✡ MESH CURRENT MEHOD

STEP 1 :- सभी Network को अलग अलग मेस (Mesh) में divide विभाजित कर देते हैं। तथा प्रत्येक मेस अर्थात closed path में करेंट assign कर देते हैं।

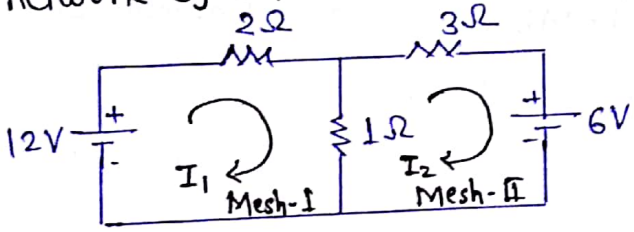
STEP 2 :- सभी Mesh में current की दिशा clockwise direction में रखते हैं।

STEP 3:- सभी Mesh में KVL apply करते हुए समीकरण का निर्माण करते हैं।

STEP 4: विभीन्न Mesh के समीकरणों को solve करके Mesh current का मान ज्ञात करें।

STEP 5: Mesh current की सहायता से ब्रांच current का निर्धारण करें।

Que: Solve the network by Mesh current method



Solve: Apply KVL at loop-1

$$+12 - 2I_1 - 1(I_1 - I_2) = 0$$

$$-3I_1 + I_2 = -12 \quad \text{---} \quad (1)$$

Apply KVL at loop-2

$$-6 - 1(I_2 - I_1) - 3I_2 = 0$$

$$-4I_2 + I_1 = 6$$

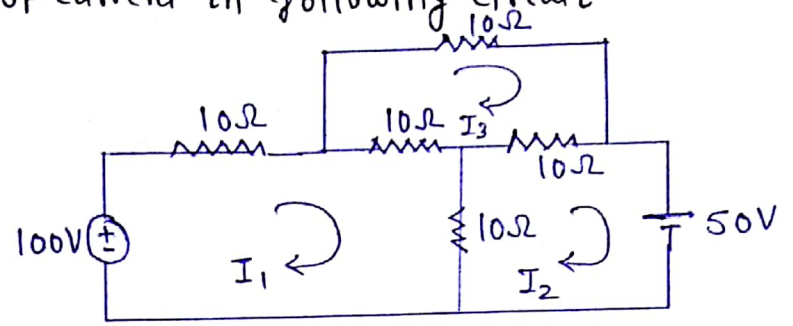
$$I_1 - 4I_2 = 6 \quad \text{---} \quad (2)$$

from eqn (1) & (2)

$$I_1 = 3.81\ A \quad \& \quad I_2 = -0.54\ A$$

Que: Find loop current in following circuit

NOV-DEC 2015



Apply KVL at loop 1

$$+100 - 10I_1 - 10(I_1 - I_3) - 10(I_1 - I_2) = 0$$

$$100 - 10I_1 - 10I_1 + 10I_3 - 10I_1 + 10I_2 = 0$$

$$-30I_1 + 10I_2 + 10I_3 = -100 \quad \text{---} \quad (1)$$

Apply KVL at loop-2

$$-50 - 10(I_2 - I_1) - 10(I_2 - I_3) = 0$$

$$10I_1 - 20I_2 + 10I_3 = 50 \quad \text{---} \quad (2)$$

Apply KVL at loop-3

$$-10I_3 - 10(I_3 - I_2) - 10(I_3 - I_1) = 0$$

$$10I_1 + 10I_2 - 30I_3 = 0 \quad \text{---} \quad (3)$$

By solving eq^n (1) (2) & (3)

