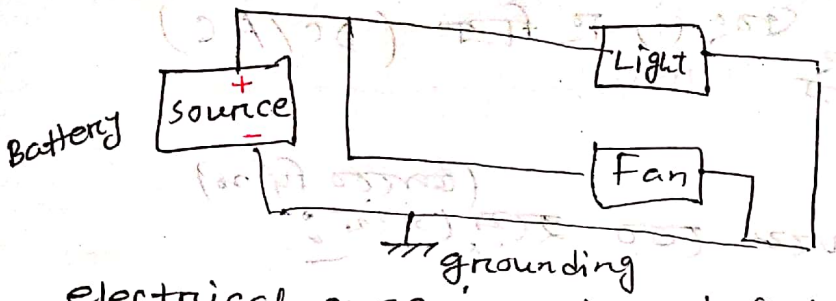
(1) C-day (20-8-19) (বৃহস্পতিবার)

EEE



electrical circuit: definition

source: Battery, generator

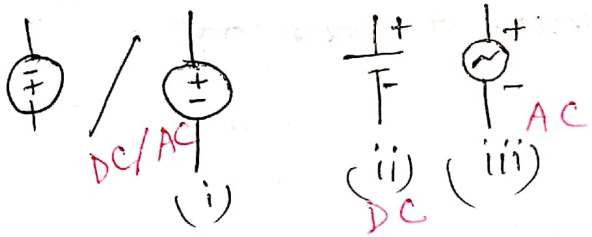
source 2 প্রকার।

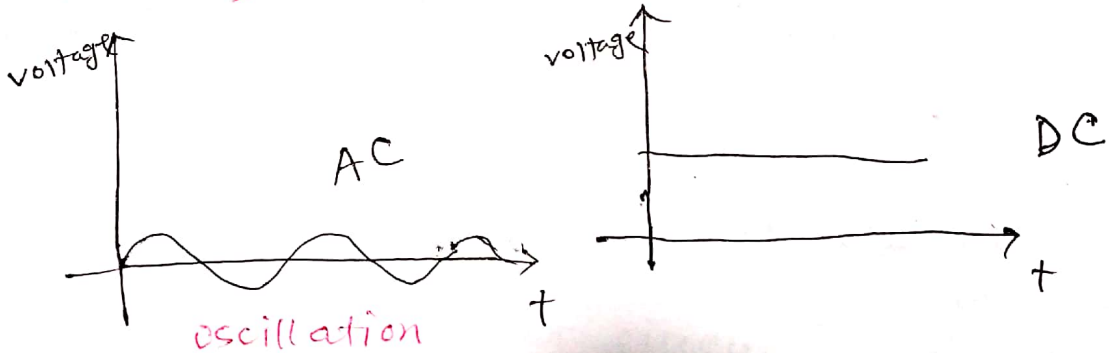
i) voltage source

ii) current "

* source হচ্ছে Active element.
* source power supply করে
* যারা power receive করে (active element থেকে) তারা passive element। such as light, fan etc.

voltage source:





Current source

Battery – DC (ii) নং চিত্র

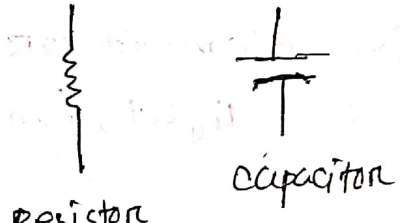
generator – AC (iii) নং চিত্র এবং (i) নং চিত্র (DC/AC)

current source :

current source কাকে বলে (উদাহরণ দিয়ে) বুঝিয়ে লেখো।

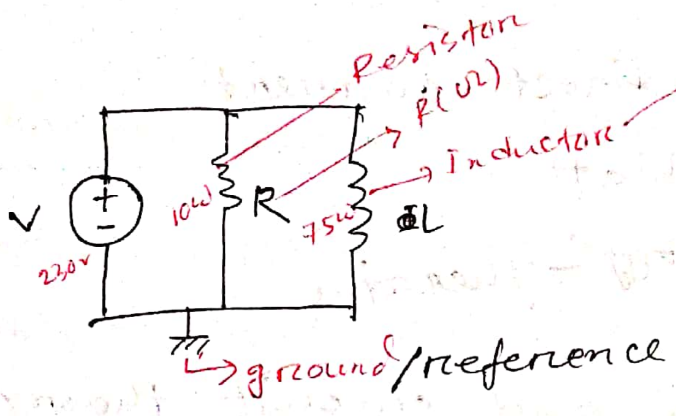
নিচের চিত্রে কোনটি source ও current প্রকৃতির?

passive element :



চারটি passive element কে বন্ধনী চিহ্ন দিয়ে represent করা যায়,

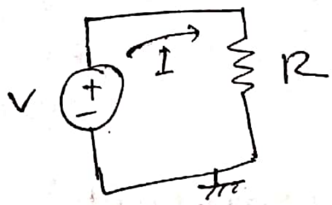
* light হচ্ছে resistor.
* Fan হচ্ছে inductor



বেশী সময় প্রয়োগ করলে ground এ চলে যায়।

ওহমের সূত্র:

At definite temperature, $V \propto I$



voltage যতগুণ বাড়বে, current ততগুণ বাড়বে।

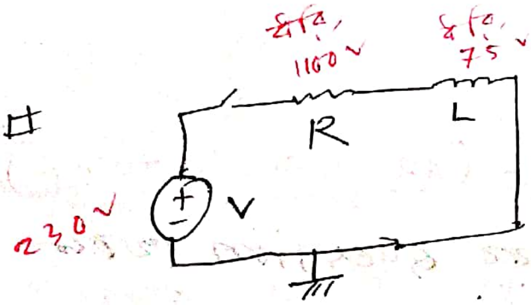
$V \propto I$

$\Rightarrow V = IR$ → proportionality constant

$\therefore R = \frac{V}{I}$

বাস্তবে অবশ্য fixed থাকে না।

#



series
একটা বন্ধ হলে সব বন্ধ হয়ে যায়

সমান্তরালে voltage same থাকে।

Electrical circuit (60-70%)

Book — (i) Fundamentals of Electric circuits — Alexander → Main book

(ii) Introductory circuit Analysis — Boylestad

machine

(III) Alternating and direct current machinery - Rosenblatt

(IV) Electrical Technology - Theraja

(V) Electronic devices and circuit theory - Boylestad

(1) D-day - (21-08-19) শুরু

Md. Farhamdur Reza

Course Name: Basic electrical circuit

Course no: EEE-1241

part

1. circuit - 6 টার question
2. machine } 2 টার "
3. Electronics }

BOOK:

Electric circuit - Alexander (বই + class lecture)

পরীক্ষায় বই এবং বিগত বছরের question থেকে হুবহু common পড়বে না।

charge: charge is an electrical property of an atomic particle of which material consists, measured in C (coloumb)

atom = electron + proton + neutron

(-ve charged) (+ve) charge chargeless

e ছাড়া অন্য কোনো positively charge হবে। কারণ proton এর পরিমাণ e এর চেয়ে বেশী হয়ে যায়।

চার্জকে সাধারণত q দিয়ে। (denoted as q)

current: ~~The ar~~

dt → dq

1 → $\frac{dq}{dt}$

$i = \frac{dq}{dt}$

dt সময়ে প্রবাহিত চার্জের পরিমাণ dq

∴ 1 " " " $\frac{dq}{dt}$

$i = \frac{dq}{dt}$

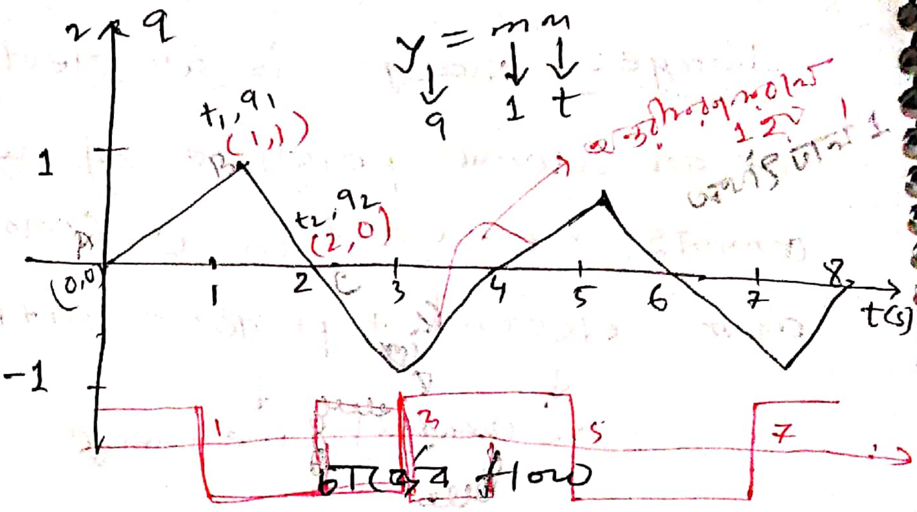
The amount of charge flows through a wire/conductor per unit time is called current.

The rate of change of charge is called current.

$i = \frac{dq}{dt}$

$\Rightarrow Q = \int i \, dt$

চার্জের flow



$$q(t) = \begin{cases} t & 0<t<1 \\ -t+2 & 1<t<3 \end{cases}$$

~~$0<t<1$~~

$$\frac{y-y_1}{y_1-y_2} = \frac{x-x_1}{x_1-x_2}$$

$$\text{slope} = \frac{y_1-y_2}{x_1-x_2}$$

বিকল্প:

$$y - y_1 = \frac{y_1-y_2}{x_1-x_2}(x-x_1)$$

~~$\Rightarrow q - y_1 = \frac{0-1}{2-1}(t-x_1)$~~

AB এর ঢাল $= \frac{1-0}{1-0} = 1$

BC এর ঢাল $= -1$

~~$\therefore i(t) = \begin{cases} 1 & 0<t<1 \\ -1 & 1<t<3 \end{cases}$~~

$\Rightarrow q-1 = \frac{1-0}{1-2}(t-1)$

$\Rightarrow q = -t+2$

অথবা, $q-1 = \frac{1-(-1)}{1-3}(t-1)$

$\Rightarrow q = -t+2$

$$\therefore i(t) = \begin{cases} 1 & 0<t<1 \\ -1 & 1<t<3 \end{cases}$$

The current flowing through an element

$$i(t) = \begin{cases} 2A & 0 < t < 1 \\ 2t^2 A & t > 1 \end{cases}$$

find the amount of charge from $t=0$ to $t=2$

Ans>

$$q = \int_0^2 i\,dt$$

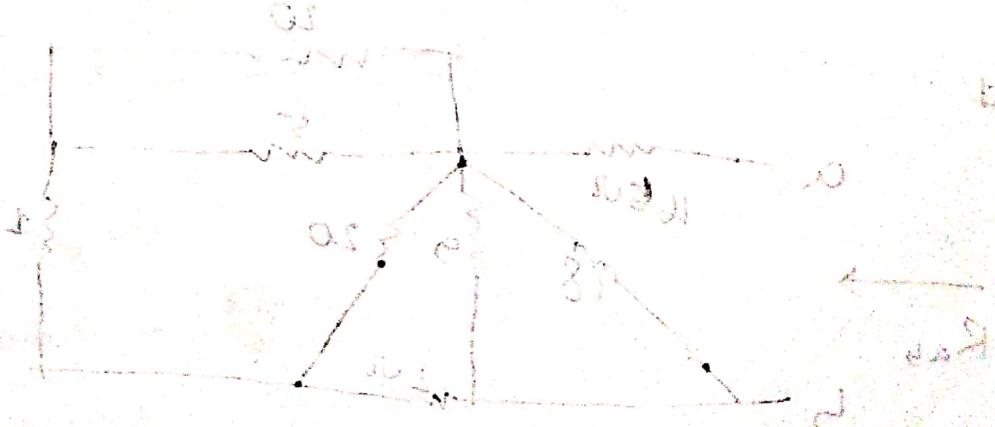
$$= \int_0^1 2\,dt + \int_1^2 2t^2\,dt$$

$$= 2 + \left[\frac{2}{3}t^3\right]_1^2$$

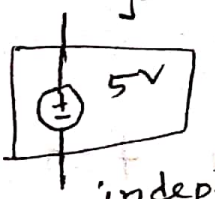
$$= 2 + \frac{2}{3}(8-1)$$

$$= 2 + 4.667$$

$$= 6.667\ C$$

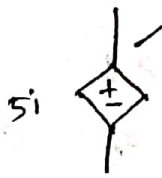


(1) E-day (24-08-19)

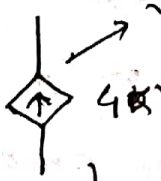


voltage source

independent source



current control voltage source



voltage control current source

Dependent source

current source (current source)

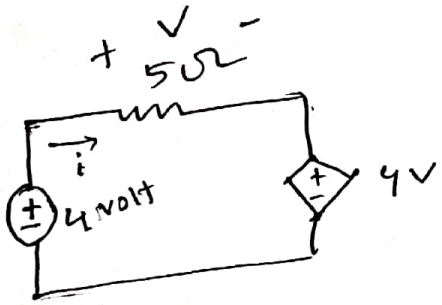
voltage ও্র মধ্যদিয়ে current flow করে।

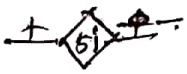
(i) voltage control voltage source / voltage current source

