

**Solid State Physics (PHYS 5371, CRN: 22538 , Spring 2014).**

Textbook: *Introduction to Solid State Physics*, C. Kittel, 8th edition Wiley.

Chapter 1: Crystal Structure

Lattice translation vectors, primitive lattice cell, fundamental types of lattices, crystal structures

Chapter 2 Wave diffraction and the reciprocal lattice

Bragg Law, Scattered Wave amplitude, reciprocal lattices, structure factor, form factor

Chapter 3 Crystal Binding and elastic constants

Crystals of inert gases, ionic crystals, covalent crystals, metals , hydrogen bonds

Chapter 6 Free electron Fermi gas

Energy level in one dimension, free electron gas in three dimensions, heat capacity, electrical conductivity and Ohm's law.

Chapter 7 Energy bands

Nearly free electron model, Bloch function, Kronig-Penny model

Chapter 4 Phonons

Crystal vibrations

Chapter 5 Phonons II Thermal properties

Phonon heat capacity, Planck distribution, density of states, Debye Model

Chapter 8 Semiconductor Crystals

Chapter 14 Plasmons, Polaritons, and Polarons

Chapter 15 Optical Processes and Excitons

Special topics: Novel Materials: - Clusters, Fullerenes, Nanotubes, Graphene and planar nanostructures (Class notes).

(Selected topics from Chapters 8, 14, 15 if time permits).

Office hours: Wednesday (2.30 PM – 4.30PM) or by appointment.

We will have two midterms. (Midterm: 30%, Final (Comprehensive) 40%, Quizz+HW and possibly simple projects 30%).

Objectives:

Students will develop a understanding of the crystal classes and the relationship between the real and reciprocal space.

Students will electronic properties of solids using simple models and elementary quantum mechanics. They will also learn about basics of phonons in crystals.

Understanding of the key concepts will be judged using quizzes and the final examination.