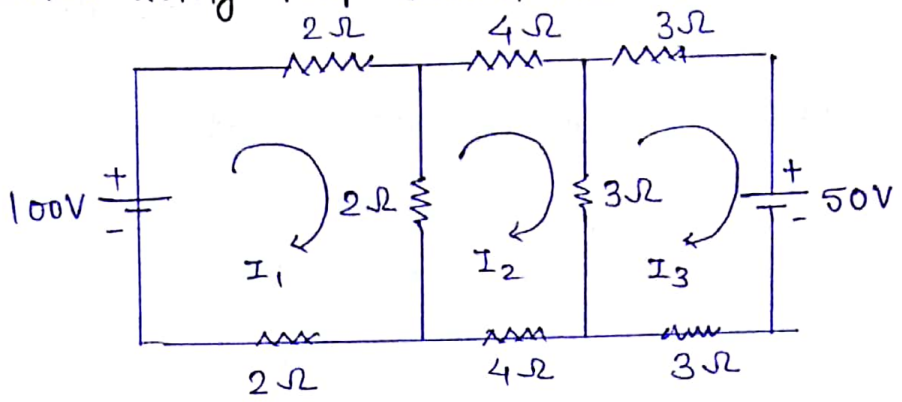
$$I_1 = 3.75\,A$$

$$I_2 = 0\,A$$

$$I_3 = 1.25\,A$$

DEC/JAN 2013-14

Find the current flowing in each resistance in following circuits using loop current method.



Solution: Apply KVL at loop 1

$$+100 - 2I_1 - 2(I_1 - I_2) + 2I_1 = 0$$

$$100 - 6I_1 + 2I_2 = 0$$

$$-6I_1 + 2I_2 = -100 \quad \text{---} \quad (1)$$

Apply KVL at loop 2

$$-4I_2 - 3(I_2 - I_3) - 4I_2 - 2(I_2 - I_1) = 0$$

$$2I_1 - 13I_2 + 3I_3 = 0 \quad \text{---} \quad (2)$$

Apply KVL at loop 3

$$-50 - 3I_3 - 3(I_3 - I_2) - 3I_3 = 0$$

$$-50 + 3I_2 - 9I_3 = 0$$

$$3I_2 - 9I_3 = 50 \quad \text{---} \quad (3)$$

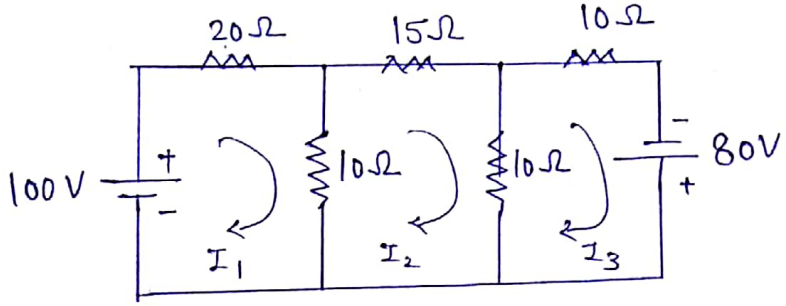
By solving eq^n (1)(2)(3)

$$I_1 = 17.15\,A$$

$$I_2 = 1.47\,A$$

$$I_3 = -5.065\,A$$

Find the current in various branch of circuit shown by Superposition theorem / maxwell loop method



Solution:

Apply KVL at loop-1

$$+100 - 20I_1 - 10(I_1 - I_2) = 0$$

$$-30I_1 + 10I_2 = -100 \quad \text{—— (1)}$$

Apply KVL at loop-2

$$-10(I_2 - I_1) - 15I_2 - 10(I_2 - I_3) = 0$$

$$10I_1 - 35I_2 + 10I_3 = 0 \quad \text{—— (2)}$$

Apply KVL at loop-3

$$80 - 10(I_3 - I_2) - 10I_3 = 0$$

$$+10I_2 - 20I_3 = -80 \quad \text{—— (3)}$$

Now from eq^n (1) (2) & (3)