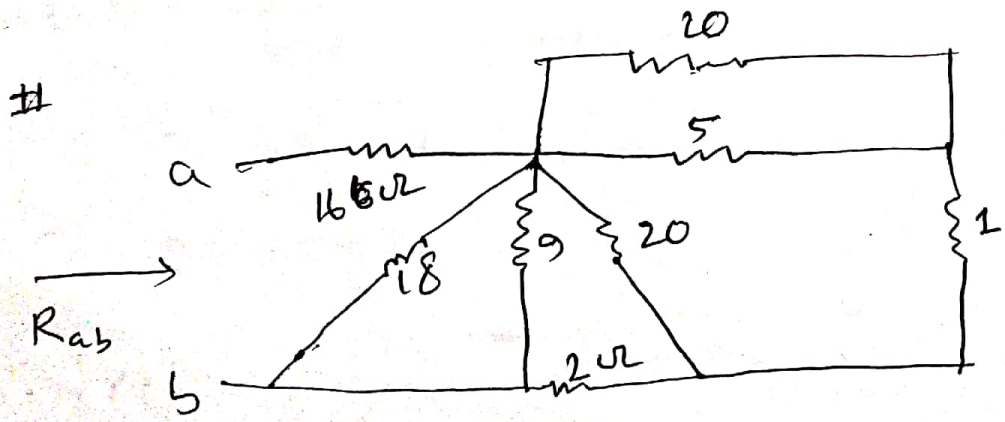
(ii) current " " "

(iii) voltage " current "

(iv) current " " "







Find the equivalent resistance / Rab / Req

$5 \| 20 = \frac{5 \times 20}{5+20}$

$= 4\Omega$

$4 + 1 = 5\Omega$

$5 \| 20 = 4\Omega$

$4 + 2 = 6\Omega$

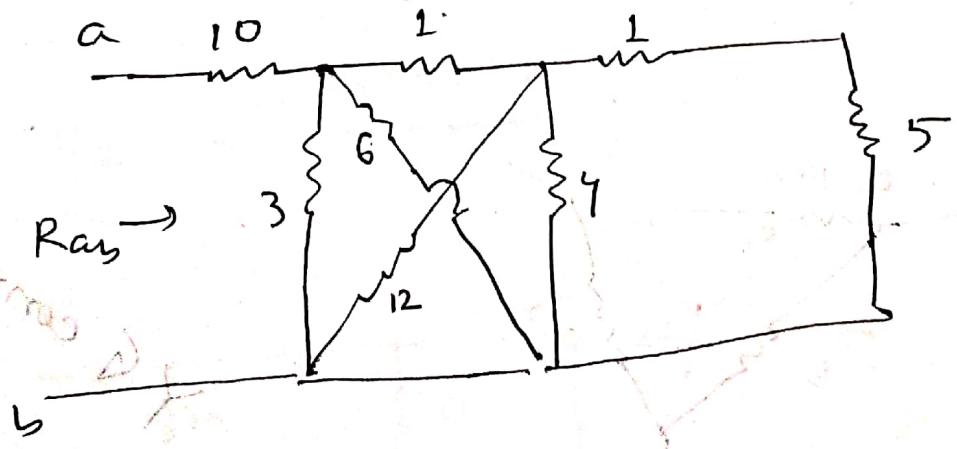
$18 \| 9 \| 6 = \frac{1}{\frac{1}{18} + \frac{1}{9} + \frac{1}{6}}$

$= 3\Omega$

$\therefore R_{eq} = 16 + 3$

$= 19\Omega$

#



##

$5 + 1 = 6\Omega$

$6 \| 4 \| 12 = \frac{12}{5} = 2\Omega$

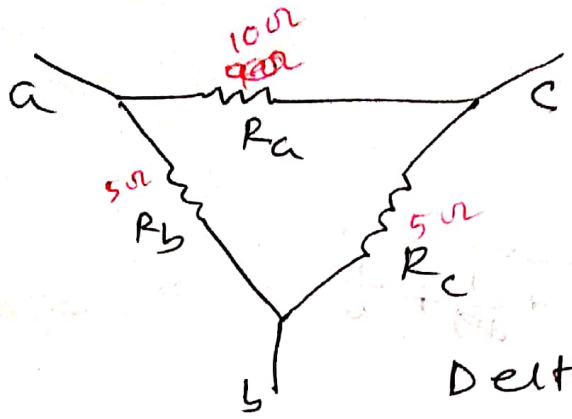
$2 \frac{12}{5} + 1 = 3$

$3 \| 6 \| 3 = \frac{6}{5}$

$\therefore R_{eq} = \frac{6}{5} + 10$

$=$

#



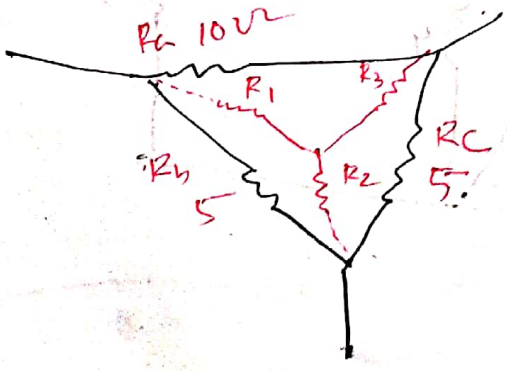
Delta network

Y

wye network

$\Delta \Leftrightarrow Y$

convert ΔtoY



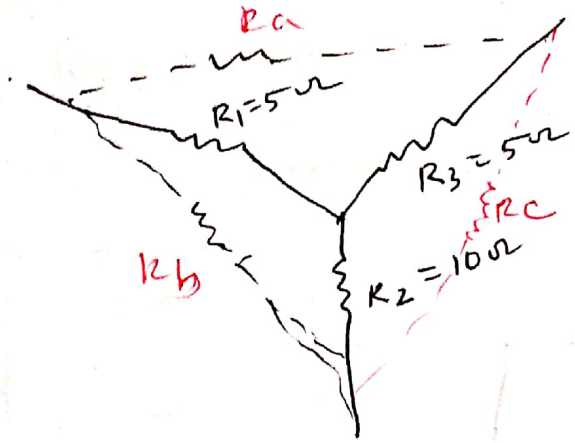
Y convert

$$R_1 = \frac{R_a R_b}{R_a + R_b + R_c} = \frac{10 \times 5}{10 + 5 + 5}$$

$$R_2 = \frac{R_b R_c}{R_a + R_b + R_c}$$

$$R_3 = \frac{R_a R_c}{R_a + R_b + R_c}$$

#



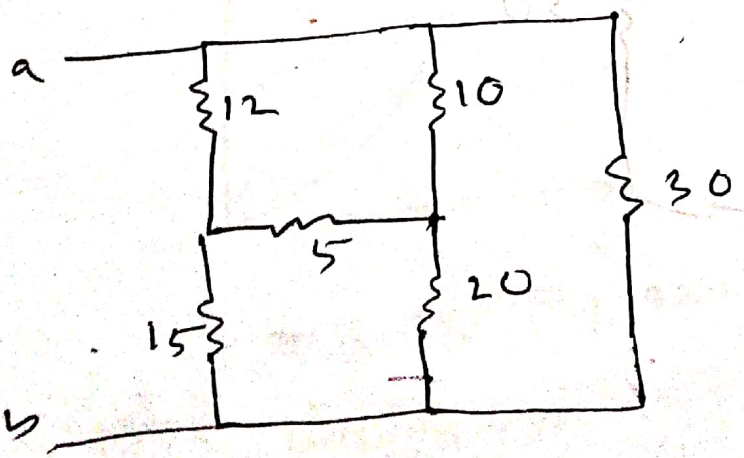
wye to ~~del~~ delta

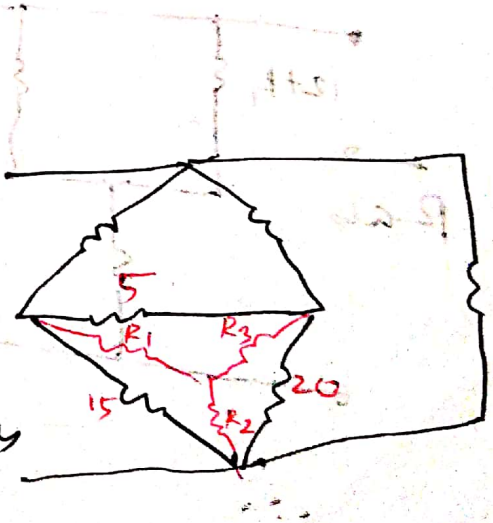
$$R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_2}$$

$$R_b = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_3}$$

$$R_c = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1}$$

#





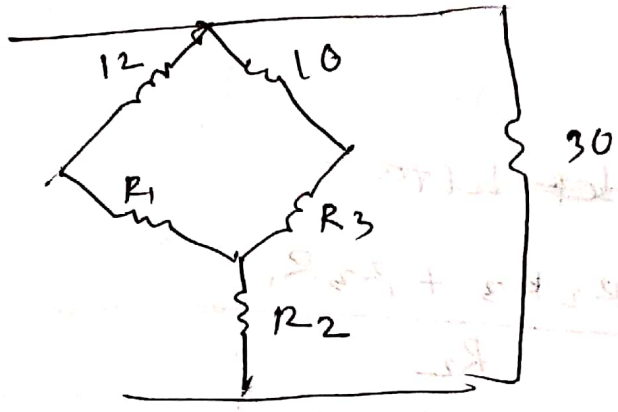
Scanned by CamScanner

$$R_1 = \frac{5 \times 15}{5+15+20}$$

$$R_2 = \frac{15 \times 20}{5+15+20}$$

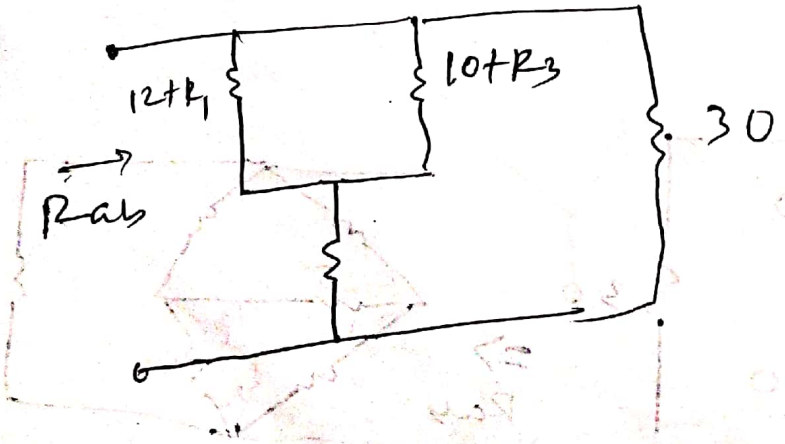
$$R_3 = \frac{5 \times 20}{5+15+20}$$

$\Rightarrow$



12 এবং R_1 বিপরীত

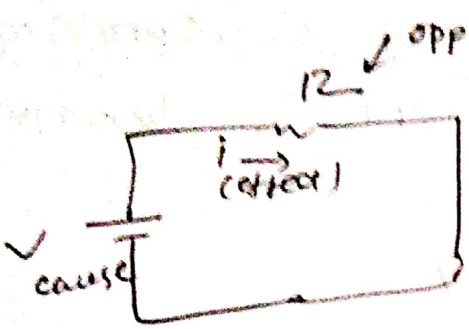
10 " R_2 R_3 "



problem

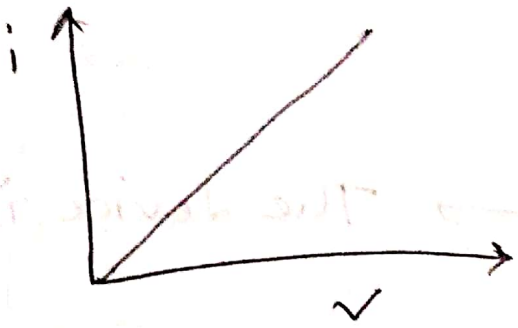
Alexander : 2·51, 2·53, 2·45, 2·46

Homework

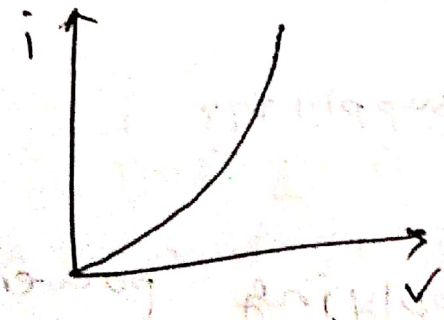


$$\text{effect} = \frac{\text{cause}}{\text{opposition}}$$

$$i = \frac{V}{R}$$



voltage হচ্ছে independent variable
current হচ্ছে Dependent variable
x বরাবর independent variable
y হচ্ছে Dependent variable



বাস্তবে এটা পাওয়া যায়।

এটার limitation
কারণ temperature vary করে।

2(c) - Day

27-08-17

power: কোন সময়ে যে কাজ সম্পন্ন হয় ।

power is the time rate of absorbing or supplying energy. It is denoted as p, measured in watt (W.)

