Semiconductor Physics

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Semiconductor Physics

Module-I: Quantum Mechanics

Introduction to Quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, De-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Time-independent Schrodinger equation for wave function, Born interpretation of the wave function, Schrodinger equation for one dimensional problems- particle in a box.

Module-II: Introduction to Solids and Semiconductors

Free electron theory, Bloch's theorem for particles in a periodic potential, Kronig- penney model (Qualitative treatment), Origin of energy bands. Types of electronic materials: Metals, Semiconductors, and Insulators; Intrinsic and Extrinsic semiconductors, Carrier concentration, Dependence of Fermi level on carrier- Concentration and Temperature, Hall effect.

Module-III: Light - Semiconductor Interaction

Carrier generation and recombination, Carrier transport: diffusion and drift, Direct and indirect band gaps, p-n junction, V-I characteristics, Energy Band diagram, Biasing of a junction.

Photo voltaic effect, Construction and working of LED, Photo detectors, PIN, Avalanche photodiode, Solar cell.

Module-IV: Engineered Electric and Magnectic Materials

Polarisation, Permittivity, Dielectric constant, Internal field in solids, Clausius Mosotti equation, Ferroelectricity, Piezoelectricity, Pyroelectricity, Magnetisation, Permeability, Susceptibility, Classification of dia, para and ferro magnetic materials on the basis of magnetic moment, Domain theory of ferro magnetism on the basis of hysteresis curve.

Module-V: Lasers and Fiber Optics

Characteristics of a Lasers, Spontaneous and Stimulated emission of radiation, Metastable State, Population Inversion, Lasing Action, Ruby laser, Semiconductor diode laser and Applications of a lasers, Principle and Construction of an optical fiber, Acceptance Angle, Numerical Aperture, Types of Optical Fibers (Single Mode, Multimode, Step Index, Graded index). Attenuation in Optical Fibers, Optical Fiber Communication System with block diagram.

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Module-I: Quantum Mechanics