

# RENOTES

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# Current electricity

## 1. Electric Current:

Definition:

Electric current is the flow of electric charge in a conductor, usually measured in Amperes (A). It can be either direct current (DC), where the electric charge flows in one direction, or alternating current (AC), where the charge changes direction periodically.

Formula:

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

Where:

- $I$  is the electric current,
- $Q$  is the charge,
- $t$  is time.

Application:

Electric current is the fundamental quantity in electrical circuits and is used to power various electrical devices.

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## 2. Ohm's Law:

Definition:

Ohm's Law states that the current passing through a conductor between two points is directly proportional to the voltage across the two points, given constant temperature.

Formula:

$$V = I \cdot R$$

Where:

- $V$  is voltage,
- $I$  is current,



Application:

Determines how much a material resists the flow of electric current in a circuit.

## **4. Circuits with Resistors:**

(i) Resistors in Series:

**Definition:**

Resistors connected end-to-end in a single path.

**Formula:**

$$R_{\text{total}} = R_1 + R_2 + \dots + R_n$$

**Application:**

Used when a specific total resistance is needed.

(ii) Resistors in Parallel:

**Definition:**

Resistors connected with both ends connected to a common point.

**Formula:**

$$\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$$

**Application:**

Used when you need to decrease the total resistance in a circuit.

## **5. Relaxation:**

**Definition:**

Relaxation is a process in which a system returns to its equilibrium state after being disturbed.

**Application:**

In electronic circuits, relaxation is used in components like capacitors and in relaxation oscillators.

## 6. Drift Velocity of Free Electrons:

**Definition:**

The average velocity of electrons in a conductor under the influence of an electric field.

**Formula:**

$$v_d = \frac{I}{nAe}$$

Where:

- $v_d$  is the drift velocity,
- $I$  is current,
- $n$  is the charge carrier density,
- $A$  is the cross-sectional area of the conductor,
- $e$  is the charge of an electron.

**Application:**

Describes the movement of electrons in a conductor.

## 7. Kirchhoff's Laws:

(i) Kirchhoff's Current Law (KCL):

**Definition:**

The total current entering a junction in a circuit is equal to the total current leaving the junction.

**Application:**

Used to analyze current distribution in complex circuits.

(ii) Kirchhoff's Voltage Law (KVL):

**Definition:**

The sum of the electromotive forces and voltage drops in any closed loop of a circuit is equal to zero.

**Application:**

Used to analyze voltage distribution in complex circuits.

## **8. Electromotive Force:**

**(i) Series Combination:**

**Definition:**

Connecting batteries or cells in a series.

**Formula:**

$$E_{\text{total}} = E_1 + E_2 + \dots + E_n$$

**Application:**

Increases the total voltage in a circuit.

**(ii) Parallel Combination:**

**Definition:**

Connecting batteries or cells in parallel.

**Formula:**

$$E_{\text{total}} = E_1 = E_2 = \dots = E_n$$

**Application:**

Increases the total current capacity in a circuit.

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## **9. Electrical Instruments:**

**(i) Galvanometer:**

**Definition:**

An instrument used to detect and measure small electric currents.

**Application:**

Used as a basis for ammeters and voltmeters.

**(ii) Wheatstone Bridge:**

**Definition:**

A circuit used to measure an unknown electrical resistance.

**Application:**

Used in resistance measurements.

**(iii) Potentiometer:**

**Definition:**

A device used to measure the electromotive force (EMF) of a cell.

**Application:**

Provides accurate voltage measurements and calibrations.

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