Syllabus

Subject Name : Basic Electrical Engineering

Module 1 : DC Network

Module 2 : AC Circuit

Module 3 : Three phase system

Module 4 : Single Phase Transformers

Module 5 : Electrical Machines

a) DC Machine

b) Three phase Induction Motor

Module 6 : Electrical Installations

Module 7 : Power Converters

Books :- Abhijit Chakrabortty & Sudipta Debnath
Basic Electrical Engineering.

Theraja & Theraja
Basic Electrical Engineering

Module 1

1) Ohm's Law

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

Resistance

Inductor:-

Inductors is the property of a substance that will oppose the rate of change of current through it.

unit :- Henry (H)

KCL

The sum of the current flowing towards the node is equal to the sum of the current flowing away from the node.

In any network, the algebric sum of current at any node = 0

$$\Sigma i = 0$$

~~In a junction / node~~, KCL is only applicable ~~false~~. in a junction / node.

KVL

It states that the algebric sum of the product of current and resistance of various branches of a closed loop + the algebric sum

of EMF in that closed loop is equals to zero.

$$\Sigma IR + \Sigma E = 0$$

It is always applicable to a closed loop.

Defn:-

i) Circuit:- A circuit is a close conducting path through which an electrical current flows.

ii) Linear Circuit and Non-Linear Circuit:-

→ A linear circuit is one whose parameter is constant with time. And they always Ohm's Law.

Some Linear Elements are - Resistor, Inductor, Capacitor etc.

→ A Non-linear circuit is that whose parameter changes with time.

Ex:- Diode, transistors, etc.

Ex: A.R

In an open circuit, current = 0 Resistance = ∞

In a short circuit path Resistance = 0 Current = ∞

ideal case

Network

iii) Active and Passive Network:-

→ Active Network is one which contains one or more than one source of EMF, means any battery will be connected through there.

- Voltage source
- Current source

→ Passive Network is one which contains no source of EMF.

iv) Uni-lateral circuit & Bi-lateral circuit:- (Transmission Line - Example)

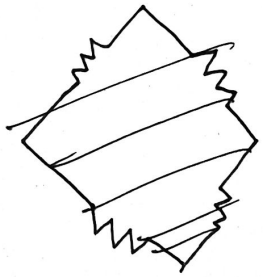
→ Unilateral circuit (Diode, ~~Transistors~~) is that whose properties or characteristics will change with the direction of its operation

Example:- rectifier

→ A Bilateral circuit is one whose properties or characteristics are same in either direction.

v) Node:- This a junction point in a circuit where two or more branches are connected together.

vi) **Branch:-** This a part of network which lies between two nodes, that is called branch.

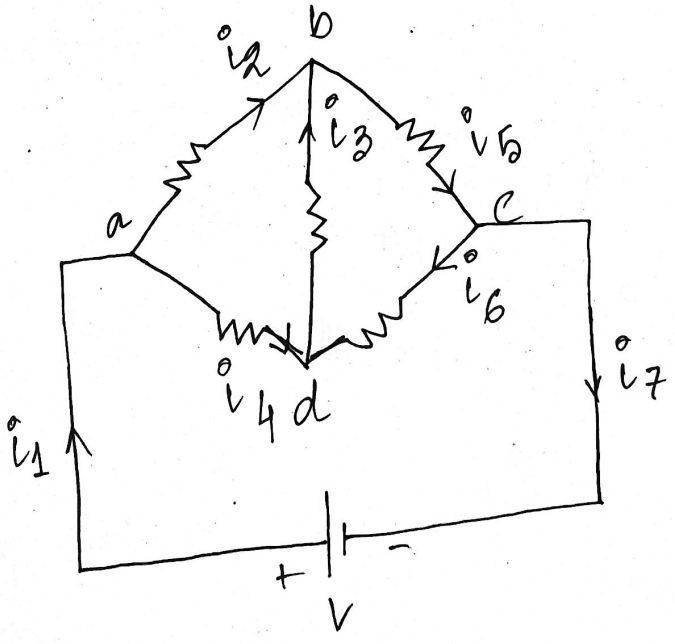


vii) **Loop:-** It is the closed path in a circuit.

viii) **Mesh:-** It is the shortest closed circuited path in a network which contain no other loop within it.