$$I_1 = 4.25\,A$$

$$I_2 = 2.75\,A$$

$$I_3 = 5.375\,A$$

Hence $I_{20\Omega} = I_1 = 4.25\,A$

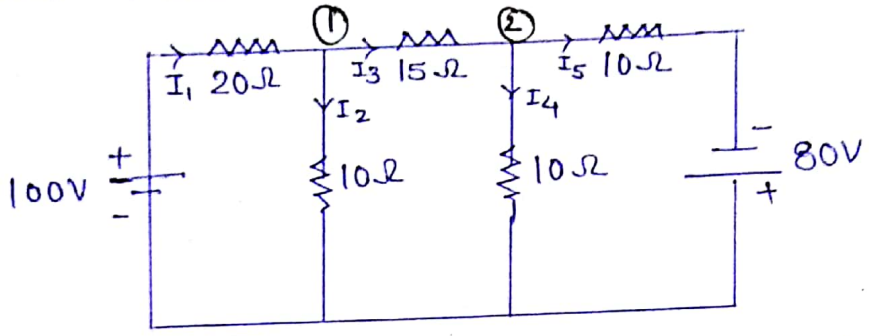
$I_{10\Omega} = (I_1 - I_2) = (4.25 - 2.75) = 1.5\,A$

$I_{15\Omega} = I_2 = 2.75\,A$

(loop3) $I_{10\Omega} = I_3 = 5.375\,A$, $I_{10\Omega} = (I_2 - I_3) = (2.75 - 5.375) = -2.625\,A$

NODAL ANALYSIS

✡ Find current in various branch of circuit shown belown by using Nodal analysis



Solution

Apply KCL at node-1 (consider node 1 is in higher potential hence all the current is outgoing from node 1)

$$I_1 + I_2 + I_3 = 0$$

$$\frac{V_1 - 100}{20} + \frac{V_1}{10} + \frac{V_1 - V_2}{15} = 0$$

$$\frac{15(V_1 - 100) + 30V_1 + 20(V_1 - V_2)}{300} = 0$$

$$15V_1 - 1500 + 30V_1 + 20V_1 - 20V_2 = 0$$

$$65V_1 - 20V_2 = 1500 \quad \text{——} \quad (1)$$

Apply KCL at node-2 (consider node 2 at higher potential)

$$I_3 + I_4 + I_5 = 0$$

$$\frac{V_2 - V_1}{15} + \frac{V_2}{10} + \frac{V_2 + 80}{10} = 0$$

$$\frac{10(V_2 - V_1) + 15V_2 + 15(V_2 + 80)}{150} = 0$$

$$-10V_1 + 40V_2 = -1200 \quad \text{——} \quad (2)$$

from eqⁿ ① & ②

$V_1 = 15$ Volt. $\quad V_2 = -26.25$ V

current $I_1 = \frac{100 - V_1}{20} = \frac{100 - 15}{20} = 4.25$ A

$I_2 = \frac{V_1}{10} = \frac{15}{10} = 1.5$ A

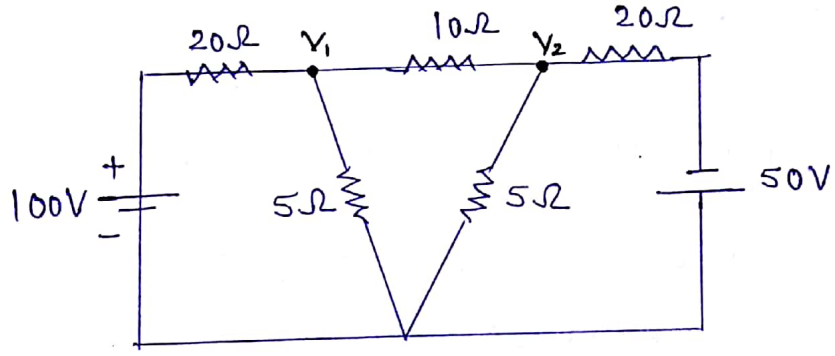
$I_3 = \frac{V_1 - V_2}{15} = \frac{15 - (-26.25)}{15} = 2.75$ A

$I_4 = \frac{V_2}{10} = \frac{-26.25}{10} = -2.625$ A

$I_5 = \frac{V_2 + 80}{10} = \frac{-26.25 + 80}{10} = 5.375$ A

APR-MAY 2017

निम्नलिखित परिपथ में 'नोडल वोल्ट विधि' का उपयोग करते हुए नोड 1 और 2 में V_1, V_2 का मान ज्ञात कीजिए



