Sub:- Applied Physics Class- MPE, EEE, ELEX (1st year)

UNIT- 4 [Current Electricity]

The study of electric charges in motion is called current electricity

Topic:- Electric Current, Ohm's law : Resistance

[1] **Electric Current :-** The rate of flow of electric charge through any section of a wire is called electric current. it is denoted by I. ie

$$I = \frac{\text{Total charge flowing}}{\text{Time taken}}$$

if charge q flows in a time t through any section of wire then.

$$I = \frac{q}{t}$$

if charge dq flows through a wire in small time dt then

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

if n carriers of electricity, each having charge e cross any section of Conductor in time t then

$$I = \frac{ne}{t}$$

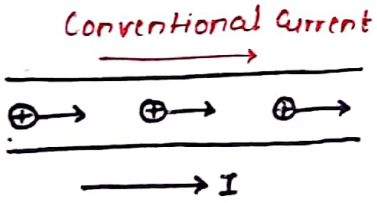
S.I unit & Dimension :- Electric Current is a Scalar quantity. its S.I unit is Ampere. it is denoted by A ie

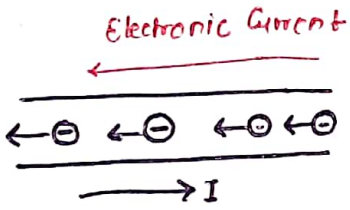
$$1 \text{ Ampere}(A) = \frac{1 \text{ Coulomb}(C)}{1 \text{ second}(s)} = 1 \text{ Coulomb second } (Cs^{-1})$$

Thus, "The Current through a wire is called one ampere, if one Coulomb of charge flows through the wire in one second."

Dimensional formula of electric Current is $[M^0L^0T^0A]$

Direction of electric Current :- By Convention, the direction of Motion of Positive charges is taken as the direction of electric Current.





Measurement :- Electric Current is Measured by an Instrument Called Ammeter.

[2] OHM's LAW ; Resistance

A German Physicist George Simon ohm derived a relationship b/w electric Current & Potential difference on the basis of his experimental observations. this relationship is know as ohm's law.

According to Ohm's law -

"At Constant Temperature & other Physical Condition, The current flowing through the conductor is directly proportional to the potential difference applied across its ends."

Thus

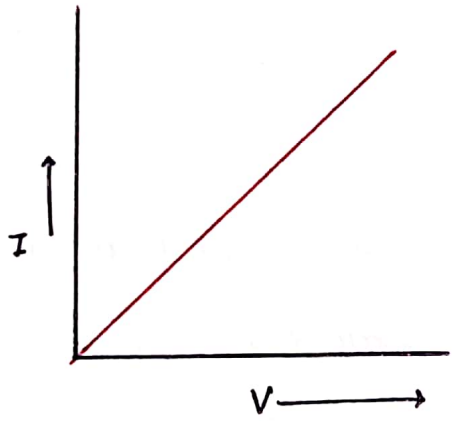
Potential difference ∝ Current

$$V \propto I.$$

$$\boxed{V = RI}$$

Here the proportionality Constant R is called the resistance of the Conductor.

V·I Characteristic :-



Resistance :- The resistance of a Conductor is the property by virtue of which it opposes the flow of charges through it. it is equal to the ratio of the potential difference applied across the Conductor to the current flowing through it.

Thus

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

S.I unit of Resistance is ohm (Ω)

"if the potential difference (V) is 1 volt & current (I) is 1 ampere, then the resistance (R) is 1 ohm"

$$\therefore \quad 1 \text{ ohm} = \frac{1 \text{ volt}}{1 \text{ ampere}}$$

or $$1\ \Omega = 1\ V A^{-1}$$

Thus "the resistance of a conductor is said to be 1 ohm if a current of 1 ampere flows through it on applying a p.d of 1 volt across it ends"