{10}$$

$$\therefore R_{234567} = 5\ \Omega$$

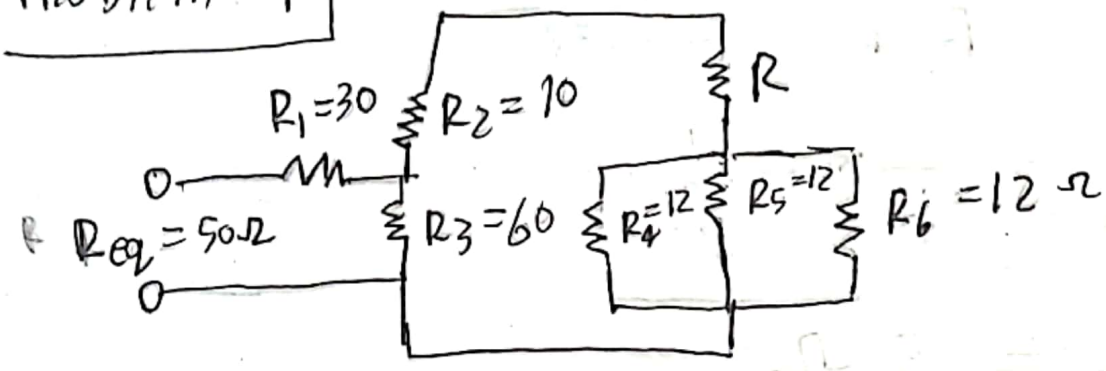
Now, $R_{ab} = R_1 + R_{234567}$

$= 7 + 5$

$= 12\ \Omega$

Slide 4

Problem 4



From the circuit we can write,

$$\frac{1}{R_{456}} = \frac{1}{R_4} + \frac{1}{R_5} + \frac{1}{R_6}$$

$$\Rightarrow \frac{1}{R_{456}} = \frac{1}{12} + \frac{1}{12} + \frac{1}{12}$$

$$\therefore R_{456} = 4\ \Omega$$

Now,

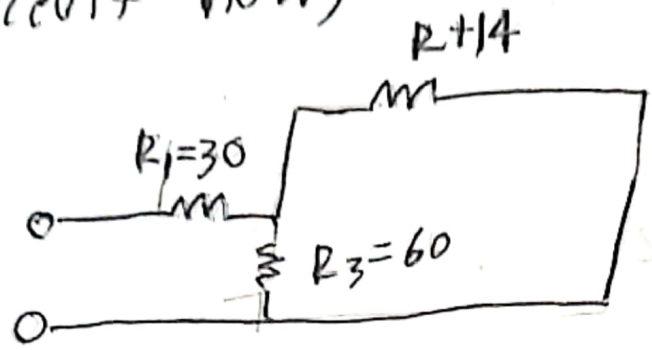
$$R + R_{456} = R + 4$$

Also,

$$R + R_{2\,456} = R + 4 + 10$$

$$= R + 14$$

Circuit now,



Now, we can write the equation,

$$\left(\frac{1}{R+14} + \frac{1}{60}\right)^{-1} + 30 = 50$$

$$\Rightarrow \frac{1}{R+14} + \frac{1}{60} = \frac{1}{20}$$

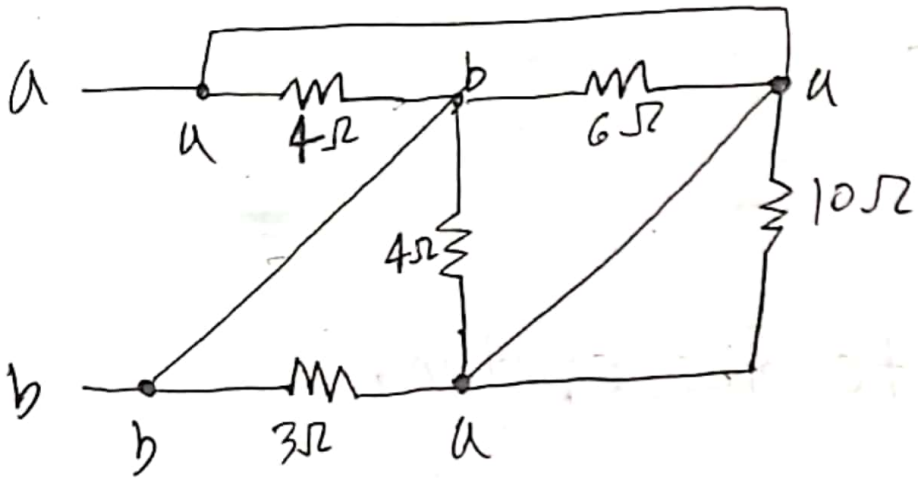
$$\Rightarrow \frac{1}{R+14} = \frac{1}{30}$$

