



Academic Session: 2022-2023

PHY 3205: Solid State Physics I

3 Hours/week

3 Credits

Examination Duration: 3 Hours

- 1. Crystal Systems:** Classification of Materials; Lattice; Crystal and its Symmetries; Classification of Crystals, Unit Cell; Basis vector; Bravais Lattice; Miller Indices; Crystal Structures; Calculation of Lattice Points; Packing Factor; Inter-planar Spacing; Reciprocal Lattice; Bragg's Diffraction; Brillouin Zones; Atomic Form Factor; Structure Factor.
- 2. Imperfections in Crystals:** Classification of Defects; Point Defects; Dislocations Screw and Edge Dislocations; Diffusion in Metals; Plane Defects; Crystal Grains and Grain Boundaries; Energy of Grain Boundaries; Color Centers.
- 3. Crystal Bindings:** Crystals of Inert Gas; Ionic Crystals; Binding Energy and Bulk Modulus; Covalent; Metallic and Hydrogen Bonded Crystals.
- 4. Dynamics of Crystal Lattice:** Elastic Vibration of a Continuous Medium; Concept of Phonon; One-dimensional Monatomic and Diatomic Lattices; Theories of Lattice Specific Heat - Einstein Model and Debye Model.
- 5. Free Electron Theory of Metals:** Classical and Quantum Pictures of Free Electron Theory; Energy Levels, Effect of Temperatures on F-D Distribution, Fermi Sphere, Density of states in One, Two, and Three-dimensions. **Electrical Conductivity and Ohm's Law; Thermal Conductivity of Metals Wiedmann-Franz Law.**
- 6. Band Theory:** Energy Bands in Crystals; Nearly Free Electron Model and Energy Gaps; Motion of Electrons in One and Three Dimensions in a Periodic Potential; Band Theory; Bloch Theory; Kronig -Penney Model; Tight Bonding Model; LCAO Band theory.

Books Recommended:

<i>Kittel, C</i>	Introduction to Solid State Physics
<i>Ashcroft and Mermin</i>	Solid State Physics
<i>Omar, MA</i>	Elementary Solid-State Physics
<i>McKelvey, JP</i>	Solid State and Semiconductor Physics
<i>Azaroff, LV and Brophy, JJ</i>	Electronic Processes in Materials
<i>Dekker, AJ</i>	Solid State Physics
<i>Singhal, RL</i>	Solid State Physics
<i>Wahab, MA</i>	Solid State Physics