PHY7103: SOLID STATE PHYSICS: 45h 3(3-0)

1. Course Name: Solid State Physics

2. Course Code: PHY7103

3. Credit Units: 3

4. Course Description:

This course starts with the band structure of electrons, leading to the electron-phonon interactions and electron-electron interactions. The cooperative phenomena of ferromagnetism and superconductivity will also be discussed. Finally, the a brief treatment of surface physics will be given.

5. Course Objectives:

At the end of the course, the students should be able to:

- Determine band structures in metals and semi-conductors.
- Discuss the electrical conductivity in metals and semi-conductors.
- Use the cooperative phenomena to in ferromagnetism and superconductivity.

6. Course Outline:

Content	Hours
Electrons: Electrons in a weak periodic potential; The tight binding method; Other methods for calculating band structure; Experimental determination of band structure of metals and semi-conductors – de Haas van Alphen effect.	9
Electron-Phonon Intractions: Form of the Hamiltonian; Rigid-ion approximation; Boltzmann transport equation: relaxation mechanisms and Onsager's relations; Electrical conductivity in metals and semiconductors.	10
Electron-Electron Interactions: Hartree_Fock equations; Correlation; Screening; Plasmons	8
Cooperative Phenomena: Ferromagnetism: exchange interaction; ground state of a Heisenberg ferromagnet; Spin waves. Superconductivity: BCS theory – Cooper pairs, Superconducting ground state, and Macroscopic properties according to BCS theory. Introduction to high Tc – Superconductivity.	10
Surface Physics: Surface crystallography; Surface electronic structure; Magneto-resistance	8
Total	**45**

7. Mode of Delivery:

This course will consist mainly of lecture sessions.

8. References:

1. J.R, Hook and H.C Hall. Solid State Physics. John Wiley & Sons (1994), NY
2. J.D. Patterson & B.C Bailey. "Solid State Physics: Introduction to Theory" Springer.