Instructor: Dr. Xiaojuan (Judy) Fan
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Office Hours : MWF 2:00 - 4:00, other time by appointment.

Prerequisites: Modern Physics, E&M 1 and Quantum 1

Textbook and Bibliography:

1/ The required text book is "***Introduction to Solid State Physics***", Charles Kittel. Publisher: Wiley; 8th edition (November 11, 2004) ISBN-10: 047141526X

2/ Some other text-book useful for reference:

- *Solid State Physics* by Neil W. Ashcroft , N. David Mermin; Publisher: Brooks Cole; 1 edition (January 2, 1976), ISBN-10: 0030839939
- *Elementary Solid State Physics: Principles and Applications* by M. Ali Omar, Publisher: Addison Wesley; 4Rev Ed edition (December 31, 1993), **ISBN-10:** 0201607336
- *Quantum Theory of Many-Particle Systems*,by Alexander L. Fetter, Publisher: Dover Publications (June 20, 2003), ISBN-10: 0486428273
- *Introduction to Quantum Mechanics*, by David J. Griffiths, Publisher: Benjamin Cummings; 2 edition (March 31, 2004) ISBN-10: 0131118927

Objectives

The purpose of the course is to provide a broad introduction to the structures and physical properties of solids, which are of extraordinary importance in the modern world. At the same time the course will serve as a basis for more advanced courses in solid state and condensed matter physics.

Beginning by discussing different types of crystal structures in nature, the course will cover most elementary topics in solid state physics with the emphasis on lattice vibrations, electron states and energy bands, Fermi surfaces, metals, semiconductors, magnetism and superconductivity. We will discuss fundamental modern theories and principles of solid state of matter and will provide good insight into the structures and the roles of important excitations in solids as phonons, plasmons, magnons, excitons, and polaritons. Also, some time will be devoted to discussions of recent and exciting important developments in condensed matter physics like nanocrystal structures, quantum Hall effects, high temperature superconductivity.

Homework :

Homework will usually be assigned every two weeks and are due in one week. Solutions to the homework will be given after the submission. Homework is a very important part of the course. As you probably already know, the only way to learn physics is to work with it as much as possible. I encourage you to work with other mates of the class, but the solutions you have should represent your own understanding of the material. **Do your own work!**

Quizzes: I will give about 3-5 in-class 20-minute quizzes

Exams: There will be two midterm exams and one final exam.

Exam1: Thursday, March 14
Exam 2: Thursday, April 18
Final: Tuesday, May 7
(Exam schedule is subject to change.)

GRADING:

Homework:	15%
Quizzes:	15%
Mid-term Exam I	20%
Mid-term Exam II	20%
Final Exam	30%

COURSE OUTLINE:

I. **Structure of Crystals**
Chapter 1: Classification of lattices (Ch. 1)
Chapter 2: Reciprocal lattices (Ch. 2)
Chapter 3: Bonding in crystals (Ch. 3)

II. **Crystal Phonons:** Chapter 4

III. **Electrons in Crystals**
Chapter 6: Free electrons in metals
Chapter 7: Electrons in periodic potentials
Chapter 8: Semiconductors
Chapter 9: Fermi Surfaces

IV. **Optical Properties**:
Chapter 14 &15: Plasmons, Polaritons, Polarons, Excitons and Optical Processes.

V. Superconductivity: Chapter 10

VI. **Magnetic Properties** (Chapter 11, 12)
VII. **Low Dimensional System** (Chapter 18).

Classroom Behavior:

Disorderly conduct that interferes with the normal classroom atmosphere will not be tolerated. All cell phones must be turned off before the beginning of class unless special permission is granted by the instructor. In that case, the cell phone must be set to silent ring mode, and the student must leave the classroom to answer any call. If a cell phone rings during class, the student may be required to leave class that day and be marked absent.

Academic Dishonesty:

"Academic Dishonesty is something that will not be tolerated as these actions are fundamentally opposed to 'assuring the integrity of the curriculum through the maintenance of rigorous standards and high expectations for student learning and performance' as described in Marshall University's Statement of Philosophy."[1] Cheating and other forms of academic dishonesty will bring serious sanctions, including possible expulsion, as described in *Undergraduate Catalog.* **Cheating on an exam will result at minimum in failing the entire course.**

You may work together on practice problems (which are not graded), but **please do your own work.**

Policy for Students with Disabilities:

Marshall University is committed to equal opportunity in education for all students, including those with physical, learning and psychological disabilities. University policy states that it is the responsibility of students with disabilities to contact the Office of Disabled Student Services (DSS) in Prichard Hall 117, phone 304 696-2271 to provide documentation of their disability. Following this, the DSS Coordinator will send a letter to each of the student's instructors outlining the academic accommodation he/she will need to ensure equality in classroom experiences, outside assignment, testing and grading. The instructor and student will meet to discuss how the accommodation(s) requested will be provided. For more information, please visit http://www.marshall.edu/disabled or contact Disabled Student Services Office at Prichard Hall 11, phone 304-696-2271.