

Revision for quarter 4

Lesson 5: The Capacitor

Definition:

- **Capacitor:** A device made of two parallel plates separated by an insulator (dielectric).

Charge & Capacitance:

- $C = \frac{Q}{V}$
- Unit: **Farad (F)**

In a DC Circuit:

- A momentary current flows as the capacitor charges.
- Final state: no current, constant voltage across plates.

Series Connection:

- Same charge on all capacitors: $Q = Q_1 = Q_2$
- Voltage splits: $V_t = V_1 + V_2 + \dots$
- Formula:

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \dots$$

Parallel Connection:

- Same voltage across all: $V_t = V_1 = V_2$
- Charge splits: $Q_t = Q_1 + Q_2 + \dots$
- Formula:

$$C_{eq} = C_1 + C_2 + \dots$$

Unit 2 Lesson 1: Some Concepts of Dynamic Electricity

Types of Materials:

- **Conductors:** Allow easy flow of electricity (e.g., copper, silver).
- **Insulators:** Poor electricity conductors (e.g., plastic, wood).
- **Semiconductors:** Intermediate (e.g., silicon, Germanium).

Electric Current (I):

- The flow of electric charges (free electrons).
- Measured in **amperes (A)**.
- Formula: $I = \frac{Q}{t} = \frac{Ne}{t}$

Direction of Current:

- **Conventional current:** + to –
- **Electron flow:** – to +

Potential Difference (V):

- Work done per unit charge.
- Formula: $V = \frac{W}{Q}$
- Unit: **Volt (V) = J/C**

Resistance (R):

- Opposition to current flow.
- Formula: $R = \frac{V}{I}$
- Unit: **Ohm (Ω)**

Lesson 2: Ohm's Law

- States that current is directly proportional to voltage at constant temperature.
- Formula: $V = IR$
- **Graph:** Straight line if Ohm's law is obeyed.

Electric Power (P):

- Rate of electrical energy consumption.
- Formulas:

- $P = VI$

- $P = I^2 R$

- $P = \frac{V^2}{R}$

- Unit: **Watt (W)** = J/s = V·A

Lesson 3: Ohmic Resistance

Factors Affecting Resistance:

- Length (l) $\uparrow \rightarrow R \uparrow$
- Area (A) $\uparrow \rightarrow R \downarrow$
- Material resistivity (ρ)

Formula:

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

Resistivity (ρ):

- Resistance of a $1\text{m} \times 1\text{m}^2$ conductor.
- Unit: **Ohm·meter ($\Omega \cdot \text{m}$)**

Conductivity (σ):

- Reciprocal of resistivity:

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

With My Best Wishes