Solution:- Apply KCL at node 1

$I_1 + I_2 + I_3 = 0$

$\frac{V_1 - 100}{20} + \frac{V_1}{5} + \frac{V_1 - V_2}{10} = 0$

$\frac{V_1 - 100 + 4V_1 + 2(V_1 - V_2)}{20} = 0$

$7V_1 - 2V_2 - 100 = 0$

$7V_1 - 2V_2 = 100$ ——— ①

Apply kcl at node '2

$$I_3 + I_4 + I_5 = 0$$

$$\frac{V_2 - V_1}{10} + \frac{V_2}{5} + \frac{V_2 + 50}{20} = 0$$

$$\frac{2(V_2 - V_1) + 4V_2 + V_2 + 50}{20} = 0$$

$$-2V_1 + 7V_2 + 50 = 0$$

$$-2V_1 + 7V_2 = -50 \quad \text{---} \quad (2)$$

from eq^n (1) & (2) $V_1 = 13.33V$

$V_2 = -3.33V$

current in 20Ω resistor $I_1 = \frac{V_1 - 100}{20} = \frac{13.33 - 100}{20} = -4.33\,A$

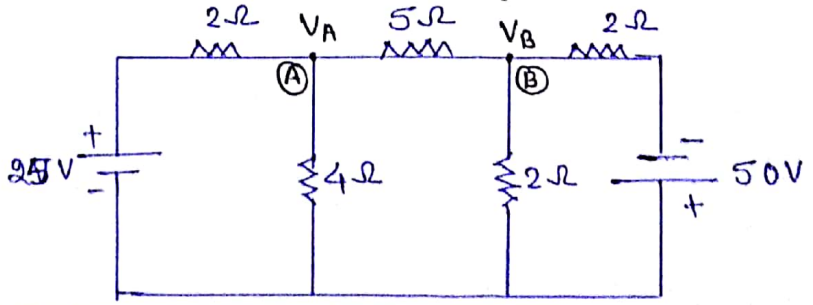
$I_2 = \frac{V_1}{5} = \frac{13.33}{5} = 2.66\,A$

$I_3 = \frac{V_1 - V_2}{10} = \frac{13.33 - (-3.33)}{10} = 1.66\,A$

$I_4 = \frac{V_2}{5} = -\frac{3.33}{5} = -0.666\,A$

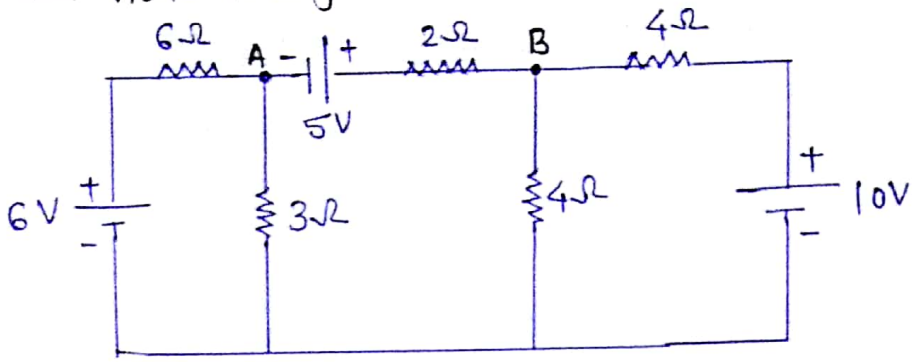
$I_5 = \frac{V_2 + 50}{20} = -\frac{3.33 + 50}{20} = 2.33\,A$

✡ Q. May-June 2015 Find the value of V_A & V_B By using Nodal analysis.



☆ Nov-Dec 2015

Explain node volt. analysis and solve the following circuit. Find out node voltage.



