INSTRUCTOR: Congjun Wu (5430 MH)
Email: wucj@physics.ucsd.edu, Tel: 858-5343325
TA: no TA assigned so far
Time/Place: 12:30am - 1:50pm, MW MHA5623
Instructor Office hours: Wed: 2:00-3:00 pm

Text Books:


Reference Books


Grade:

20% problem sets, 40% midterm, 40% final project. There will be only one midterm in Physics 211A.

Homework Assignments:
Homework will be assigned every one or two weeks.
Class Schedule

1. Metal – discovery of electrons
   Lecture 1: The Drude theory of metals – the start of condensed matter physics
   Lecture 2: The Sommerfeld theory of metals – electrons are fermions
   Lecture 3: Hartree-Fock theory of interacting electron gases, exchange energy, Stoner ferromagnetism – electrons are interacting!

2. Crystal and phonons
   Lecture 4: Bravais lattice and non-Bravais lattice, reciprocal lattice, point group symmetries
   Lecture 5: Lattice Waves, Debye-Waller factor, acoustic and optical phonons, lattice specific heat,
   Lecture 6: The long-wave length method, phonon dielectric constant, Huang’s equation

3. Band (solid state physics) v.s. bond (chemistry)
   Lecture 7: Bloch Theorem, crystal momentum, DOS, van Hove Singularities, electrons in a weak periodic potential, pseudo-potential
   Lecture 8: Basics of density functional theory – from potential to density, Lendegre transformation
   Lecture 9: The tight-binding model – resonance valence bond
   Lecture 10: Band structure of graphene, Haldane model, Kane-Mele model

4. Interacting electron gas
   Lecture 11: Lindhard response response, screening
   Lecture 12: Friedel sum rule, Kohn effect, Plasma oscillation

5. Semi-classic dynamics
   Lecture 13: The Boltzmann equation, conductivity
   Lecture 14: Hall effect, magneto-resistance
   Lecture 15: Electron orbitals, De Haas- Van Alphen effect

6. Magnetism
   Lecture 16: Heisenberg model, spin-waves, H-P transformation
   Lecture 17: Mott transition, antiferromagentism, Spin-wave in antiferromagnets
   Lecture 18: Kondo effect