Problem

1)



Find the magnitude and direction of the current, given, $i_1 = 20A$, $i_2 = 12A$, $i_5 = 8A$

→ Now, from the figure, we can say,

$$i_1 = i_7$$

$$\therefore \quad i_7 = 20\ A$$

- Apply KCL at node a

$$i_1 = i_4 + i_2$$
$$20 = i_4 + 12$$
$$i_4 = 8A$$

- Apply KCL at node b

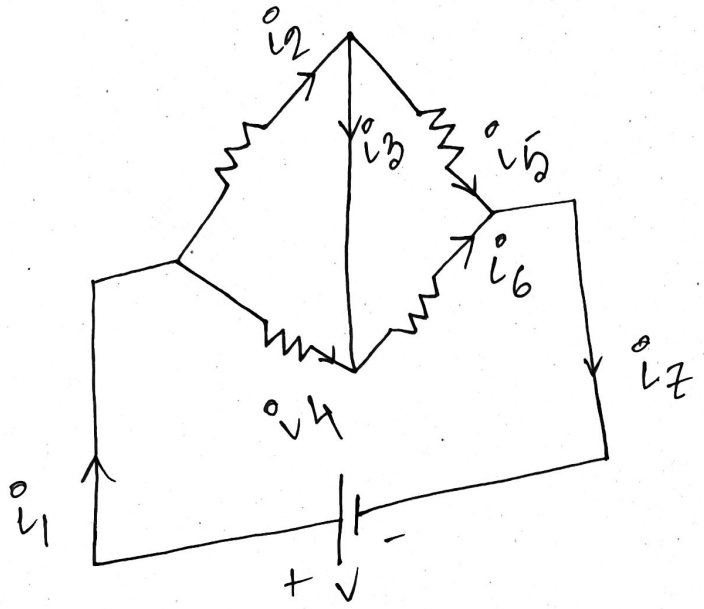
$$i_5 = i_2 + i_3$$
$$8A = 12A + i_3$$
$$i_3 = -4A$$

- KCL at node C

$$i_5 = i_6 + i_7$$

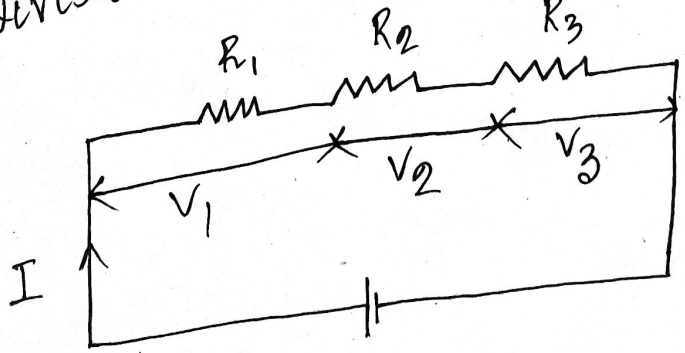
$$\Rightarrow 8A = i_6 + 20A$$

$$\Rightarrow i_6 = -12A$$



~~Voltage~~ Voltage division Rule :- (series)

When n number of registors are connected in series, then only we can apply voltage division Rule.



$$R_{eq} = R_1 + R_2 + R_3$$

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

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

$\therefore$ voltage drop accross R_1 will be,

$$V_1 = IR_1$$

$$= \frac{V}{R_1 + R_2 + R_3} \times R_1$$

$$\therefore R_1 = \frac{VR_1}{R_{eq}}$$

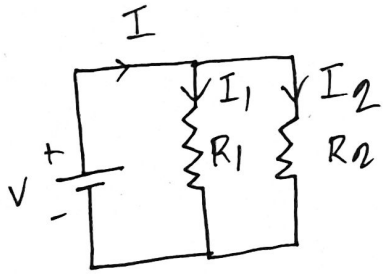
similarly,

$$V_2 = \frac{VR_2}{R_{eq}}$$

$$V_3 = \frac{VR_3}{R_{eq}}$$

Current Division Rule :-

When n number of registors are connected in parallel, then only this rule is applied.



$$I_1 = \frac{V}{R_1} \qquad I_2 = \frac{V}{R_2}$$

Again from KCL we get,

$$I = I_1 + I_2$$

$$\Rightarrow I = \frac{V}{R_1} + \frac{V}{R_2} = V\left(\frac{R_2 + R_1}{R_1 R_2}\right)$$

$$\Rightarrow V = I\left(\frac{R_1 R_2}{R_1 + R_2}\right)$$

So, by substituting we get,

$$I_1 = \frac{V}{R_1}$$

$$= \frac{I\,(R_1 R_2)}{(R_1 + R_2)\cdot R_1}$$

$$\boxed{I_1 = \frac{I R_2}{R_1 + R_2}}$$

Similarly, $I_2 = \frac{V}{R_2} = I\,\frac{R_1 R_2}{(R_1 + R_2)\cdot R_2}$

$$\Rightarrow \boxed{I_2 = \frac{I R_1}{R_1 + R_2}}$$