$$\Rightarrow R+14 = 30$$

$$\therefore R = 16\,\Omega$$

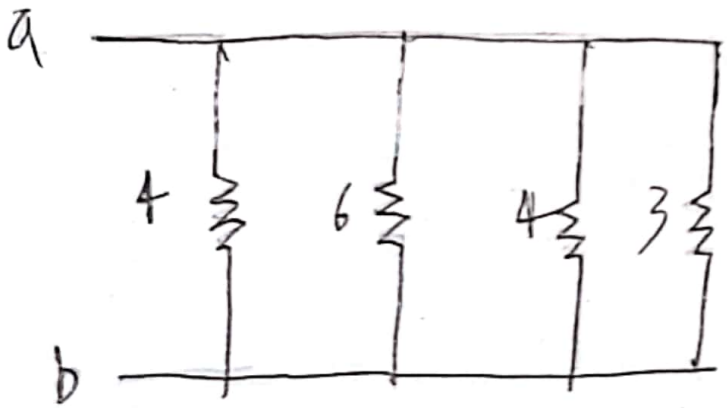
(Ans)

Problem 5 | Slide-4



~~As the all the wholse~~

As the whole circuit have only two nodes we can draw the circuit in the following manner,



As 10Ω resistance is not included in the new circuit because of the

Short wire,

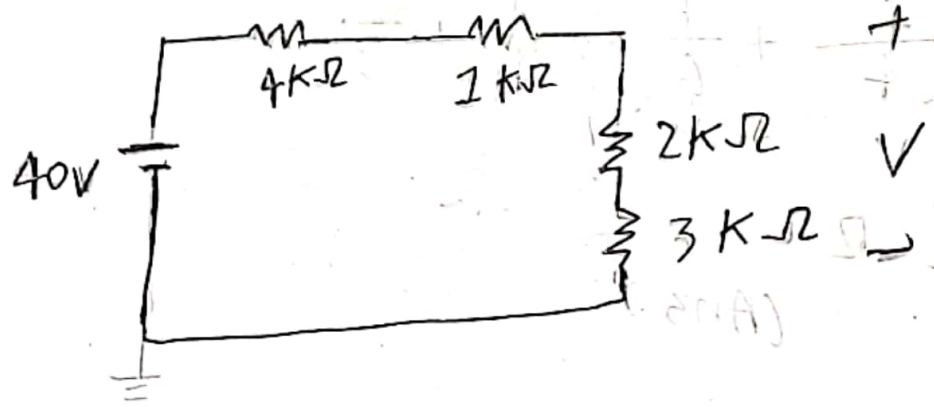
$$\therefore \frac{1}{R_{ab}} = \frac{1}{4} + \frac{1}{6} + \frac{1}{4} + \frac{1}{3}$$

$$\therefore R_{ab} = 1\ \Omega$$

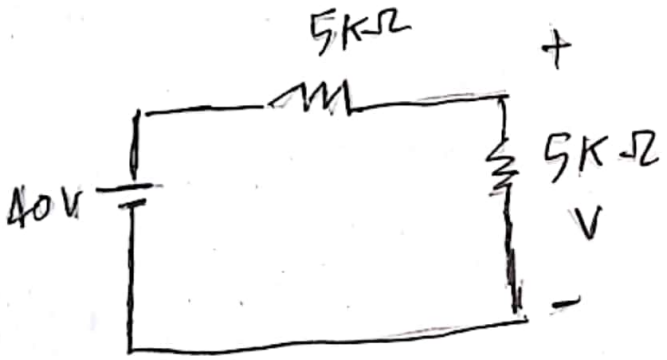
(Ans)