$w \rightarrow$ energy

$$p = \frac{dw}{dt}$$

$$= \frac{dq}{dt} \cdot \frac{dw}{dq}$$

$$= iv$$

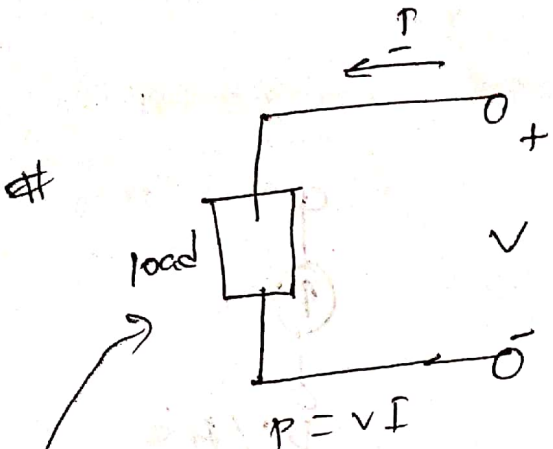
$$= vi$$

If, $p \Rightarrow (+ve) \rightarrow$ The device is absorbing power

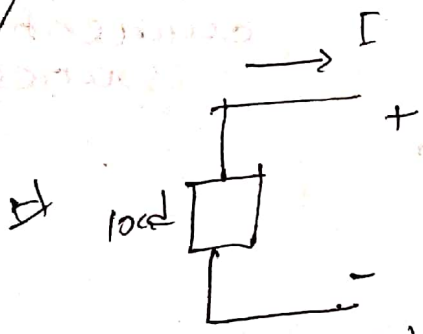
যে mechanical energy to convert হচ্ছে ।

generator power supply দেয় ।

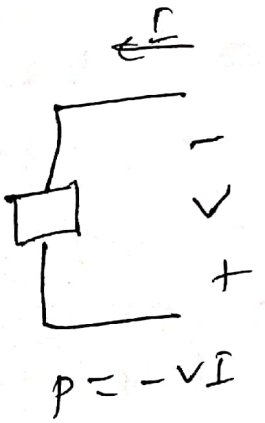
If, $p \rightarrow (-ve)$ $\rightarrow$ supplying power

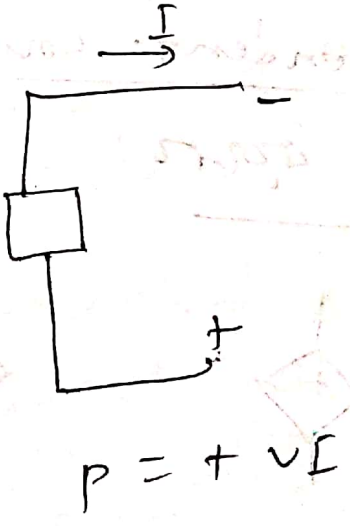


+ দিয়ে ঢুকলে, (−) দিয়ে বের হলে, power (+ve) ধরে absorb



current সব সময় (+) দিয়ে ঢুকে, (−) দিয়ে বের হয়

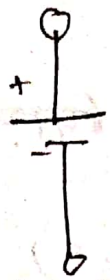




Energy: Energy is the capacity to do work and it is measured in Joule.

$$w = \int_0^t p \, dt$$

$$= pt \quad [\text{power constant হলে}]$$



DC voltage source

AC/DC voltage source

5 বলতে—DC

5 — AC

DC/AC current source

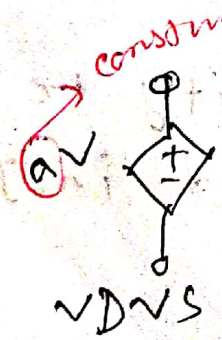
ডায়মন্ড, in dependent source

Dependent Source:

চার প্রকার:

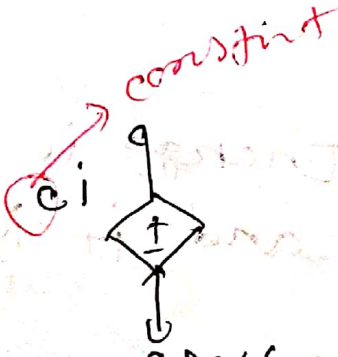
voltage

current source

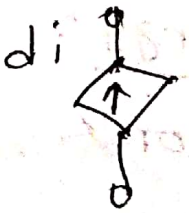


VDVS

VDCS

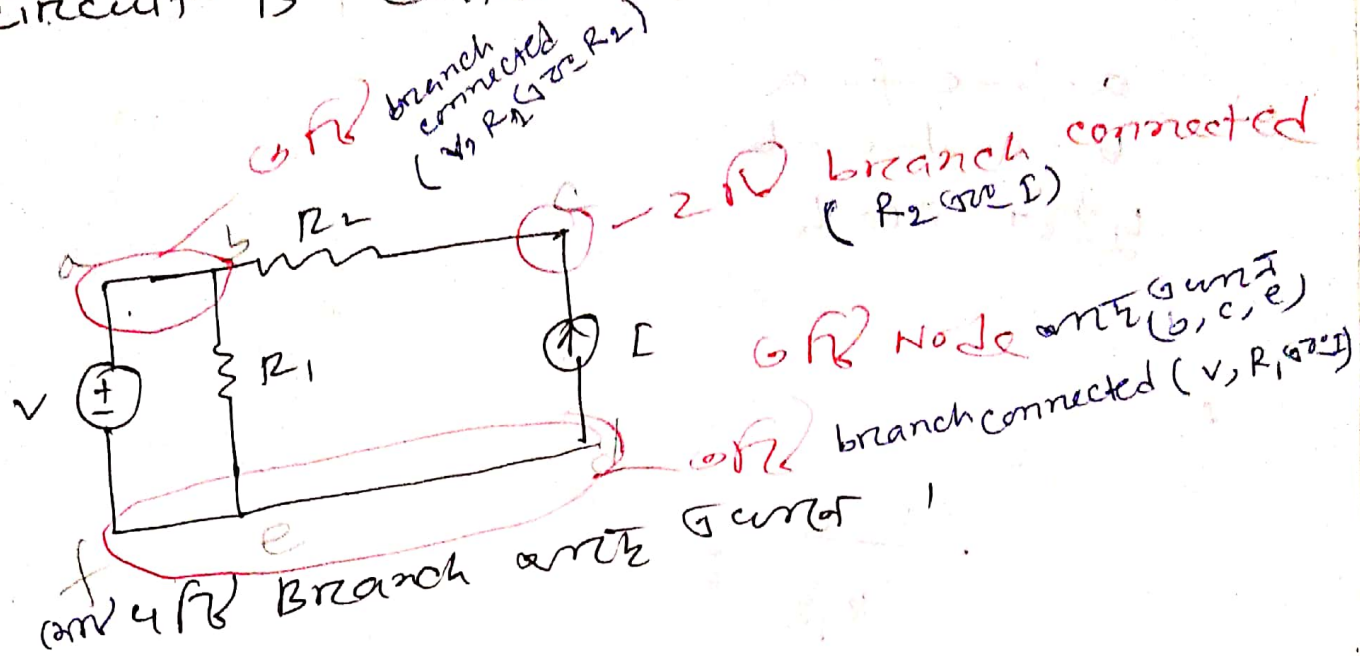


CDVS



CDCS

(I) Branch: Each element of an electrical circuit is called Branch.



(II) Node: এমন circuit এ interconnected point এবং, যেখানে দুই বা ততোধিক branch connected থাকে।

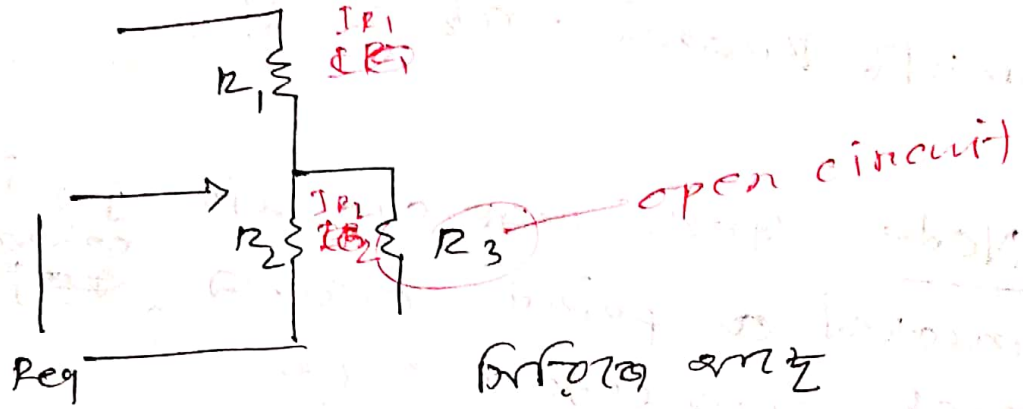
Node is a Interconnected point where two or more branch are connected. (From Sanzida)
(দুই বা তার অধিক branch মিলিত হলে তাকে node বলে। এর হিসাবে, আমাদের ৮ নং node এখানে b তে 3টি ব্রাঞ্চ মিলিত হয়েছে)

(III) Loop: Loop is a close path of a circuit. এমন circuit এ কিছু loop আছে।

a-b-e-f-a
b-c-d-e-b
a-b-c-d-e-f-a

(iv) Mesh: Mesh is also a close path where no other Loop is exist.

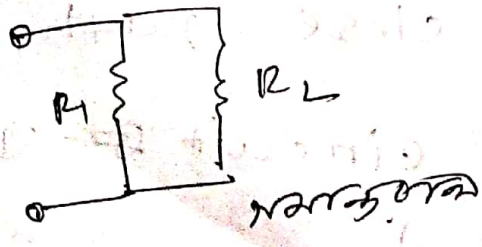
a-b-e-f-a
b-c-d-e-b
দুইটা Mesh



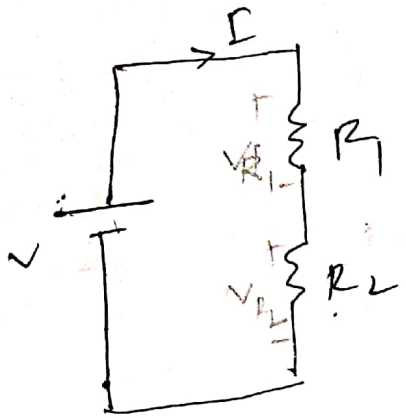
সার্কিট খোলা

$R_{eq} = R_1 + R_2$

$I_{R_1} = I_{R_2}$



voltage devider Rule (series connection)



$$I = \frac{V}{R_1 + R_2}$$

$$V_{R_1} = IR_1$$

$$= \frac{V}{R_1 + R_2} \cdot R_1$$

$$= \frac{R_1}{R_1 + R_2} \cdot V$$

$$V_{R_2} = IR_2$$

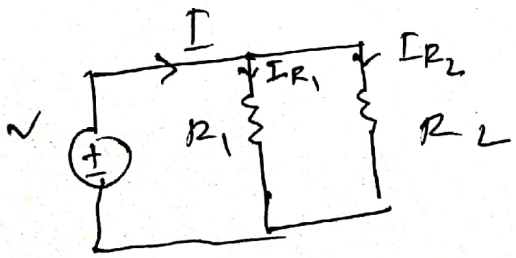
$$= \frac{V}{R_1 + R_2} \cdot R_2$$

$$= \frac{R_2}{R_1 + R_2} V$$

If, N resistors are connected in series, then, voltage across the resistor R_m, $V_{R_m} = \frac{R_m}{R_1 + R_2 + \cdots + R_N} \times$ applied voltage

where, $m = 1, 2 \cdots N$

current devider rule:



$$R_{eq} = \frac{V}{I}$$

$$I_{R_1} = \frac{V}{R_1}$$

$$I_{R_2} = \frac{V}{R_2}$$

$$I = I_{R_1} + I_{R_2}$$

$$\Rightarrow \frac{V}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2}$$

$$\Rightarrow \frac{1}{R_{eq}} = \frac{R_1 + R_2}{R_1 R_2}$$

$$\Rightarrow R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

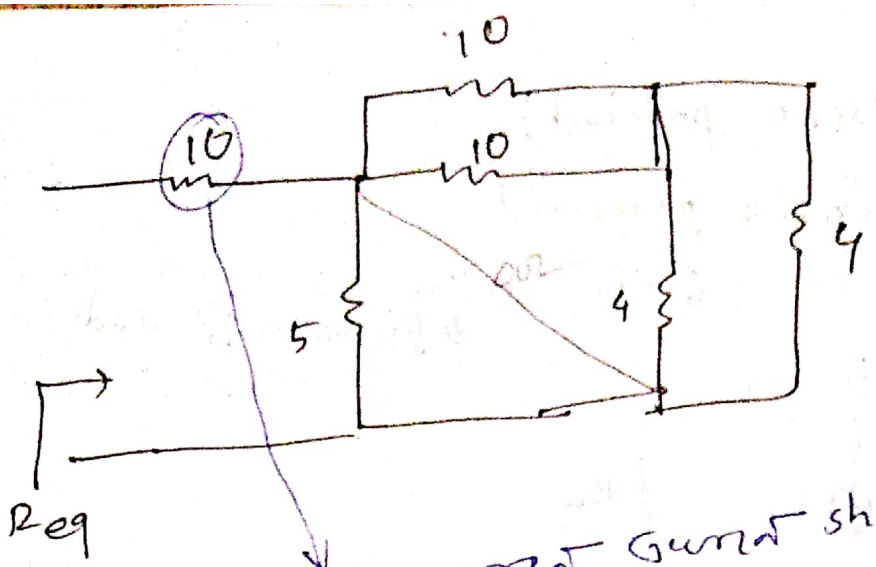
R_{eq} for parallel connection

current devider

$$I_{R_1} = \frac{V}{R_1} = \frac{I R_{eq}}{R_1} = \frac{I}{R_1} \times \frac{R_1 R_2}{R_1 + R_2}$$

