5. SEMICONDUCTOR MATERIALS

Module I (12 Hours)

Physics of Semiconductor: Free electrons in metals, free electrons in a periodic potential, density of states; band theory of solid, metals, insulators and semiconductors; Intrinsic and Extrinsic semiconductor; n-type semiconductor, p-type semiconductor; drift velocity, mobility and conductivity of intrinsic semiconductor; Career concentration and Fermi level for intrinsic semiconductor, electron/hole concentration in the conduction/valence band respectively, Fermi level, effective mass; narrow and wide band gap semiconductors

Module II (8 Hours)

Basic thermodynamics of materials; Phase diagrams; Kinetics: Reaction kinetics, nucleation Atomic transport; temperature dependent conductivity of intrinsic and extrinsic (doped) semiconductors; preparation and doping techniques of elemental and compound semiconductors and their characterization

Module III (10 Hours)

Diffusion and drift of carriers: Chemical potential, Carrier motion in a chemical potential gradient; Simple diodes: The junction contact potential, Biased junctions, Non ideal diode behavior; Schottky barriers and ohmic contacts: Ideal metal/semiconductor junctions , Real Schottky diodes; Semiconductor heterojunctions : Heterojunctions at equilibrium, Heterojunctions as diodes; Transistors: Bipolar junction transistors, Field-effect transistors; Light-emitting devices: Light-emitting diodes, Laser diodes

Module IV (6 Hours)

Thermoelectric, magnetic and optical properties of semiconductor; different types of semiconductors and their application in commercial devices: Ge, Si, GaAs, InP, PbS, HgxCd.

Text and Reference Books:

1. Angus Rocket, The Materials Science of Semiconductors, Springer.

2. R. K Puri, and V. K. Babbar, Solid State Physics, S. CHAND Publications.

3. Charles Kittel, Introduction to Solid State Physics, Wiley.