Solution:

Apply kcl at node ①

$$\frac{V_1 - 6}{6} + \frac{V_1}{3} + \frac{V_1 - V_2 + 5}{2} = 0$$

$$\frac{V_1 - 6 + 2V_1 + 3(V_1 - V_2 + 5)}{6} = 0$$

$$6V_1 - 3V_2 + 9 = 0$$

$$6V_1 - 3V_2 = -9 \quad \text{——} \quad (1)$$

Apply kcl at node 2

$$\frac{V_2 - V_1 - 5}{2} + \frac{V_2}{4} + \frac{V_2 - 10}{4} = 0$$

$$\frac{2(V_2 - V_1 - 5) + V_2 + V_2 - 10}{4} = 0$$

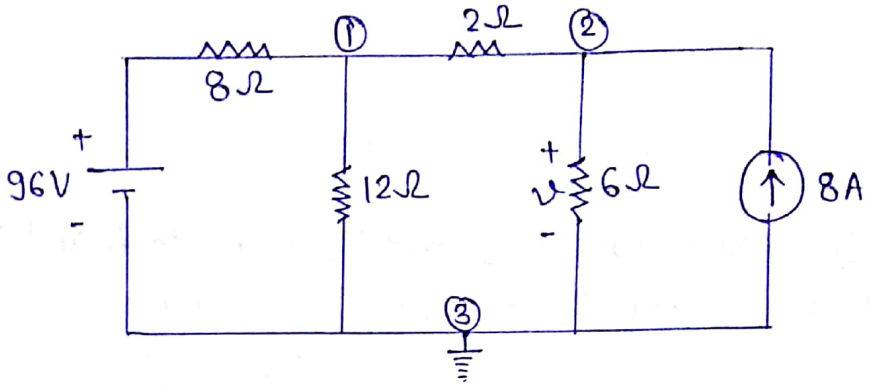
$$-2V_1 + 4V_2 - 20 = 0$$

$$-2V_1 + 4V_2 = 20 \quad \text{——} \quad (2)$$

from eqn ① & ② $V_1 = \frac{4}{3} = 1.33V$

$V_2 = \frac{17}{3} = 5.667V$

Determine the volt. 'v' in the network using 'nodal analysis'.



Solution:-

Apply KCL at node-1

$$\frac{V_1 - 96}{8} + \frac{V_1}{12} + \frac{V_1 - V_2}{2} = 0$$

$$\frac{3(V_1 - 96) + 2V_1 + 12(V_1 - V_2)}{24} = 0$$

$$3V_1 - 288 + 2V_1 + 12V_1 - 12V_2 = 0$$

$$17V_1 - 12V_2 = 288 \quad \text{——} \quad (1)$$

Apply KCL at node-2

$$\frac{V_2 - V_1}{2} + \frac{V_2}{6} - 8 = 0$$

$$\frac{3(V_2 - V_1) + V_2}{6} = 8$$

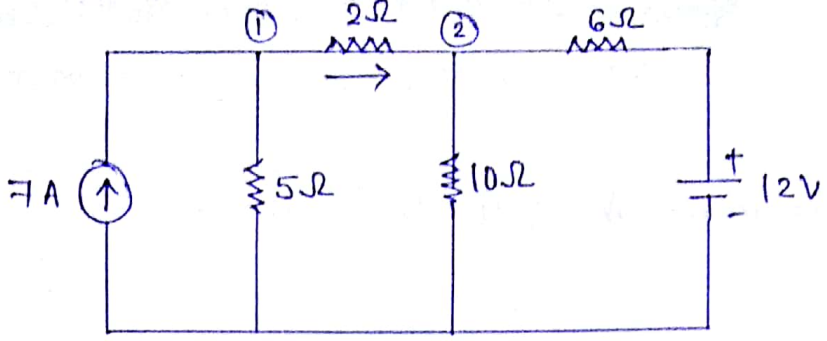
$$-3V_1 + 4V_2 = 48 \quad \text{——} \quad (2)$$

from eqn (1) & (2) $V_1 = 54V$

$V_2 = 52.5V$

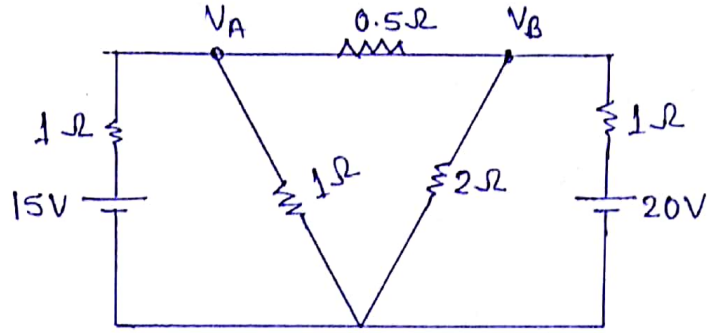
Hence volt across 6Ω resistor $v = V_2 = 52.5V$.

