Unit-2 ELECTRICAL FUNDAMENTALS

(SESSION-4)

Topics:

- Relation between voltage, current and resistance (Ohm's Law)
- Behaviour of V, I in series and parallel DC circuits
- Open circuit, closed circuit and short circuit

4.1 Ohms Law:

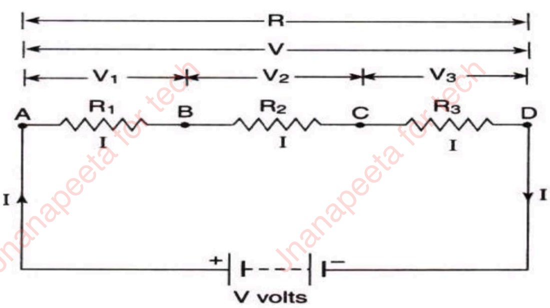
Ohm's law states that the current flowing through a conductor is directly proportional to the potential difference (voltage) between two points of a conductor provided the temperature and other parameters remains constant

i.e. $V \, \alpha \, I$

$V = I*R$ where, V = Voltage
I = Current
R = Resistance

4.2.1 Behavior of V, I in Series DC circuit:

In series circuit resistances are connected end to end like a chain. In DC series circuit the emf source if battery.



Characteristics of series circuit:

- Voltage drops add to equal total voltage.
- All components share the same (equal) current.
- Resistances add to equal total resistance.
- Example for series circuit is "serial light set"

Fig. shows three resistances R1, R2 and R3 Connected in series with a battery of V volts. Let the p.d. across R1, R2 and R3 is V1, V2 and V3 respectively. Total voltage across the combination divides among each resistance. The total voltage is given by, V = V1 + V3 + V2;

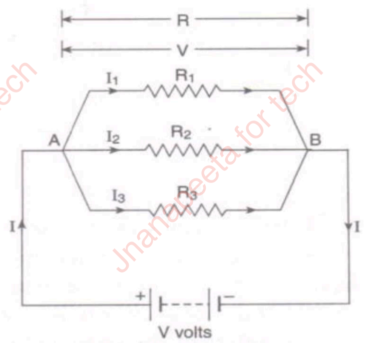
The total resistance is given by,

R = R1 + R2 + R3;

The effective resistance of resistances connected in series is the sum of individual resistances.

4.2.2. Behaviour of V, I in Parallel DC circuit:

The resistances are said to be connected in parallel, if first end of all resistances are connected to a common point and other ends of resistances are connected to another common point.



- All components share the same (equal) voltage.
- Branch currents add to equal total current.
- Resistances diminish to equal total resistance.
- Example for parallel circuit is – all appliances, lamps in home are connected in parallel.

If I is the total current flowing in the circuit, then the current passing through resistance R_1 (branch 1) is I_1, current passing through resistance R_2 (branch 2) is I_2 and current passing through resistance R_3 (branch 3) is I_3.

Total current $I = I_1+I_2+I_3$;

Effective resistance R is given by (explained in the next session)

1/R = 1/R1 + 1/R2 + 1/R3;

4.3 Open circuit, Closed circuit and Short Circuit:

Open circuit: An electrical circuit in which the continuity is broken so that current does not flow.

Closed circuit: a circuit without interruption, providing a continuous path through which a current can flow.

Short Circuit: A low-resistance connection between two points in an electric circuit through which the current tends to flow rather than along the intended path. A short circuit can damage the circuit by overheating.