

# Solid State Physics

(PHYS 5371, CRN: 21525 , Spring 2021).  
( **Jan 19, 2021 - May 06, 2021**)

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

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: After class 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.

COS policy about incomplete grades:. The College of Science will remain aligned with the University and not approve any drop requests after that date.

All grades of Incomplete must be accompanied by an Incomplete Contract that has been signed by the instructor of record, student, departmental chair, and the dean. Although UTEP will allow a maximum of one year to complete this contract, the College of Science requests it be limited to one month based upon completion data. A grade of Incomplete is only used in extraordinary circumstances confined to a limited event such as a missed exam, project, or lab. If the student has missed a significant amount of work (e.g. multiple assignments or tasks), a grade of Incomplete is not appropriate or warranted.