Class: 1st
Subject: Electrical Technology
Lecturer: Omar A. Alkawak
E-mail: OmarAhmed@mustaqbal-college.edu.iq

Lecture No. 1

"Resistance"

Chapter one

Lecture one

"Resistance"

Resistance : It is defined as the property of a material due to which it oppose the flow of electrons through it . The unit of resistance is ohm (Ω) . The resistance (R) offered by a conductor depends on the following factors :

1. **It varies directly as its length (L. (**
2. **It varies inversely as the cross sectional area (A) of the conductor.**
3. **It depends on the nature of the material.**
4. **It also depends on the temperature of conductor .**

Neglecting the last factor for the time being , we can say that :

$$R \propto \frac{L}{A} \quad -- \quad R = \rho \frac{L}{A}$$

Where :

R is the resistance of the conductor (Ω) .

L is the length of the conductor (m) .

A is the cross sectional area of the conductor (m2) .

ρ is a constant depending on the nature of the material of the conductor and known as its specific resistance (Ω .m) .

Example : Calculate the resistance of 1 km cable composed of 19 strands of similar alloy conductors , each strand being 1.32 mm in diameter . Resistivity of alloy may be taken as 1.72 x 10 – 8 Ω . m .

Sol.

$$A = \frac{\pi d^2}{4} = \frac{3.14 \times (1.32 \times 10^{-3})^2}{4} = 13.67 \times 10^{-7}\ m^2$$

Total cross sectional area of the cable = $19 \times 13.67 \times 10^{-7}\ m^2$

$$R = \rho \frac{L}{A} = \frac{1.72 \times 10^{-8} \times 1000}{19 \times 13.67 \times 10^{-7}} = 0.66\ \Omega$$

Effect of temperature on the resistance :

The resistance of a conductor depends on the temperature as follows :

R α T

Where

R is the value of resistance .

T is the temperature of the conductor .

R t = Ro (1 + α o t (

R 2 = R 1 { 1 + α (t 2 - t 1) }

Where R t is the resistance of the conductor at t° C .

R o is the resistance of the conductor at 0° C .

α o is the temperature coefficient of the conductor at 0° C

R 1 is the resistance of the conductor at t1° C .

R 2 is the resistance of the conductor at t2° C .

Example : A lamp of 100 watt power , 240 volt reaches 2000° C . If the temperature coefficient of the lamp at 15°C is 5 x 10-3 . Calculate the resistance of the lamp at 15° C .

Sol.

$$P = \frac{V^2}{R}, \quad R = \frac{(240)^2}{100} = 576\ \Omega$$

$$R_2 = R_1 \{ 1 + \alpha (t_2 - t_1) \}$$

$$576 = R_1 \{ 1 + 5 \times 10\text{-}3 (2000 - 15) \} \quad R_1 = 52.7\ \Omega$$