$$= \frac{R_2}{R_1 + R_2} I$$

$$I_{R_2} = \frac{R_1}{R_1 + R_2} I$$



Ans : 10 , কারণ উপরে short circuit আছে।

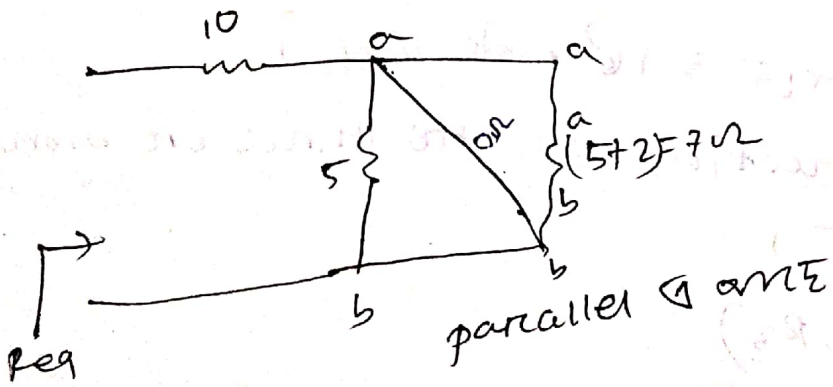
এবার calculation করে সহজে বোঝা,

$10 \parallel 10 \Rightarrow 5\ \Omega$

$4 \parallel 4 \Rightarrow 2\ \Omega$

5 এবং 2 শ্রেণিতে সংযুক্ত,

$5+2 = 7\ \Omega$

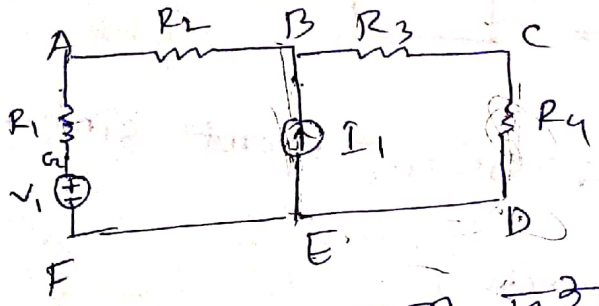


parallel এ আছে

E-day (4th period)

C-day (5th period)

From Youtube: (6 মিনিট 29 সেকেন্ড) definition of node



Node: দুই অথবা দুইয়ের অধিক branch মিলিত হলে তাকে node বলে।

উপরে node গুলো,

A (R_1, R_2)

B (R_2, I_1, R_3)

C (R_3, R_4)

E (V_1, I_1, R_4)

G (R_1, V_1)

উপরে 5 টি node আছে।

Junction: connection যে three or more element থাকে।

B (R_2, I_1, R_3)

E (V_1, I_1, R_4)