Slide-4

Problem 6)



we can write the circuit as,



If we use voltage division rule we get,

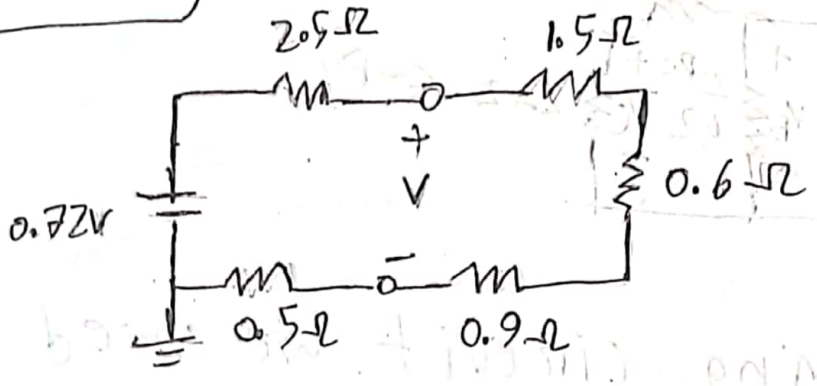
$$V = \frac{5\,K\Omega}{5K\Omega + 5K\Omega} \times 40\,V$$

$$= 20\,V$$

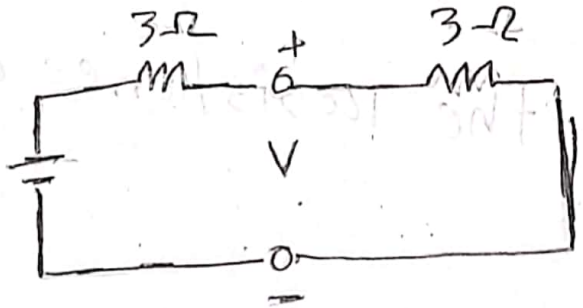
(Ans)

Slide -

Problem - 7



we can draw the following circuit as



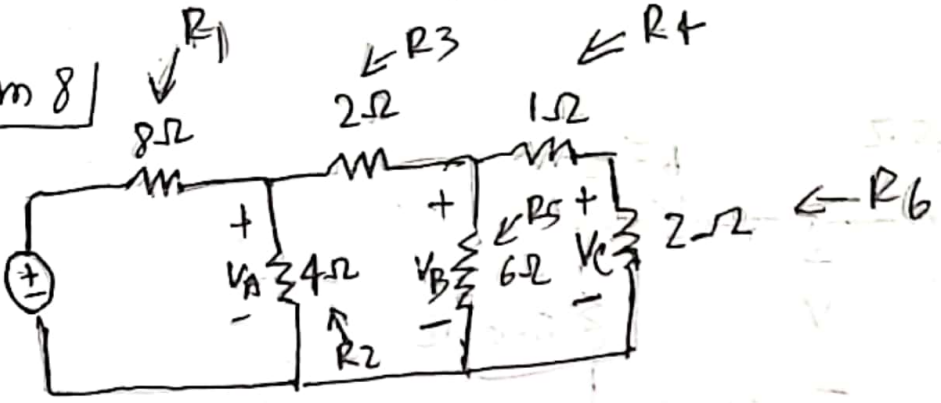
If we use voltage division rule we get

$$V = \frac{3}{3+3} \times 0.72V = 0.36\ V$$

$$\therefore V = 0.36\ V$$

Slide-4

Problem 8



For the following circuit we need to compote V_A at first, for this we need to get the resistence of V_A.

