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

Topic :- Factors Affecting the Resistance, Specific Resistance, Conductance, specific conductance.

[3] **Factors affecting the resistance :-** At Constant temprature, the resistance of the Conductor deperds on the following factors.

(1) **length :-** The resistance R of a Conductor is directly proportional to its length ie

$R \propto l$.

(2) Area of Cross-Section :- The resistance R of a uniform conductor is inversely proportional to its area of cross section A ie.

$$R \propto \frac{1}{A}$$

(3) Nature of Material :- The Resistance of a Conductor also depends on the Nature of its Material. for example, the resistance of a nichrome wire is 60 times that of a copper wire of equal length & area.

[4] Resistivity or Specific Resistance :-

Since from above discussion

$$R \propto l \quad \text{---------- (i)}$$

$$R \propto \frac{1}{A} \quad \text{---------- (ii)}$$

on Combining equation (i) & (ii) we get

$$\boxed{R = \rho \frac{l}{A}} \quad \text{---------- (iii)}$$

Here ρ is proportionality constant known as Resistivity or Specific Resistance.

Put $l = 1m$

$A = 1m^2$

then from equation (iii) we get

$$R = \rho$$

Hence "the resistivity or specific resistance of the material may be defined as the resistance of a conductor of that material having unit length & unit area of cross-section"

Note :- Specific Resistance or Resistivity depends on the Nature of the material of the conductor, Temprature & Pressure only.

S.I unit of Resistivity :-

we can write -

$$\rho = \frac{R \times A}{l}$$

$$\therefore \text{ SI unit of } \rho = \frac{\text{ohm} \times \text{metre}^2}{\text{metre}}$$

$$= \text{ohm metre } (\Omega m)$$

[5] **Conductance :-** Conductance of a conductor is defined as the reciprocal of its resistance & is denoted by G

thus

$$\text{Conductance} = \frac{1}{\text{Resistance}}$$

$$G = \frac{1}{R}$$

S.I unit - $ohm^{-1} m^{-1}$ or $mho\, m^{-1}$ or $S m^{-1}$

S.I unit :- Ohm or mho or Simens (S)

[6] **Conductivity or Specific Conductance** :- The reciprocal of the resistivity of a material is called its Conductivity or Specific Conductance. it is denoted by σ. thus

$$\text{Conductivity} = \frac{1}{\text{Resistivity}}.$$

$$\sigma = \frac{1}{\rho}$$

S.I unit :- $Ohm^{-1}m^{-1}$ or $Mho\ m^{-1}$ or Sm^{-1}