দুটি junction

Branches

যারা দুই junction ধরে

BAGFE

BCDE

BE

3 টি Branch

Loop

ABEFGA

BCDEB

ABCDEFA

four Loop

Mesh

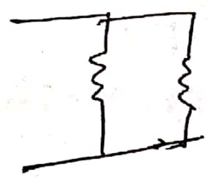
ABEFGA

BCDEB

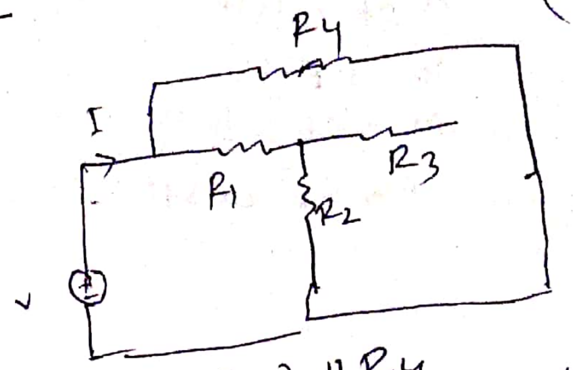
2 no Mesh

(2) D-day

28-08-19

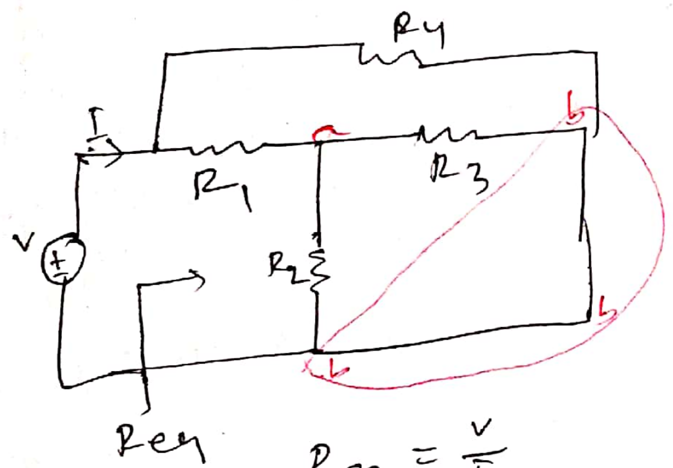


parallel



$(R_1 + R_2) \parallel R_4$

R_3 এ current যাবে না। কারণ open circuit



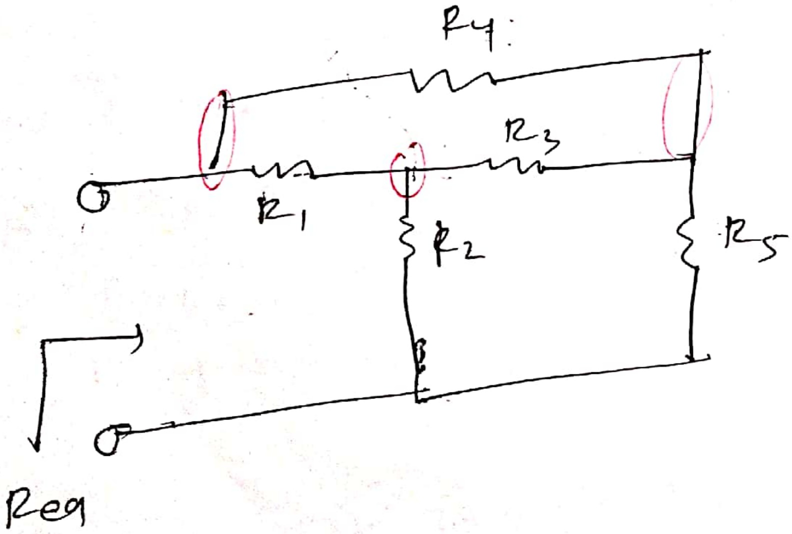
R_2 এবং R_3 parallel

R_1 এর (R_2 ও R_3) এর

$$Req = (R_1 + R_2 \parallel R_3) \parallel R_4$$

$$Req = \frac{V}{I}$$

open circuit এ current প্রবাহিত হয় না।



রেজিস্টরগুলো এখানে সিরিজে বা parallel এ connect নয়

সিরিজে বা parallel না থাকলে ডেল্টা থেকে Y বা স্টার আছে

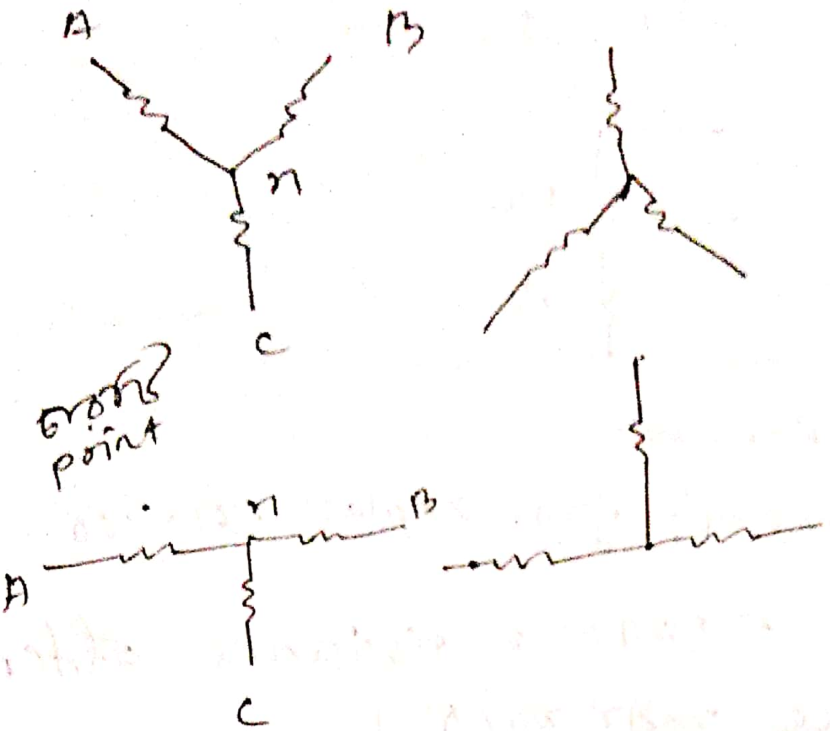
$R_1 R_4 R_3$ — Δ

$R_1 R_3 R_2$ — Y

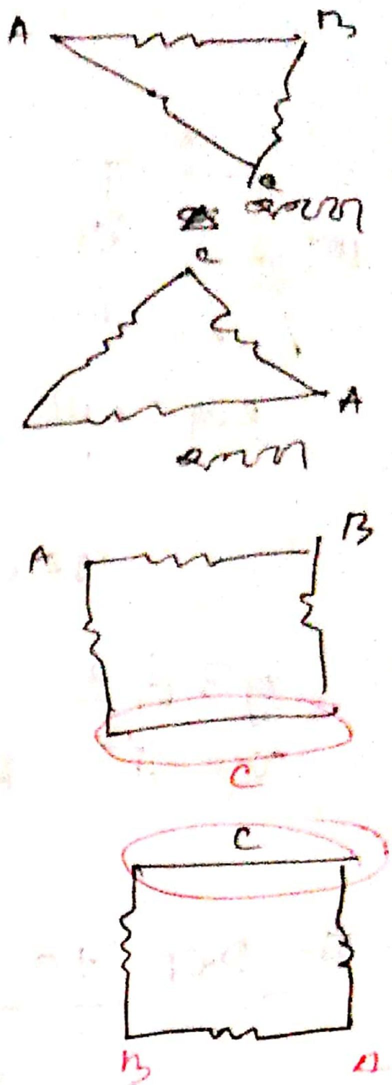
$R_2 R_3 R_5$ — Δ

$R_5 R_3 R_4$ — Y

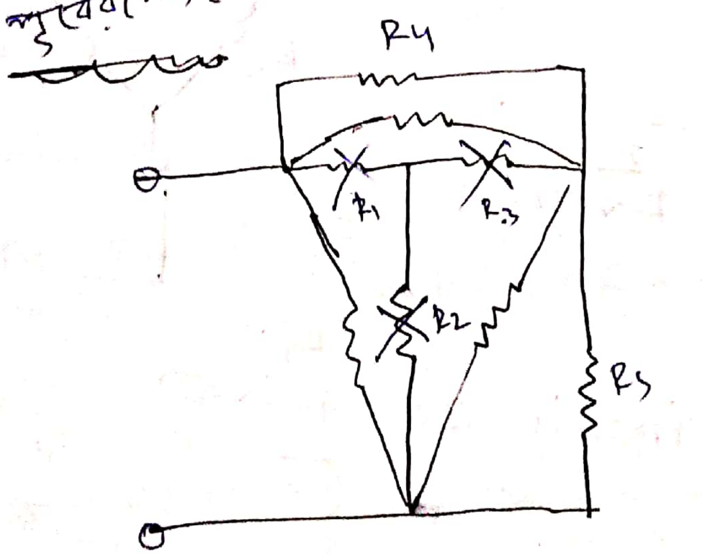
wye-connected



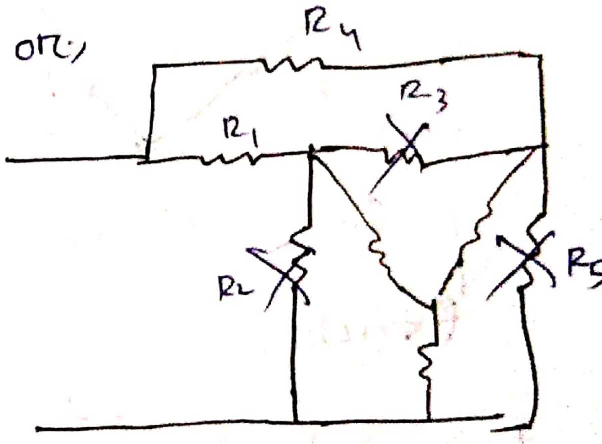
Del-connected

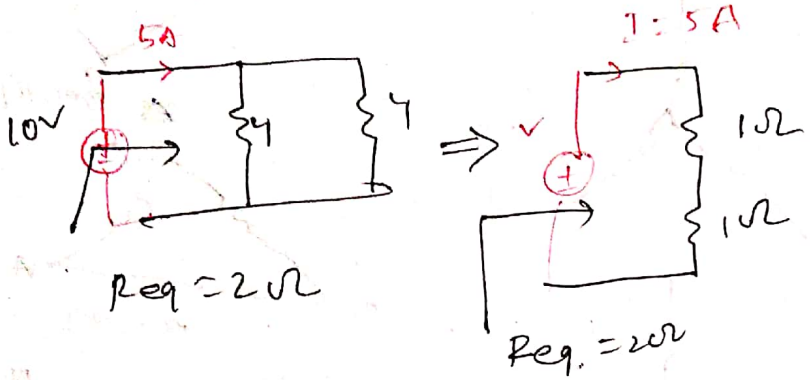


তিনটি resistance এর একটি common point (n) থাকবে।



OR,

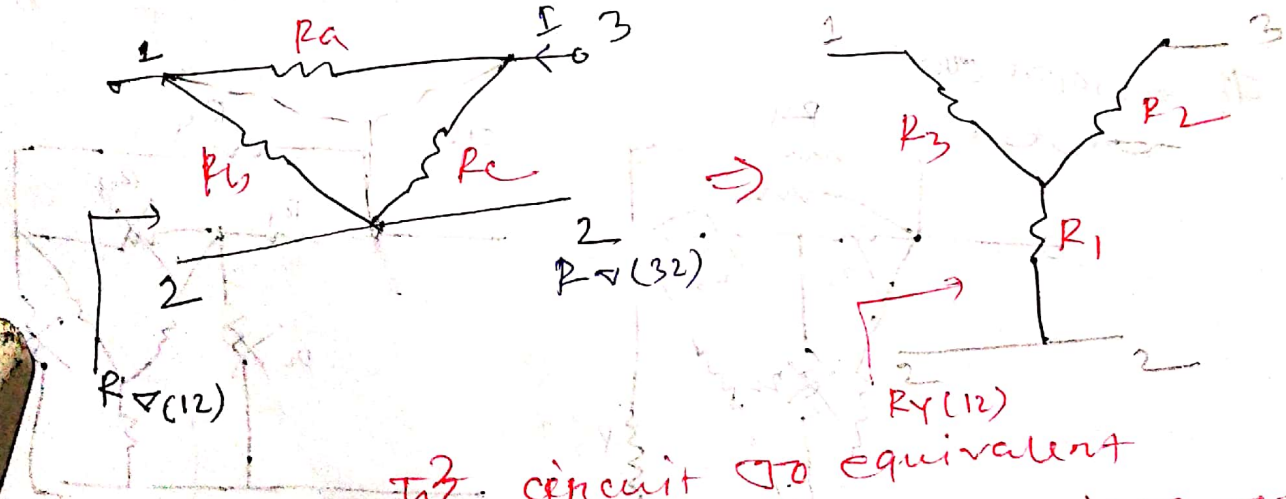




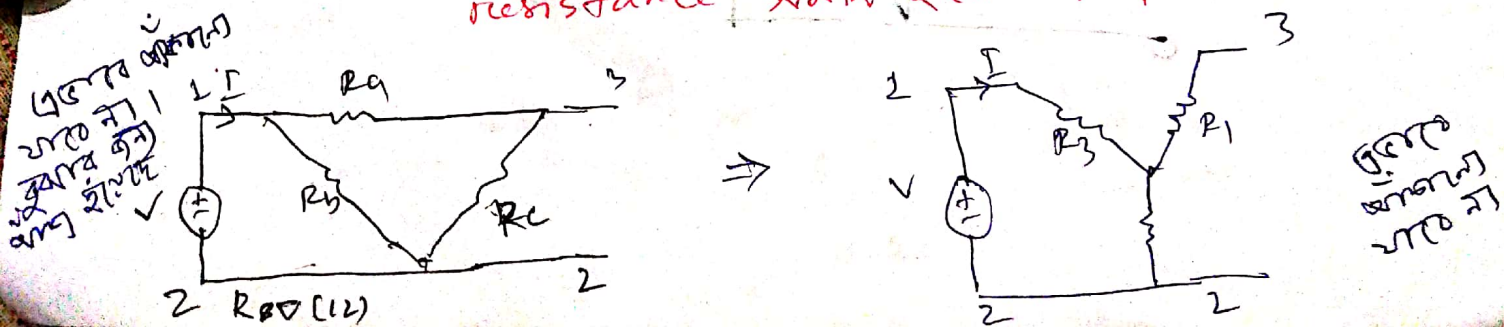
একইভাবে আরও কিছু ক্ষেত্রে replace করা যায়।

যেকোনো same পরিমাণ resistance থাকলে replace করা যায়।

Del to wye conversion:



যেকোনো circuit কে equivalent resistance সমান হলে replace করা যায়



যেভাবে আলাদা করা যাবে না।

যেভাবে আলাদা করা যাবে।

$$R_{\nabla(12)} = R_b \,||\, (R_a + R_c)$$

$$R_{Y(12)} = R_3 + R_1$$

~~$R_{\nabla(12)} = R$~~

$$R_{Y(12)} = R_{\nabla(12)}$$

$$\Rightarrow R_3 + R_1 = \frac{R_b(R_c + R_a)}{R_a + R_b + R_c} \quad \text{— (I)}$$

Now,

$$R_{\nabla(32)} = R_c \,||\, (R_a + R_b)$$

$$R_{Y(32)} = R_1 + R_2$$

$$\therefore R_{Y(32)} = R_{\nabla(32)}$$

$$\Rightarrow R_1 + R_2 = \frac{R_c(R_a + R_b)}{R_a + R_b + R_c} \quad \text{— (II)}$$

similarly,

$$R_2 + R_3 = \frac{R_a(R_b + R_c)}{R_a + R_b + R_c} \quad \text{— (III)}$$

(I) + (II) + (III)

$$2(R_1 + R_2 + R_3) = \frac{2(R_aR_b + R_bR_c + R_cR_a)}{R_a + R_b + R_c}$$

$$\Rightarrow R_1 + R_2 + R_3 = \frac{R_aR_b + R_bR_c + R_cR_a}{R_a + R_b + R_c} \quad \text{— (IV)}$$

R_1 কে সমীকরণ করলে,

(IV) − (III)

$$R_1 = \frac{R_b R_c}{R_a + R_b + R_c}$$

similarly,

$$R_2 = \frac{R_a R_c}{R_a + R_b + R_c}$$

$$R_3 = \frac{R_a R_b}{R_a + R_b + R_c}$$

Wye to Del conversion Homework:

$$R_a = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_1}$$

$$R_b = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_2}$$

$$R_c = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_3}$$

II

If, $R_a = R_b = R_c = R_\Delta$

$$R_1 = \frac{R_\Delta}{3R_\Delta}$$

$$\Rightarrow \frac{R_\Delta}{3}$$

$$R_2 = \frac{R_\Delta}{3} \quad R_3 = \frac{R_\Delta}{3}$$

$\therefore R_1 = R_2 = R_3 = R_Y$ (Ans)

$\therefore R_Y = \frac{R_\nabla}{3}$

$R_\nabla = 3R_Y$

3টি element সমানভাবে থাকলে তবেই applicable

practice problem (assignment)

2.14, 2.15

2.51, 2.56

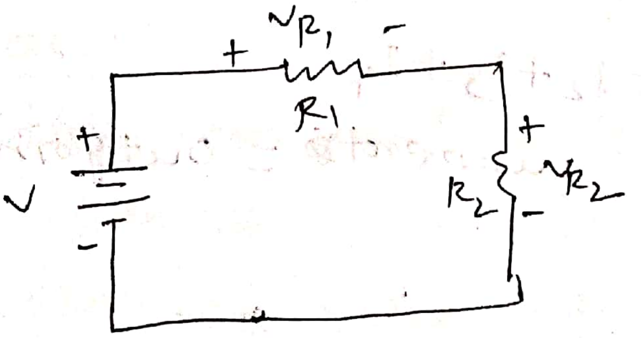
31-08-19 ((2)-E-day)

Kirchhoff's laws:

- KCL
- KVL

KVL:

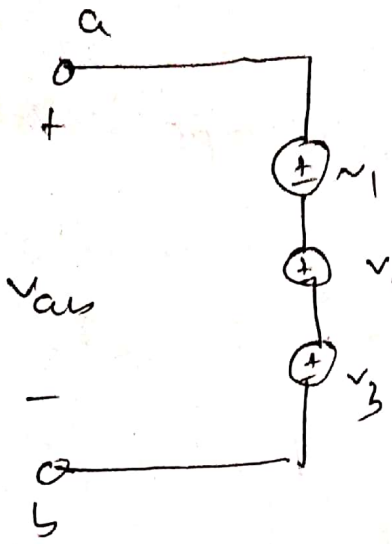
Kirchhoff's voltage law states that the algebraic sum of the voltages in a close path of a circuit is zero.



$-V + V_{R_1} + V_{R_2} = 0$

$\Rightarrow V = V_{R_1} + V_{R_2}$

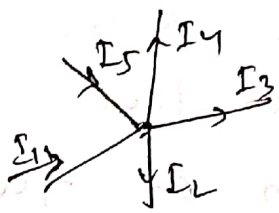
supply voltage = voltage drop



$V_{ab} = V_1 + V_2 + V_3$

$-V_{ab} + V_1 + V_2 + V_3 = 0$

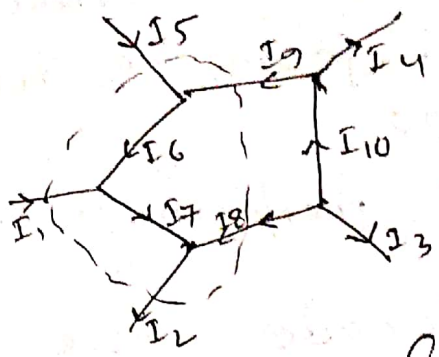
KCL :- KCL states that the algebric sum of the currents in entering in a node or a close boundary is equal to zero



$$I_1 + (-I_2) + (-I_3) + (-I_4) + I_5 = 0$$

$$\Rightarrow I_1 + I_5 = I_2 + I_3 + I_4$$

∴ Entering currents = Outgoing currents



In the close boundary,

$$I_1 + (-I_2) + I_8 + I_9 + I_5$$

$$\Rightarrow (I_7 - I_6) - (I_7 + I_8) + I_8 + I_9 + (I_6 - I_9)$$

$$= I_7 - I_6 - I_7 - I_8 + I_8 + I_9 + I_6 - I_9$$

$$= 0$$

$I_7 = I_{8_1} + I_{6_6}$

$I_5 = I_6 - I_9$

$I_6 = I_5 + I_9$

Methods of circuit Analysis:

(i) Nodal Analysis

(ii) Mesh Analysis

(i) Nodal Analysis:

process:

1) First we need to determine the number of nodes in the circuit

2) Then we need to consider a node as a reference node

2) Generally we ~~cond~~ consider the voltage of the reference node ~~as~~ is ~~zero~~ equal to zero.

ground point কে reference node ধরব

3) we need to denode the potential of each node with respect to reference node ~~exp~~ except the reference node.

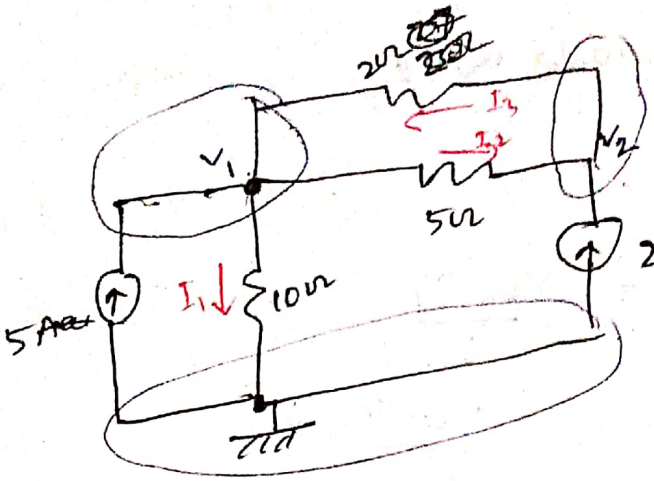
n সংখ্যক থাকলে (n-1) সংখ্যক

4) we need ~~a~~ to apply KCL at each node.

5) Then we need to solve the expressions obtain from ~~KVL~~ KCL ~~to determine the~~ at each node to determine the potential of each node.

