PHYSICS

INTRODUCTION TO SOLID STATE PHYSICS

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TYPE OF COURSE : New | Core | UG
COURSE DURATION : 12 weeks (28 Jan'19 - 19 Apr'19)
EXAM DATE : 28 April 2019

COURSE OUTLINE :

The course deals with introducing concepts of condensed matter physics to advanced undergraduate and postgraduate students. The course will be pitched at the level of a first year course in MSc in Physics. For this course, an exposure to undergraduate level of: (a) quantum mechanics, (b) statistical and thermal physics and (c) electromagnetic theory, is expected. It is hoped that through this course, the student will understand the quantum theory of solids which is used to describe the thermal and electrical properties of a solid.

ABOUT INSTRUCTOR :

Dr. Satyajit Banerjee is a faculty member in the Department of Physics at IIT Kanpur; Professor from 2012 onwards, Associate Professor from 2007 to 2012 and Assistant Professor from 2004 to 2007. He was a Feinberg Postdoctoral Fellow. Between 2000 - 2004, in the Dept. of Condensed Matter Physics at Weizmann Institute of Science, Israel. He obtained his Ph.D degree from the Department of Condensed Matter Physics and Materials Science, from Tata Institute of Fundamental Research, Mumbai, India in 2000.

Dr. Manoj Kumar Harbola joined the Department in 2000. He obtained his doctoral degree at the City University of New York, USA, Subsequently he carried out postdoctoral research at the University of North Carolina, Chapel Hill, USA before joining the Centre for Advanced Technology, Indore as a Scientist.

COURSE PLAN :

Week 01 : Introduction to Drudes free electron theory of metals, electrical conductivity Ohms law and Hall effect

Week 02 : Specific heat of an electron gas

Week 03 : Behaviour of thermal conductivity of a solid and relationship with electrical conductivity

Week 04 : Periodic Arrays of Atoms, Fundamental Types of Lattices, Index System for Crystal Planes

Week 05 : Direct Imaging of Atomic Structure, Diffraction of Waves by Crystals, Reciprocal lattice, Brillouin Zones

Week 06 : Vibrations of Crystals with Monatomic Basis, Acoustic and Optical modes

Week 07 : Two Atoms per Primitive Basis, Quantization of Elastic Waves, Phonon Momentum

Week 08 : Phonon contribution to heat capacity, Einstein and Debye theory of specific heat.

Week 09 : Bloch Functions, Nearly Free Electron Model, Kronig-Penney Model

Week 10 : Wave Equation of Electron in a Periodic Potential,Band Gap

Week 11 : Equations of Motion, effective mass, concept of a hole, Intrinsic Carrier Concentration, Impurity Conductivity

Week 12 : Superconductivity