Level Seven

SolidState Physics

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
PHY	**361**	**SolidState Physics**	**4**	**4**	**0**	**1**	**PHY312**

Objectives:

- Provide the student with a clear and logical presentation of the basic concepts and principles of solid state physics.
- Strengthen an understanding of the concepts and principles through a broad range of the interesting applications to the real world.

Upon completion of the course students will be able to:

- Demonstrate and apply knowledge of the crystalline lattice.
- Solve problems concerning the definition of the Bravais lattice.
- Understand and apply the definition of the reciprocal lattice.
- Understand the energy bands of solids and their application.

Syllabus:

Topic	No of Weeks	Contact hours
Crystal Structure: Periodic array of atoms; fundamental types of lattices; index systems for crystal planes, simple crystal structures; direct imaging of atomic structure; nonideal crystal structures.	2	10
Wave Diffraction and the Reciprocal Lattices: diffraction of waves by crystals; scattered wave amplitude; Brillouin zones; Fourier analysis of the basis.	2	10
Binding in Crystals: Basic types of binding, examples	1/2	5
Phonons-Crystal Vibrations: vibrations of crystals with monoatomic basis; two atoms per primitive basis; quantization of elastic waves; phonon momentum; inelastic scattering by phonons.	2	10
Phonons-Thermal Properties: phonon, heat capacity; anharmonic crystal interactions; thermal conductivity.	2	10

Free electron Fermi gas : Energy level in One dimension, effect of temperature on the Fermi-Dirac distribution, Free electron gas in three dimensions, Heat capacity of the electron gas, electrical conductivity and Ohm's law.	2	10
Semiconductor crystals: Band Gap, equations of Motion, intrinsic Carrier Concentration, impurity Conductivity and Thermoelectric Effects.	2	10
Introduction to suprerconductivity	1	5
Introduction to magnetism : Diamagnetism, Paramagnetism, Ferromagnetism and Antiferromagnetism	1	5

References:

- Introduction to SolidState Physics, C Kittel, Eighth Edition, Wiley.
- SolidState Physics, Hook and Hall. ISBN: 0471928054. 2nd edition, (wiley) 1995.
- The Physics and Chemistry of Solids, S R Elliott. ISBN: 0471981958, (Wiley) 1998.
- SolidState Physics, Ashcroft and Mermin. ISBN: 0471111813. Brooks Cole; 1 edition, 1995