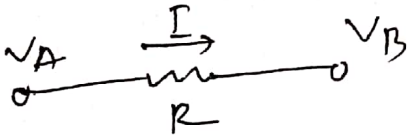
calculator use করে ~~solve~~ equation solve করতে হবে।

যাদের বেশী Interconnection থাকবে — reference node



5A, 10Ω, 5Ω, 2A, 5Ω
মোট 1টি node
3টি node

circuit-এর ground-এর potential V_1
" V_2
"



current যে circuit দিয়ে voltage-এর বিপরীত দিকে চলে।

$$I = \frac{V_A - V_B}{R}$$

current দুইভাবে ধরা যায়

Applying KCL at node 1

$$5 + I_3 = I_1 + I_2$$

I_3-এর জন্য V_2 বেশি high potential

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

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

~~$\Rightarrow 50 + 5V_2 - 5V_1$~~

$$\Rightarrow 8V_1 - 7V_2 = 50$$

App KCL at node 2

$$2 + I_2 = I_3$$

$$\Rightarrow 2 + \frac{V_1 - V_2}{5} = \frac{V_2 - V_1}{2}$$

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

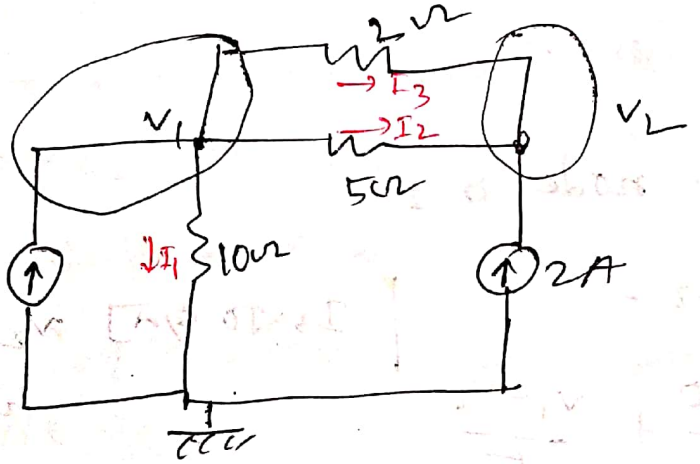
$$\Rightarrow 5V_2 - 5V_1 = 20 + 2V_1 - 2V_2$$

$$\Rightarrow 5V_2 + 2V_2 - 5V_1 - 2V_1 = 20$$

$$\Rightarrow 7V_2 - 7V_1 = 20$$

$$\Rightarrow 7V_1 - 7V_2 = -20$$

#



$$5 = I_1 + I_2 + I_3$$

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

$$\Rightarrow 8V_1 - 7V_2 = 50$$

At node-2

$$2A + I_2 + I_3 = 0$$

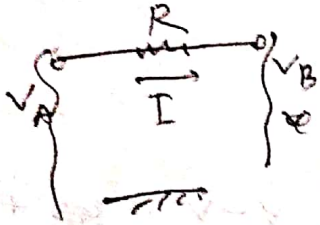
$$\Rightarrow 2A + \frac{V_1 - V_2}{5} + \frac{V_1 - V_2}{2} = 0$$

$$\Rightarrow \frac{20 + 2V_1 - 2V_2 + 5V_1 - 5V_2}{10} = 0$$

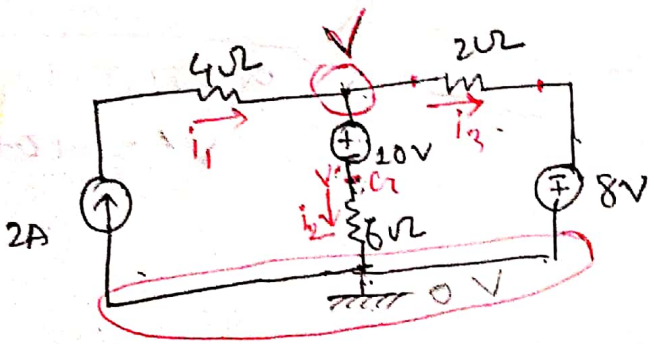
$$\Rightarrow 20 + 2V_1 - 2V_2 + 5V_1 - 5V_2 = 0$$

$$\Rightarrow 7V_1 - 7V_2 = -20$$

(3) D-day
7-9-17



$V_A - V_B = V_{AB}$



যদি কিছু বলা না থাকে, Math করার জন্য তিন বা তার অধিক Interconnection point কে node ধরব।

তিন বা তার অধিক connection কে node ধরলাম

V হচ্ছে V point এবং ground এর potential.

KCL অনুযায়ী

$i_1 = i_2 + i_3$

$i_1 = 2$

$i_2 = \frac{(-10+V)-0}{6}$

$i_3 = \frac{\{V-(-8)\}-0}{2}$

$= \frac{V+8}{2}$

$i_1 = i_2 + i_3$

$\therefore 2 = \frac{-10+V}{6} + \frac{V+8}{2}$

V বের হবে,

i_2, i_3 এর voltage drop এর বিষয় বের করা যাবে,

$i_2 = \frac{-10+V}{6}$

$i_3 = \frac{V+8}{2}$

এখন Independent source এ i_1 এ 2A current supply

2V

$i_1 = 2$

এক্ষেত্রে V point এর potential = −10

10V

V_A — V_B

$V_A - V_B = 10$

$V_B - V_M = -10$

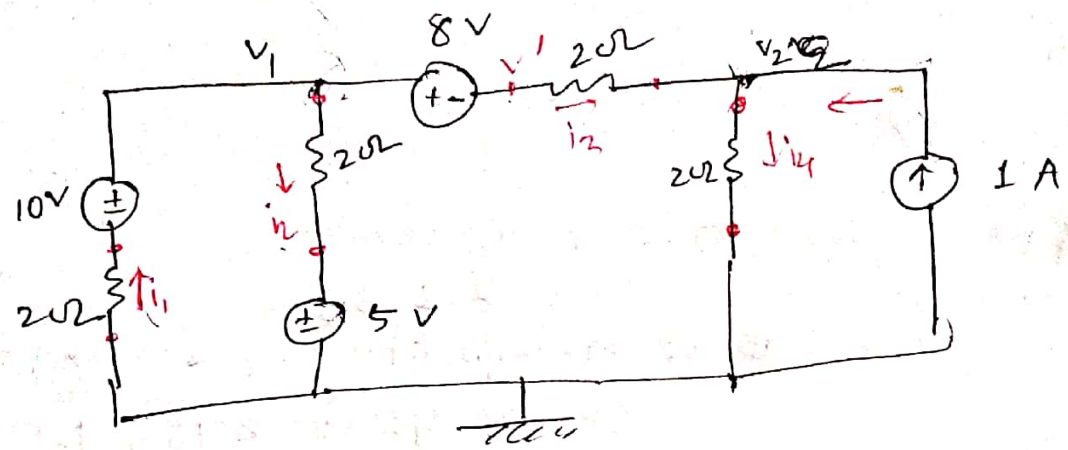
V' = ground এর voltage

$V - V' = +10$

$\Rightarrow V' = V - 10$

এখন,

$V' = -10 + V$



$V_1 - V' = 10$
$\Rightarrow V' = V_1 - 10$

~~$i_1 = i_2 + i_3$~~

Applying KCL at node 1,

i3 টা শুধু ground এ যেতে পারে বাম side দিয়ে

$i_1 = i_2 + i_3$

~~$\Rightarrow \frac{-10-V_1}{2} - \frac{(V_1 - V' + 5) - 0}{2} + \frac{(8 - V_2) - 0}{2}$~~

$$\Rightarrow \frac{0-(-10+V_1)}{2} = \frac{V_1 - 5}{2} + \frac{(-8+V_1) - V_2}{2}$$

i3 এর জন্য V2 থেকে ground এ

Applying KCL at node 2

$1 + i_3 = i_4$

$$\Rightarrow 1 + \frac{(-8+V_1) - V_2}{2} = \frac{V_2 - 0}{2}$$

$V_1 - V' = 8$
$\Rightarrow V' = V_1 - 8$

$V' = -8 + V_1$

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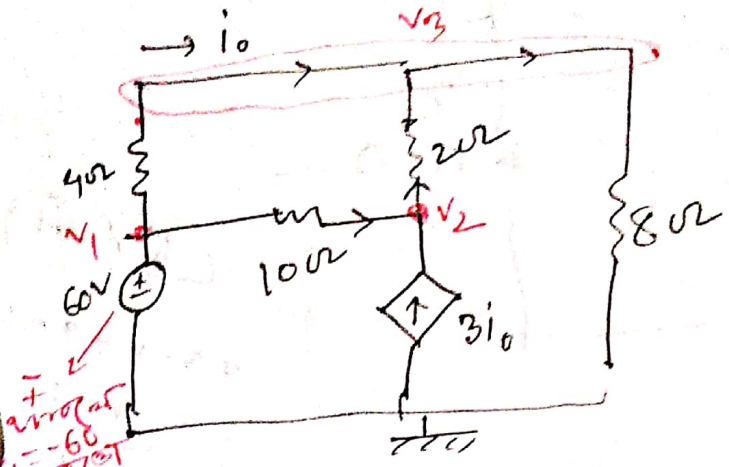
chapter-3

example
3.1

assignment — practice problem —
3.1, 3.2, 3.3
এর অনুশীলনী থেকে যে
কোনো দুইটি করিন problem

3.17

(3)E Day
8-9-12



Node-1

$v_1 = 60$ V

Node-2

$$\frac{v_1 - v_2}{10} + 3i_o = \frac{v_2 - v_3}{2}$$

Node-3

$$\frac{v_1 - v_3}{4} + \frac{v_2 - v_3}{2} = \frac{v_3 - 0}{8}$$

super node :

যদি দুটি node এর মাঝে শুধুমাত্র voltage source থাকে তাহলে দুইটা node কে একসাথে একটা node consider করা হয়।

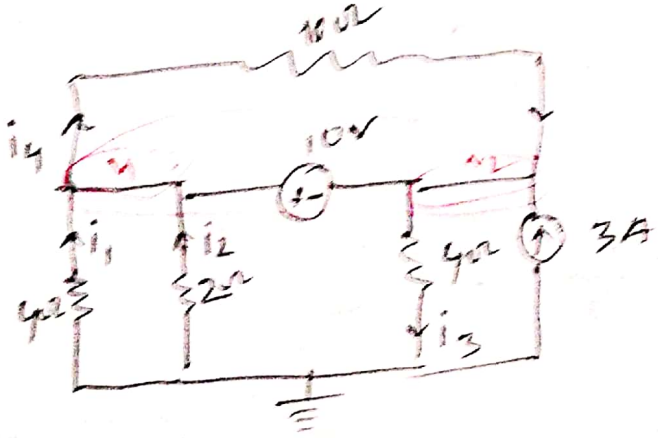
এখানে series G resistance থাকলে super node বলা যাবে না।

$i_1 + i_2 + 3 = i_3$

$\Rightarrow \frac{0-v_1}{4} + \frac{0-v}{2} + 3 = \frac{v_2-0}{4}$ — (1)

$v_1 - v_2 = 10$ — (11)

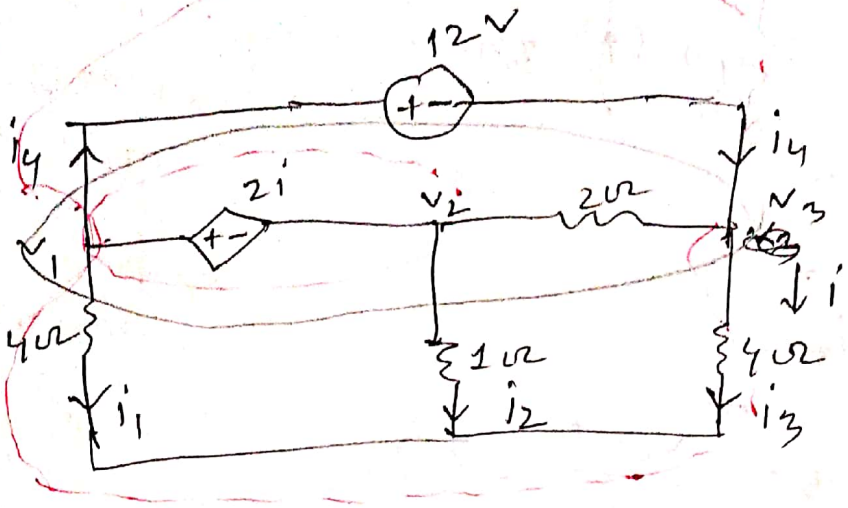
#



$i_1 + i_2 + 3$ ~~i_3~~ $+ i_4 = i_3 + i_4$

$\Rightarrow i_1 + i_2 + 3 = i_3$

3.20



$$i_1 + i_2 + i_3 + i_4 = i_4$$

$$\Rightarrow i_1 + i_2 + i_3 = 0$$

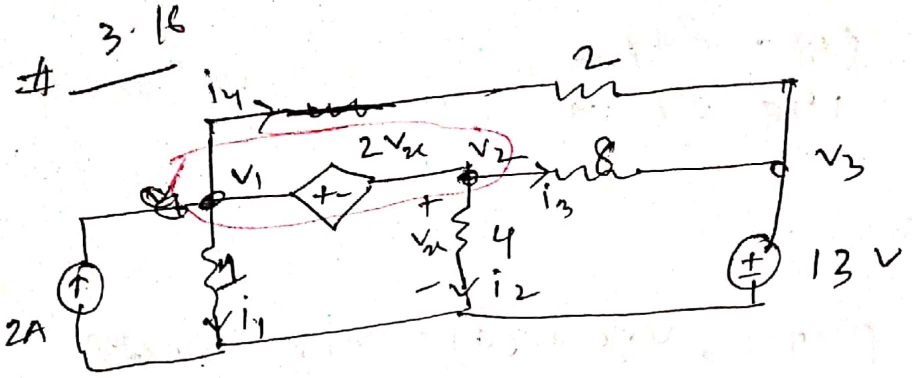
$$\Rightarrow \frac{V_1}{4} + \frac{V_2}{1} + \frac{V_3}{4} = 0 \quad \text{— (1)}$$