Q. Find nodal volt. and current through 2Ω resistance

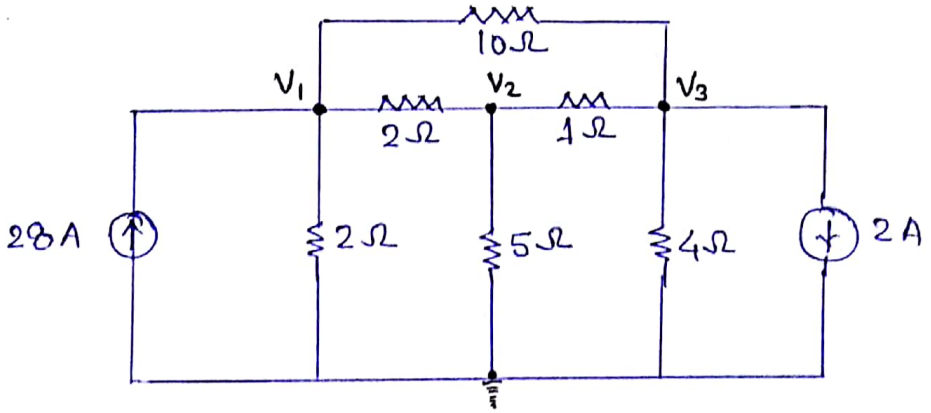


Ans: 22.2V , 17.1V, 2.55A

☆ Q. June2014 Find the value of V_a and V_b at node A and B using "Nodal" volt. method in circuit shown below



☆ NOV-DEC 2016 नोडल वोल्टेज सेनालिसिस का उपयोग करते इस परिपथ में दिए गए विभिन्न प्रतिरोधों में धारा का मान ज्ञात कीजिए:-



Solution Apply KCL at node 1

$$-28 + \frac{V_1}{2} + \frac{V_1 - V_2}{2} + \frac{V_1 - V_3}{10} = 0$$

$$\frac{5V_1 + 5(V_1 - V_2) + V_1 - V_3}{10} = 28$$

$$11V_1 - 5V_2 - V_3 = 280 \quad \text{— (1)}$$

Apply KCL at node 2

$$\frac{V_2-V_1}{2} + \frac{V_2}{5} + \frac{V_2-V_3}{1} = 0$$

$$\frac{5(V_2-V_1) + 2V_2 + 10(V_2-V_3)}{10} = 0$$

$$-5V_1 + 17V_2 - 10V_3 = 0 \quad \text{—— (2)}$$

Apply KCL at node 3

$$\frac{V_3-V_2}{1} + \frac{V_3}{4} + \frac{V_3-V_1}{10} + 2 = 0$$

$$\frac{20(V_3-V_2) + 5V_3 + 2(V_3-V_1)}{20} = -2$$

$$-2V_1 - 20V_2 + 27V_3 = -40 \quad \text{— (3)}$$

from eqn (1) (2) & (3)

$V_1 = 24.25V \quad V_2 = -0.19V \quad V_3 = -12.25V$

Current in 10Ω resistor $= \frac{V_1-V_3}{10} = \frac{24.25-(-12.25)}{10} = 3.65A$

current in 5Ω resistor $= \frac{V_2}{5} = \frac{-0.19}{5} = -0.038A$

current in 1Ω resistor $= \frac{V_2-V_3}{1} = \frac{-0.19-(-12.25)}{1} = 12.06A$

current in 4Ω resistor $= \frac{V_3}{4} = -\frac{12.25}{4} = 3.06A$

current in 2Ω resistor $= \frac{V_1-V_2}{2} = \frac{24.25-(-0.19)}{2} = 12.22A$

current in 2Ω resistor (node 1) $= \frac{V_1}{2} = \frac{24.25}{2} = 12.125A$