Birla Institute of Technology & Science, Pilani
Hyderabad Campus

Second Semester 2019 - 2020

Course Handout (Part II)

Date: 06/01/2020

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No.	**:**	**PHY F341**
Course Title	**:**	**Solid State Physics**
Instructors	**:**	**Hariharavenkataraman and Kannan Ramaswamy**
Instructor-in-charge	**:**	**KANNAN RAMASWAMY**

Scope and Objective:

This is an introductory course on Solid State Physics. It aims at providing physical as well as mathematical understanding of a wide range of phenomena associated with crystalline matter. Its objective is to lay the foundation for a working understanding of solids through fundamental theoretical concepts.

Learning outcomes: At the end of the course students must gain knowledge on the following points -

- Differentiating between different types of solid materials; their structure and the structure determination
- Applying the vibrations and waves from Mechanics, Oscillations and Waves course in understanding the lattice waves and Brillouin zones
- Different models on thermal and electrical transport studies
- Explaining the electrical properties such as conductivity and Hall Effect using the classical and quantum models
- How the energy bands are formed and understanding density of states
- Theory and applications of some important materials (magnetic materials) in today's use

Text Book:

Introduction to Solid State Physics, C. Kittel, 7th ed., Wiley (1997)

Reference Book:

Solid State Physics, N W Ashcroft and N D Mermin, 1st ed., Thomson (1976)
Elementary Solid State Physics - Principles and Applications, M. Ali Omar, Pearson
Quantum States of Atoms, Molecules and Solids, Morrison, Estle and Lane, Prentice – Hall Physics

Course Plan:

No of Lectures	Learning Objectives	Topics to be covered	Chapter in the Text Book
3	Crystal Structure	Bravais Lattices, Miller Indices	Chapter 1 (Kittel)
6	Diffraction of waves by crystals	Bragg Law, Reciprocal Lattice, Laue Equations, Brillouin Zones	Chapter 2 (Kittel)
6	Crystal Vibrations	Monatomic and Diatomic Crystals	Chapter4 (Kittel)
6	Thermal Properties	Einstein and Debye Models of Heat Capacity; Umklapp processes	Chapter 5 (Kittel)
6	Free Electron Fermi Gas	Drude theory, Sommerfeld theory and failures of free electron model; Electrical conductivity and Ohm's law, Hall effect, Widemann – Franz law	Chapter 6 (Kittel) Chapters 1, 2 and 3 (Ashcroft and Mermin)
8	Energy Bands	Bloch theorem, Electrons in a periodic potential, Kronig-Penney Model, Fermi surface and Tight binding method	Chapter 7, 9 (Kittel) Chapters 8, 9 and 10 (Ashcroft and Mermin)
5	Magnetism	Types of Magnetic structure and Mean field theory	Chapters 31, 32 and 33 (selected topics) (Ashcroft and Mermin)

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid-Sem	90 min	30	3/3 11.00 -12.30 PM	Closed Book
Assignment		30		Open Book
Comprehensive Examination	180 min	40	04/05 AN	Closed Book

Chamber Consultation Hour: To be announced in the class

Notices: Notices and solutions of Tests & Final Comprehensive Examination will be displayed only on the **Physics Notice Board**.

Make-up Policy: Make-up will be given only in genuine cases with **prior permission** from the Chief Warden & IC. *No Make – up's for Quizzes*.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
PHY F341