Chapter 9: Household Circuits

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1. Definition of a Circuit

- A circuit is a closed loop through which electricity flows.
- Basic components: **current source**, **conductors**, and a **load**.

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2. Power Transmission (From Generating Station to Consumer)

- Electricity is generated at **11 kV** and then stepped up to **132 kV** for efficient long-distance transmission.
- Stepped down progressively:
  - **132 kV → 33 kV** → heavy industries
  - **33 kV → 11 kV** → light industries, city sub-stations
  - **11 kV → 220 V** → homes
- **Why AC is used instead of DC?**
  - AC can be easily **stepped up/down** using transformers, reducing energy loss.

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3. Power Distribution to a House

- Electricity reaches homes via **overhead/underground cables** with **three wires**:
  - **Live (L)**: supplies current
  - **Neutral (N)**: return path
  - **Earth (E)**: safety
- Key components:
  - **Company Fuse**: High-rated fuse at the pole
  - **kWh Meter**: Measures energy consumption
  - **Main Switch/MCB**: Controls and protects household circuits

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4. House Wiring (Ring System)

- Appliances connected in parallel to a ring circuit.
- Each has a **separate switch and fuse**.

Advantages:

1. Cost-effective
2. Isolated appliance protection
3. Uniform plugs and sockets
4. Easy to add new appliances

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5. Fuse

- **Safety device** that protects from excess current.
- Works on the **Heating Effect of Current**.
- Made of **lead-tin alloy** (low melting point, high resistance).

Fuse depends on:

- Current rating (I^2)
- Radius of wire (r^{-3})
- *Not* on wire length

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6. MCB (Miniature Circuit Breaker)

- Replaces fuse in modern setups.
- Trips quickly (within **25 ms**) in case of faults.

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7. Switches

- Devices to control current flow.

Types:

- **Single Pole**: Disconnects live wire only
- **Double Pole**: Disconnects live and neutral wires

Important:

- Always connect switch in the **live wire** for safety.

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8. Earthing (Grounding)

- **Local Earthing**: Near kWh meter for safety
- **Appliance Earthing**: Prevents electric shock in case of insulation failure

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9. Three-Pin Plug

- **Top pin**: Earth (longest)
- **Left pin**: Neutral
- **Right pin**: Live
- Ensures earth connection first for safety.

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10. Colour Coding of Wires

Wire	Old Colour	New Colour
Live	Red	Brown
Neutral	Black	Light Blue
Earth	Green	Green/Yellow

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11. High Tension Wires

- Used for heavy current/voltage.
- **Low resistance, large surface area** to prevent overheating.

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12. Safety Precautions

- Prevent **fire** (use proper wires/fuses)
- Prevent **electric shock**:
    - No wet hands
    - Proper insulation
    - Use earthing and fuses
    - Use proper rated MCBs