

Semiconductors

1. Introduction

- Transition from vacuum tubes to semiconductor devices.
- Advantages of semiconductors over vacuum tubes.
- Early discoveries in solid-state electronics.

2. Classification of Materials

- Conductors, semiconductors, and insulators (based on conductivity).
- Elemental and compound semiconductors.
- Energy band theory and band gap explanation.

3. Intrinsic Semiconductors

- Diamond-like lattice structure of Si and Ge.
- Covalent bonding and thermal ionization.
- Carrier generation: electrons and holes.

4. Extrinsic Semiconductors

- Doping: n-type and p-type semiconductors.
- Donor and acceptor impurities.
- Majority and minority carriers.

5. p-n Junction

- Formation of a depletion region.
- Diffusion and drift currents.
- Barrier potential and equilibrium condition.

6. Semiconductor Diode

- Forward bias and reverse bias characteristics.
- Minority carrier injection.
- V-I characteristics and threshold voltage.

7. Applications of Diodes

- Rectifiers:
 - Half-wave rectifiers.
 - Full-wave rectifiers.
- Filters for DC voltage.

8. Special Purpose Diodes

- Zener diode:
 - Characteristics.
 - Voltage regulation.
- Optoelectronic devices:
 - Photodiodes.
 - LEDs.
 - Solar cells.

9. Digital Electronics and Logic Gates

- Analog vs. Digital signals.
- Basic logic gates: NOT, OR, AND, NAND, NOR.
- Truth tables and applications.

