## Band Theory and Electronic Properties of Solids Phys 674 Physics Department, King Saud University

## Text books

1. Solid State Physics by Ashcroft and Mermin

2. Introduction to solid state physics by Charles Kittle eight edition

3. Band Theory of Solids - An Intro. from the Point of View of

Symmetry by S. Altmann

## **Chapters and Topics:**

- 1. The Drude Theory of Metals (Chapter 1 Ashcroft)
- 2. The Sommerfeld Theory of Metals (Chapter 2 Ashcroft)
- 3. Electron Levels in a Periodic Potential (Chapter 8 Ashcroft)
- 4. Electrons in a Weak Periodic Potential (Chapter 9 Ashcroft)
- 5. Semiconductor Crystals (Chapter 8 Kittel)

This will cover:

- 1. Classical models for the electronic properties of metals: Drude and Sommerfeld models.
- 2. Quantum mechanics of particles in periodic potentials (Bloch's theorem).
- 3. Band structure models: Nearly Free and Tight Binding electronic models.
- 4. Semiconductors and insulators: Energy gap, Number of carriers, Density of states. Associated physical phenomena: electrical, optical, thermal and magnetic properties.
- 5. Characterization and device applications. Wavevector (K) and effective mass of electrons in solids.
- 6. Band-structure engineering: multilayers and quantum wells.
- 7. Magnetoresistance and the quantum Hall effect.

Grading: First Midterm Exam: 30% Second Midterm Exam: 30% Final Exam: 60% Total: 100%