$$R_{46} = R_4 + R_6 = 1 + 2 = 3\Omega$$

For, R_{456} we get,

$$\frac{1}{R_{456}} = \frac{1}{R_{46}} + \frac{1}{R_5}$$

$$= \frac{1}{3} + \frac{1}{6} \quad \text{---(1)}$$

$$R_{456} = 2\Omega \quad \text{---} \quad (1)$$

$R_{3456} = R_3 + R_{456} = 2+2 = 4\Omega$

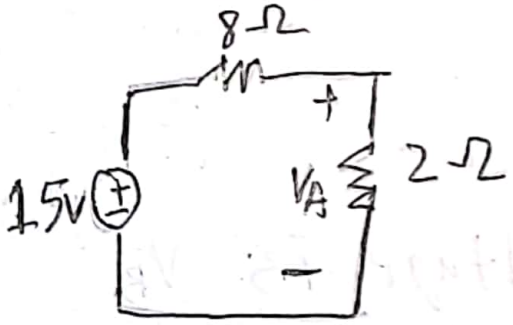
Again,

$$\frac{1}{R_{23456}} = \frac{1}{R_{3456}} + \frac{1}{R_5}$$

$$= \frac{1}{4} + \frac{1}{4}$$

$$= 2\Omega$$

Now, the circuit looks,



$$\therefore V_A = \frac{R_{23456}}{R_1 + R_{23456}} \times V_{eq}$$

$$= \frac{2}{8+2} \times 15$$

$$= 3V$$

From equation ① we get,

$$R_{456} = 2\Omega$$

For V_B the equavalent voltage is V_A.

$$\therefore V_B = \frac{R_3}{R_3 + R_{456}} \times V_A$$

$$= \frac{2}{2+2} \times 3$$

$$= 1.5\ V$$

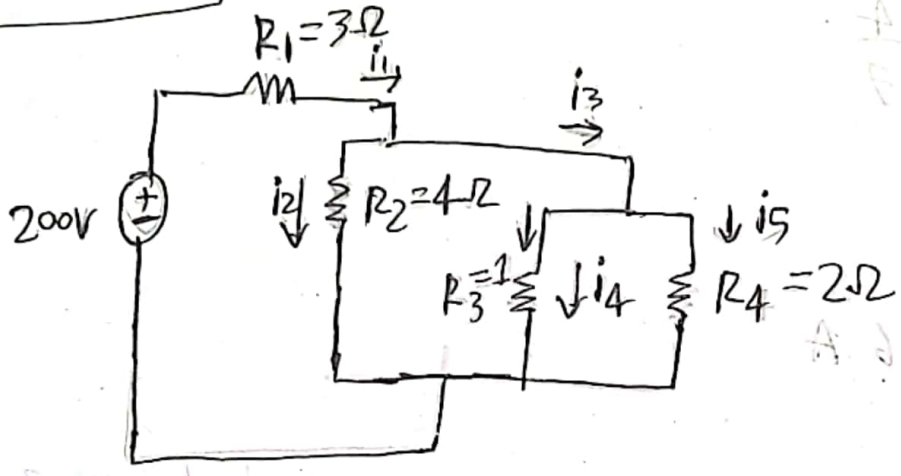
For V_C the equavalent voltage is V_B

$$\therefore V_C = \frac{R_6}{R_6 + R_4} \times V_B$$

$$= \frac{2}{2+1} \times 1.5$$

$$= 1\ V$$

Problem-9



Here,

$$\frac{1}{R_{34}} = \frac{1}{R_3} + \frac{1}{R_4}$$

$$\Rightarrow \frac{1}{R_{34}} = \frac{1}{1} + \frac{1}{2}$$

$$\therefore R_{34} = \frac{2}{3}\,\Omega \quad \text{— (1)}$$

Again,

$$\frac{1}{R_{234}} = \frac{1}{R_2} + \frac{1}{R_{34}}$$

$$= \frac{1}{4} + \frac{1}{2/3}$$

$$\therefore R_{234} = \frac{4}{7} \quad \text{— (1)}$$

$$\therefore R_{1234} = R_1 + R_{234}$$

$$= 3 + \frac{4}{7}$$

$$= \frac{25}{7}$$

$$i_1 = \frac{200}{25/7} = 56\ A$$

For other i_2, i_3, i_4, is we need to use current division rule.

From eq (iii) we get, and from eq (i)

$$R_{234} = \frac{4}{7}, \quad R_{34} = \frac{2}{3}$$

$$\therefore i_2 = \frac{R_{234}}{R_2} \times i_1$$

$$= \frac{4/7}{4} \times 56$$

$$= 8\ A$$

$$i_3 = \frac{R_{234}}{R_{34}} \times i_1$$

$$= \frac{4/7}{2/3} \times 56$$

$$= 48A$$

$$i_4 = \frac{R_{34}}{R_3} \times i_3$$

$$= \frac{2}{3} \times 48$$

$$= 32A$$

$$i_5 = \frac{R_{34}}{R_4} \times i_3$$

$$= \frac{2/3}{2} \times 48$$

$$= 16\ A$$