

PHYSICS 162: Condensed Matter Physics (#77099)

Fall 2008

CALIFORNIA STATE UNIVERSITY, FRESNO
Department of Physics

Course No: Phys 162

Unit Value: 3

Instructor: Daqing Zhang

Office Number: McLane 260

Email: dzhang@csufresno.edu

Telephone: 278-7096

Class Hours: 09:00—09:50am MWF **Class Room:** McLane 167

Office Hours: 10:00—11:00 MTWF, 9:00—10:00 T, or by appointment

Grading: Letter (A, B, C, D, F)

Course Textbook:

Elementary Solid State Physics (revised printing) M. Ali Omar (required)

Introduction to Solid State Physics Charles Kittel 8th edition, (recommended)

Solid State Physics N. W. Ashcroft and N. D. Mermin (recommended)

Prerequisite: Physics 4C

Course Description:

This course is designed to give students a good foundation in the field of Solid State Physics. Being one semester-long course, only major key topics and ideas will be covered which will give students what they need to be successful in more advanced courses. The concepts of lattice, crystal structure, reciprocal lattice, phonon, Fermi surface, Brillouin zone, metal and semiconductor theory and properties will be taught. And the course will conclude with a brief introduction to the nanostructures if time allowed.

Course Goals:

Solid state physics is an extremely broad topic. This course is just at an introduction level but it is an introduction to a big, complex subject. After completing this course, the students should possess the basic tools to proceed onto more complex topics in condensed matter and material science. Basically, the primary goals of this course for students are to understand the basic ideas, fundamental concepts and principles in the field of solid state physics; to practice their logic and reasoning skills by applying their knowledge of physics and mathematics to physical situation (problem-solving).

Course Objectives (Student Learning Outcomes):

This course is designed for Physics-major upper division undergraduate students to learn one of the most important areas in classic physics: condensed matter physics. Through the course lectures, problem-solving practice and discussion,

1. Students will be familiar with most fundamental principles, concepts, physical quantities, laws, and characteristic of condensed matter physics.
2. Students will be able to apply the following to the solution of condensed matter physics problems: basic crystal structures, reciprocal and diffraction lattice structures, phonons and thermo/acoustic/optical properties.
3. Students will be able to perform the energy band structures in metals and semiconductors.

4. Students will be able to apply the concepts of impurity and doping on semiconductor devices.
5. Students will demonstrate an awareness of the impact of condensed matter physics on the practical experiments/applications such as electron microscopy, surface/thin film physics, material science, nanotechnology, to name a few.

Course Grading:

Your grade in this class will be based on:

Homework	30%
2-50min midterm tests	40%
Final exam (comprehensive)	30%

Final Grades: A 85-100, B 75-84.9, C 60-74.9, D 60-74.9, F 0-49.9

Homework:

Homework each including approximately 1~5 problems will be assigned **in lecture** on a weekly basis. The homework is due exactly one week later **in lecture (at the beginning of class)**. Graded homework will be returned in class. Homework solutions will be provided after grading. **LATE HOMEWORK WILL NOT BE ACCEPTED.** Work together with classmates or consultate with fellow students is encouraged but copying the homework of another is considered cheating. You will get zero point in this case. Also remember that just copying your classmate's solution will not increase your knowledge and you will not learn what you will need to know for the exams. Start as early as possible on them.

Exam Schedule (tentative dates):

1st midterm:	Friday, October 10	Ch.1, 2
2nd midterm:	Monday, November 24	Ch. 3, 4, 5
Final exam:	08:45 – 10:45 AM Monday, December 15, (Comprehensive)	

Exams:

All midterm tests and final exam are **CLOSED BOOK** exams. You **are allowed** to bring in one 8x11 **formula sheet** on each test. Physical constants will be provided if needed. A non-programmable calculator is allowed to use in midterm and final exams. There is no make up exams (**documented** medical or legal excuses must be provided at least three days before a missed exam if allowances are to be made).

Attendance:

If you are absent from class, it is your responsibility for the material presented in the lecture, reading assignments, the homework, and to check on announcements made while you were away.

Right to Changes:

The instructor reserves the right to change the course policy during the term due to unforeseen problems in the course pace, fairness, conflicts, etc.

UNIVERSITY POLICIES

Cheating and Plagiarism: "Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one's grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term 'cheating' not be limited to examination situations only, but that it include any and all actions by

a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one's own work." Penalties for cheating and plagiarism range from a 0 or F on a particular assignment, through an F for the course, to expulsion from the university. For more information on the University's policy regarding cheating and plagiarism, refer to the Schedule of Courses (Legal Notices on Cheating and Plagiarism) or the University Catalog (Policies and Regulations)

Disruptive Classroom Behavior: "The classroom is a special environment in which students and faculty come together to promote learning and growth. It is essential to this learning environment that respect for the rights of others seeking to learn, respect for the professionalism of the instructor, and the general goals of academic freedom are maintained. ... Differences of viewpoint or concerns should be expressed in terms which are supportive of the learning process, creating an environment in which students and faculty may learn to reason with clarity and compassion, to share of themselves without losing their identities, and to develop and understanding of the community in which they live . . . Student conduct which disrupts the learning process shall not be tolerated and may lead to disciplinary action and/or removal from class."

Students with Disabilities: Upon identifying themselves to the instructor and the university, students with disabilities will receive reasonable accommodation for learning and evaluation. For more information, contact Services to Students with Disabilities in Madden Library 1049 (278-2811).

Course Content / Tentative Course Schedule:

Subject to Change: This syllabus and schedule are subject to change in the event of extenuating circumstances. If you are absent from class, it is your responsibility to check on announcements made while you were absent.

Date	Topics	Chapter Reading
Week 1 08/25~08/29	Course introduction Review of atomic physics and quantum mechanics: energy level, wave function, Schrödinger equation	
09/01	Labor day no class	
Week 2&3 09/03~09/12	Lattices , crystal structures and inter-atomic forces	Ch1.1-10
Week 4&5 09/15~09/26	X-Ray diffraction in crystals, Bragg's law, Reciprocal lattice	Ch2. 1-10
Week 6&7 09/29~10/08	Lattice vibration, phonon, specific heat, density states of lattice	Ch3. 1-12
10/10 (Fri)	1st midterm test Ch. 1, 2	
Week 8&9 10/13~10/24	Free electron model, electrical conductivity, Fermi surface	Ch4. 1-10
Week 10&11 10/27~11/07	Energy band theory in metal	Ch5. 1-21
Week 12&13 11/10~11/21	Semiconductor theory	Ch6. 1-15
11/24 (Mon)	2nd midterm test Ch. 3, 4, 5	
Week 14 11/26&28	Thanksgiving break no class	
Week 15&16 12/01~12/10	Semiconductor device physics	Ch7. 1-9
12/15 (Monday)	Final comprehensive exam Ch. 1~7	08:45-10:45 AM