

## Layout of Electrical Power System & Its Functions

1st **Generation**: Electricity is generated in power plants (thermal, hydro, nuclear, solar, etc.).

2nd **Transmission**: High voltage AC is transmitted over long distances to reduce losses.

3rd **Substations**: Step-down transformers reduce voltage for distribution.

4th **Distribution**: Electricity is supplied to homes, industries, and commercial places.

5th **Utilization**: End-users consume electricity for various applications.

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## Wiring Accessories

- **Switch**: Controls the flow of electricity.
  - **Socket**: Provides a connection point for appliances.
  - **Plug**: Connects an electrical device to a socket.
  - **Lamp Holder**: Holds and connects light bulbs.
  - **MCB (Miniature Circuit Breaker)**: Protects circuits from overloads.
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## Types of Domestic Wiring

1st **Cleat Wiring**: Uses insulated wires fixed on cleats, used for temporary installations.

2nd **Casing and Capping Wiring**: Wires run inside wooden casing, used in old buildings.

3rd **Batten Wiring**: Wires fixed on wooden battens, suitable for low-cost installations.

4th **Conduit Wiring**: Wires placed inside PVC or metal pipes, commonly used in modern buildings.

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## Necessity of Earthing

- Protects humans and appliances from electric shocks.
  - Provides a low-resistance path to safely discharge fault currents.
  - Prevents fire hazards due to leakage currents.
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## Insulators and Cables

- **Insulators**: Materials like porcelain, glass, and polymer used to prevent leakage of current.
  - **Cables**: Carry electricity; types include **PVC, XLPE, Armoured, and Flexible cables**.
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## Safety Devices

- **Fuse**: Protects against short circuits and overloads by melting when current exceeds a limit.
  - **Relay**: Electrically operated switch that controls high-power circuits.
  - **Circuit Breaker**: Automatically disconnects power during faults.
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## Sensors and Their Types

- **Temperature Sensor**: Measures temperature (e.g., thermocouple).
  - **Proximity Sensor**: Detects nearby objects (e.g., infrared sensor).
  - **Pressure Sensor**: Measures fluid or gas pressure.
  - **Light Sensor**: Detects light intensity (e.g., LDR).
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## Faraday's Laws of Electromagnetic Induction

1st **First Law**: A changing magnetic field induces an electromotive force (EMF) in a conductor.

2nd **Second Law**: The induced EMF is proportional to the rate of change of magnetic flux.

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## Fleming's Right-Hand & Left-Hand Rule

- **Right-Hand Rule:** Determines the direction of induced current in a conductor moving in a magnetic field.
  - **Left-Hand Rule:** Determines the force direction in a motor due to a current-carrying conductor in a magnetic field.
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## DC Machines (Generator & Motor)

- **Construction:** Contains armature, commutator, brushes, field winding, and yoke.
  - **Principle:** Works based on electromagnetic induction.
  - **Load Test:** Measures output power under different loads.
  - **Performance Characteristics:** Includes efficiency, torque, and speed variations.
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## Transformers

- **Auto Transformer:** Has a single winding; used for voltage step-up or step-down with high efficiency.
  - **Single-Phase Transformer:**
    - **Construction:** Contains primary and secondary windings with an iron core.
    - **Principle:** Works on mutual induction.
    - **Load Test:** Measures efficiency and voltage regulation.
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## Single-Phase Induction Motor (Capacitor Start & Run)

- **Construction:** Contains stator, rotor, and capacitor for starting.
- **Principle:** Works on the rotating magnetic field principle.
- **Load Test:** Measures efficiency and speed under different loads.