$$V_1 - V_3 = 12 \quad \text{— (11)}$$

$$V_1 - V_2 = 2i$$

$$\Rightarrow V_1 - V_2 = 2 \cdot \frac{V_3}{4} \quad \text{— (111)}$$

3.16



সিমেন্স এ কাজ হইছে

v_1 ও ground এর node থেকে হবে ভুলবে না। তাই এটা neglect করা যাবে না

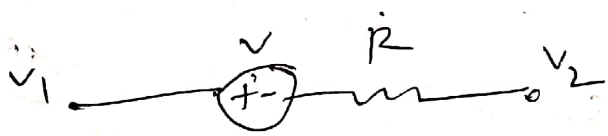
$$2A = i_1 + i_2 + i_3 + i_4$$

$$\Rightarrow 2A = \frac{v_1 - 0}{1} + \frac{v_2 - 0}{4} + \frac{v_2 - v_3}{8} + \frac{v_1 - v_3}{2} \quad \text{--- (I)} \qquad v_x = v_2$$

$$v_1 - v_2 = 2v_x \quad \text{--- (II)}$$

$$v_3 = 13 \quad \text{--- (III)}$$

যদি দুটি node এর মাঝে



$$I = \frac{-V + v_1 - v_2}{R}$$

তাহলে supernode করা যাবে না।

$I = ?$

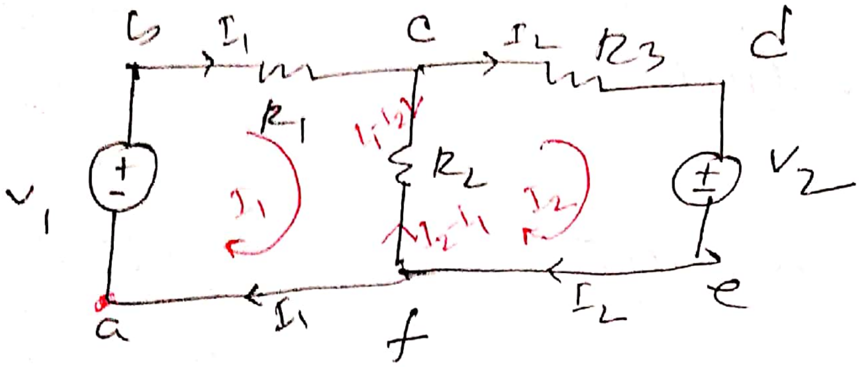
অর্থাৎ I সরাসরি বের করা যায় না।

(4)c-day
14-09-19

Mesh Analysis

Mesh হচ্ছে এমন close path, যার মধ্যে অন্য (কোনো) close path থাকবে না।
Mesh কে কিন্তু বলা যায় loop?

Mesh is a closed path of a circuit where no other closed path exist.



abcfa → Mesh
cdefc → Mesh
abcdefa → Mesh নয়

দুই mesh এর current এর direction দুই দিকে হলে $(I_1 - I_2)$ অথবা $(I_2 - I_1)$ হবে

steps of mesh Analysis:

1. we need to determine the number of meshes in a circuit.
2. Then we need to consider the direction of current in each mesh if it is not given.

3. After this, KVL is applied in each mesh

Then we need to solve the expressions obtained from KVL in each mesh.

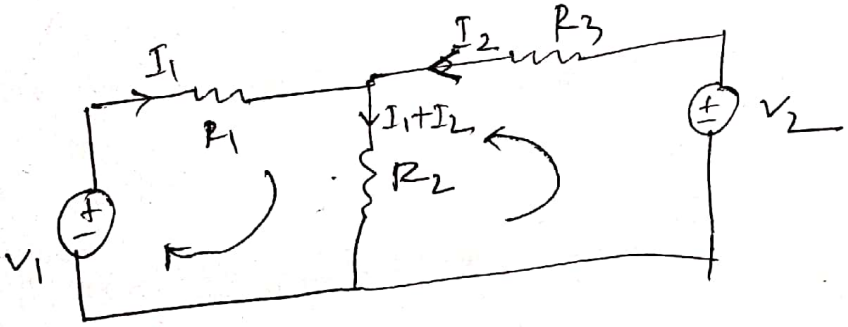
Mesh-1:

$$-V_1 + I_1R_1 + (I_1 - I_2)R_2$$

Mesh-2:

$$I_2R_3 + V_2 + (I_2 - I_1)R_2 = 0$$

$$\Rightarrow I_2R_3 + V_2 - (I_1 - I_2)R_2 = 0$$



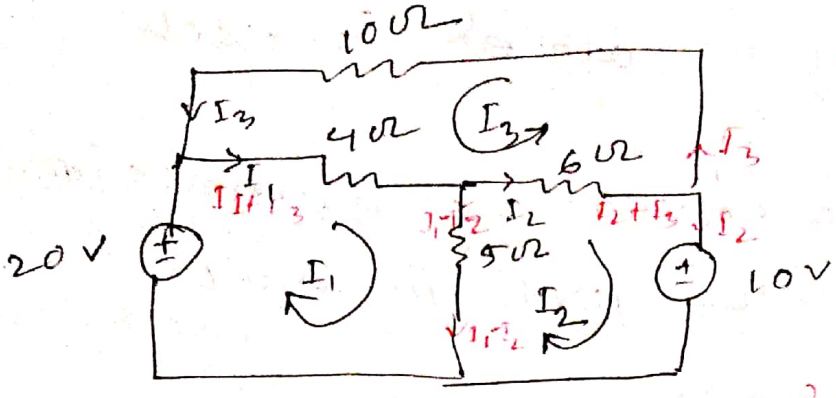
Mesh-1:

$$-V_1 + I_1R_1 + (I_1 + I_2)R_2 = 0$$

Mesh-2:

~~$I_2R_3 + V_2$~~

$$-V_2 + I_2R_3 + (I_1 + I_2)R_2 = 0$$



Mesh-1 (বাম লুপ)

$$-20 + (I_1 + I_3)4 + (I_1 - I_2)5 = 0$$

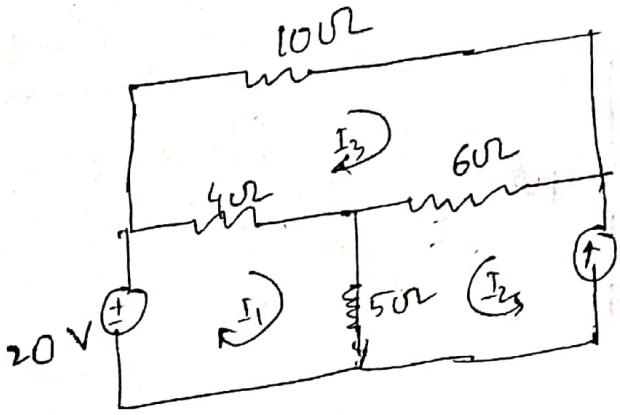
Mesh-2 (ডান লুপ)

$$(I_2 + I_3)6 + 10 + (I_2 - I_1)5 = 0$$

Mesh-3 (উপরের লুপ)

$$10I_3 + (I_1 + I_3)4 + (I_2 + I_3)6 = 0$$

#



voltage source থাকলে সেখানে KVL apply করা যাবে না।

$I_2 = 2A$

I_2 যখন 2A এর দিক যেদিকে থাকে তখন +2 এবং যখন বিপরীত দিক থাকে তখন -2।

Mesh-1:

$$-20 + (I_1 - I_3)4 + (I_1 + 2)5 = 0$$

Mesh-2:

~~$(2 + I_3)6 + (I_1 + 2)5 = 0$~~

Mesh-3:

$$10I_3 + (2 + I_3)6 + (I_3 - I_1)4 = 0$$

mesh Analysis এর দুটো problem করে দেখাতে হবে।

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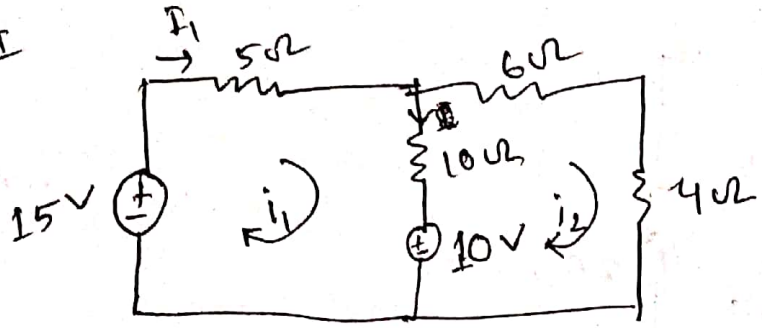


Mesh-1

$$-15 + 5I_1 + 10(I_1 - I_2) + 10 = 0$$

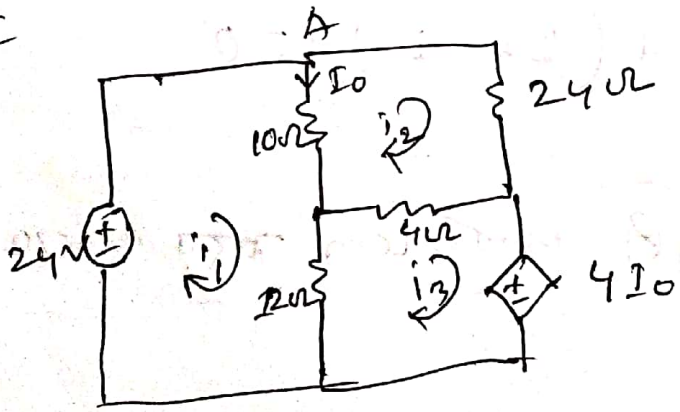
Mesh-2:

$$-10 + 10(I_2 - I_1) + 6I_2 + 4I_2 = 0$$

$$I_1 = 1\ A$$

$$I_2 = 1$$

#



Mesh-1:

$$-24 + 10(i_1 - i_2) + 12(i_1 - i_3) = 0$$

$$\Rightarrow 11i_1 - 5i_2 - 6i_3 = 12$$

Mesh-2:

$$24 i_2 + 4(i_2 - i_3) + 10(i_2 - i_1) = 0$$

$$\Rightarrow -5i_1 + 19 i_2 - 2i_3 = 0$$

Mesh-3:

$$4I_0 + 12(i_3 - i_1) + 4(i_3 - i_2) = 0$$

But at node A, $I_0 = i_1 - i_2$, so that,

$$4(i_1 - i_2) + 12(i_3 - i_1) + 4(i_3 - i_2) = 0$$

$$\Rightarrow -i_1 - i_2 + 2i_3 = 0$$

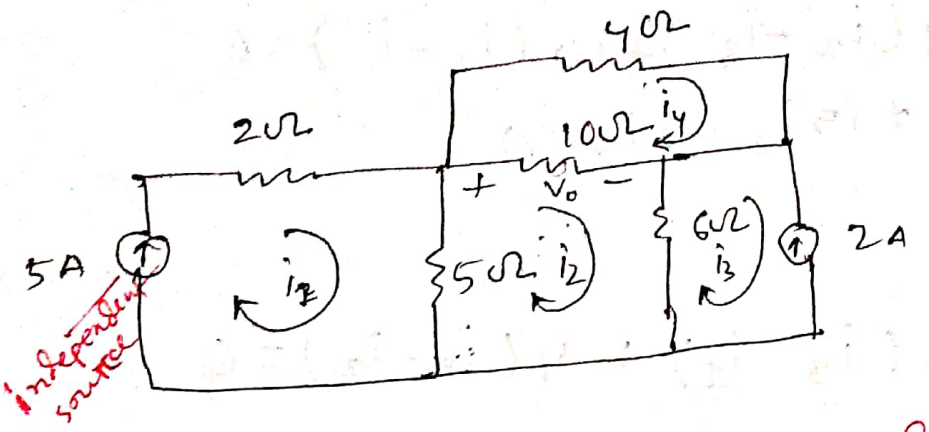
$\therefore i_1 = 2.25\,A$

$i_2 = 0.75\,A$

$i_3 = 1.5\,A$

(4) D-Day

15-09-19



4Ω mesh

independent source ও current constant থাকে।

Mesh-1:

$i_1 = 5A$

$V_o = 10(i_4 - i_2)$

$V_o = 10(i_2 - i_4)$

Mesh-1:

$5(i_2 - i_1) + 10(i_2 - i_4) + 6(i_2 - i_3) = 0$

$i_3 = -2A$

Mesh-2:

$4i_4 + 10(i_4 - i_2) = 0$

যে Branch এ current source থাকবে সেখানে KVL apply করার দরকার নাই।

From mesh-1:

$5i_2 - 5i_1 + 10i_2 - 10i_4 + 6i_2 - 6i_3 = 0$

$\Rightarrow 5i_2 - 25 + 10i_2 - 10i_4 + 6i_2 + 12 = 0$

$\Rightarrow 21i_2 - 10i_4 = 13$

From mesh 2

$-10i_2 + 14i_4 = 0$

$\therefore i_2 = 0.93$

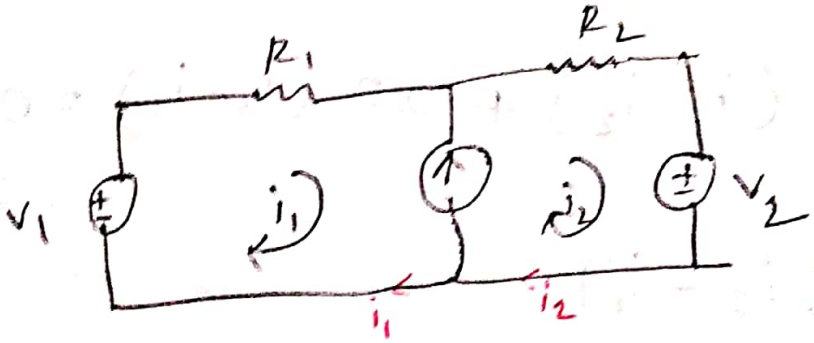
$i_4 = 0.67$

$V_0 = 10(i_2 - i_4)$

$= 2.68\ V$

Super Mesh:

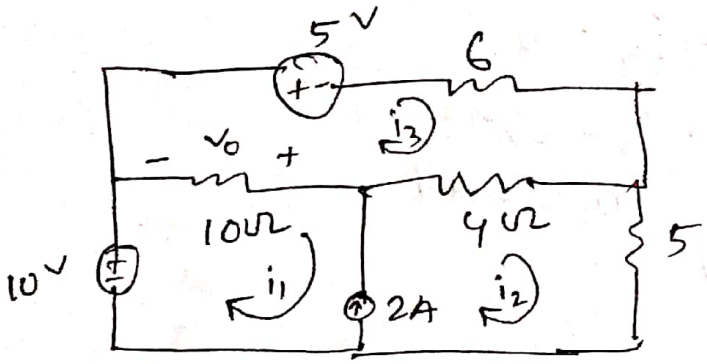
যদি দুটি mesh এ common branch এ শুধু current source থাকে তখন দুটি mesh কে একসাথে super mesh consider করা হয়।



$-V_1 + i_1R_1 + i_2R_2 + V_2 = 0$ — (1)

$i_2 - i_1 = 0$ I

current এলোমেলো দিকে flow করছে, তাকে i_2 ধরা হয়েছে। তাই i_2 থেকে i_1 বিয়োগ করা হয়েছে।



$v_o = ?$

& super mesh,

$$-10 + 10(i_1 - i_3) + 4(i_2 - i_3) + 5i_2 = 0$$

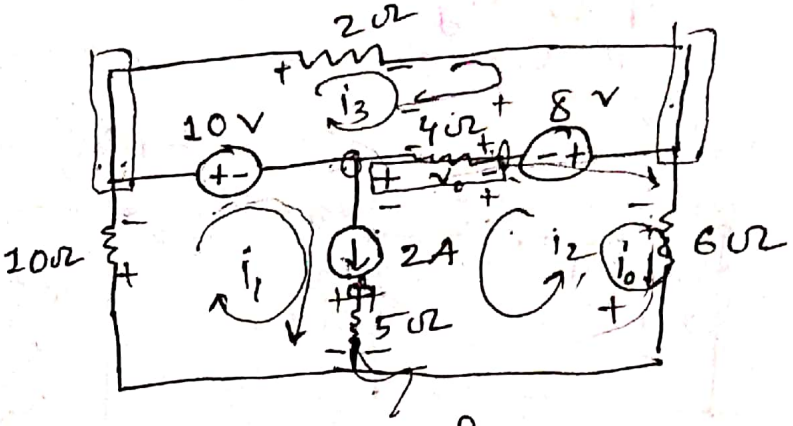
$$i_2 - i_1 = 2$$

Mesh-2:

$$5 + 6i_3 + 4(i_3 - i_2) + 10(i_3 - i_1) = 0$$

$$v_o = 10(i_3 - i_1)$$

CT * syllabus — Mesh, node analysis

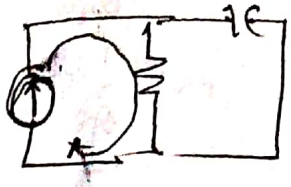


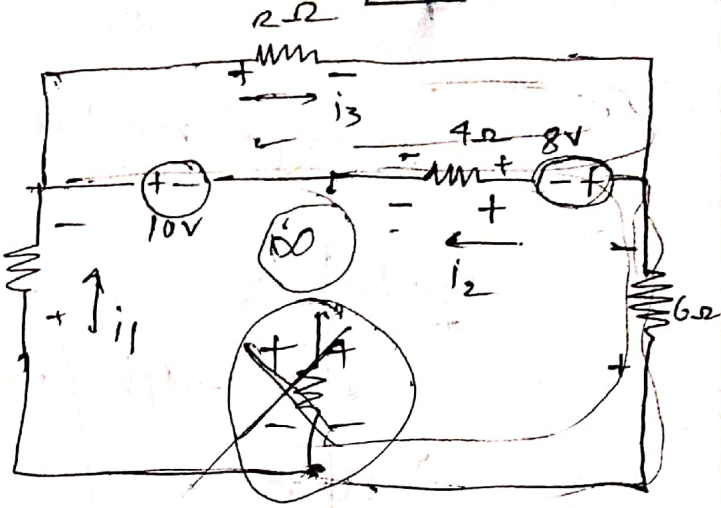
$v_o = ?$

$i_o = ?$

Node mesh

① In de— branch current





$i_1 =$

$i_2 = +$

$i_3 = -$

$+10 - (i_2+i_3)\times 4 - 8 - (i_1 \pm$

$10\, i_1 = 0$

~~$\pm (i_2 - i_3)$~~

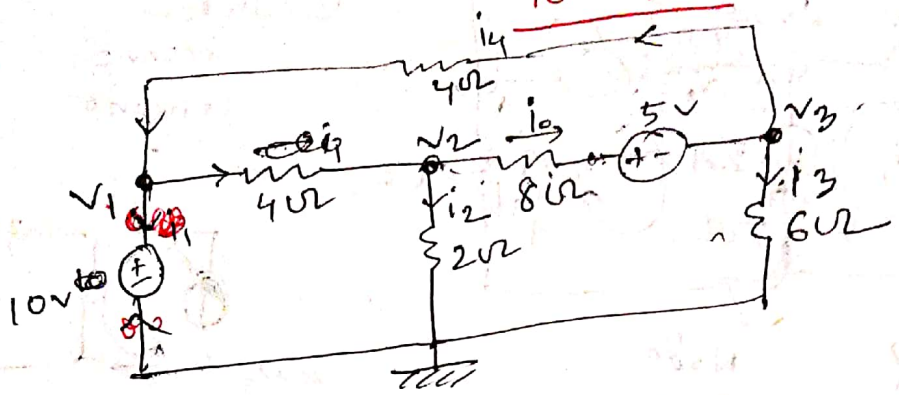
$+2i_3 + 8 + (i_2+i_3)\times 4 - 40 = 0$

$i_1 + i_2 = 2$

current ক্ষেত্রে current কে ধরতে হয় open circuit

voltage ক্ষেত্রে voltage কে ধরতে হয় short circuit

4(E) - day
16-09-19



$5 + V_3$

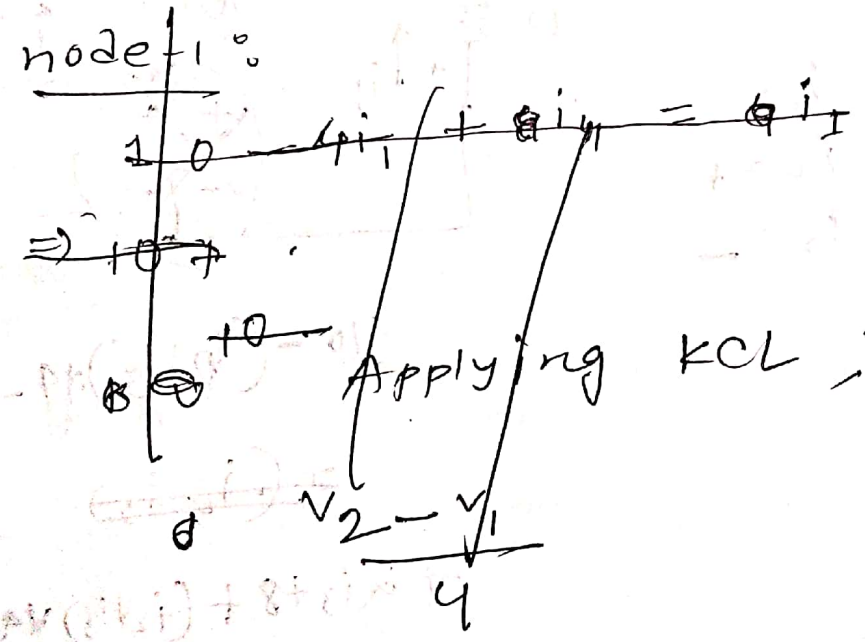
$V' - V_3 = 5$

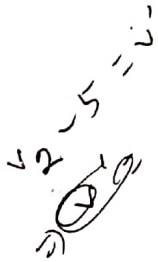
$V' = 5 + V_3$

$V_2 - (5 + V_3)$

using nodal Analysis find i_o

node-1 :





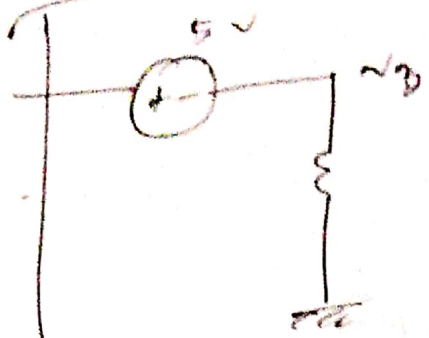
node-1 :

$V_1 = 10\,V$

node-2

$$\frac{V_2 - (5 + V_3)}{8} + \frac{V_2}{2} = \frac{V_1 - V_2}{4}$$

$$\Rightarrow 7V_2 - V_3 = 25 \quad \text{—(1)}$$



$5 + V_3$ 2Ω ground

node-3

$$\frac{V_2 - (5 + V_3)}{8} = \frac{V_3}{6} + \frac{V_3 - V_1}{4}$$

$$\Rightarrow 3V_2 - 13V_3 = -45$$

$$I_0 = \frac{V_2 - (5 + V_3)}{8}$$

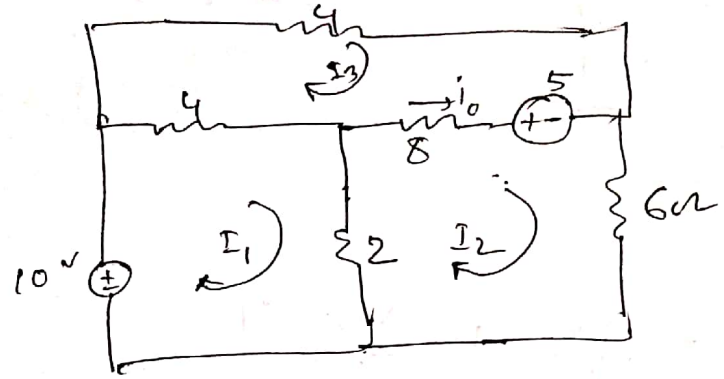
$V_2 = 4.2$

$V_3 = 4.43$

$$\therefore I_0 = \frac{4.2 - 5 - 4.43}{8}$$

$$= -0.65375 \text{ A}$$

Mesh



Mesh-1:

$$-10 + 4(I_1 - I_3) + 2(I_1 - I_2) = 0$$

$$\Rightarrow 6I_1 - 2I_2 - 4I_3 = 10 \quad \text{—(1)}$$

Mesh-2:

~~$8I_2 + 5 + 6I_2$~~

$$8(I_2 - I_3) + 5 + 6I_2 + 2(I_2 - I_1) = 0$$

$$\Rightarrow -2I_1 + 16I_2 - 8I_3 = -5 \quad \text{—(2)}$$

Mesh-3

$$4I_3 - 5 + 8(I_3 - I_2) + 4(I_3 - I_1) = 0$$

$$\Rightarrow -4I_1 - 8I_2 + 16I_3 = 5$$

~~$i_o = 8(I_2 - I_3)$~~

$I_1 = 2.84^0$

$I_2 = 0.7938$

$I_3 = 1.392$

~~$\therefore i_0 = 8(I_2 - I_3)$~~

~~$= 8(0.74 - 1.39)$~~

~~$= -5.2$~~

$i_0 = (I_2 - I_3)$

$= 0.739 - 1.392$

$= -0.653$