

Department of Materials Science and Engineering
University of Maryland, College Park, Maryland

ENMA460/PHYS431: Introduction to the Physics of Solid Materials

Course Description: Classes of materials; introduction to the behavior ideal and real material, including mechanical, electrical, thermal, magnetic and optical responses of materials; importance of microstructure in behavior. One application of each property will be discussed in detail.

Prerequisites: MATH 241, PHYS 263 and ENES 230

Textbook: Introduction to Solid State Physics, Seventh Edition by Charles Kittel (Available at the University Bookstore)

Course Objectives/Goals:

The purpose of this course is to introduce students to the basics and fundamental concepts of properties of solid materials. The topics include crystal structures, diffraction techniques, formation of crystals, phonons, transport properties, and band gaps. Physical and mathematical basis for understanding the properties of solid materials will be presented. Some experimental techniques and contemporary topics will be covered.

Course Goals to meet ABET 2005 Criteria:

1. Know the different crystal structures, and how they are responsible for the properties of the materials: Elastic, Lattice Vibrations, Specific Heat, Thermal Expansion and conductivity, Electrical conductivity
2. Diffraction: X-ray and Internal (band structure)
3. Electron structure and how it gives rise to the band structure and how the band structure is related to the properties mentioned above.

Course Website: on ajconline (www.ajconline.umd.edu)

Grading:

Homework: 30%
Midterm I: 20% (10/6 Monday)
Midterm II: 20% (11/5 Wednesday)
Final: 30% (12/20 Tuesday)

Lab Tour: Experimental techniques are a crucial part of solid state physics. In order to learn about and understand how experiments are performed in solid state physics, we will have a lab tour on 12/1 (Monday). The details of the tour will be given later.

Homework:

Problem sets will be handed out on Mondays, and they are due the following Mondays.

Topics:

**Approximate # of lectures
Chapter**

Crystal Structure	2	1
Crystal Diffraction	2	2
Crystal Binding and Cohesive Energy	3	3
Phonons I	3	4
Thermal Properties of Phonons	4	5
Metals and Free Electron Models	4	6
Energy Bands	3	7
Semiconductors	3	8
Superconductors, Magnetic Materials, Ferroelectric/Dielectric Materials, etc.	2	Others
Total number of lectures:	26	

Expected Outcome:

After taking this course, students should have a good understanding of basic properties of solid materials. It is designed to raise interests in modern topics in materials science and physics. The topics are laid out in such a way so that students can then go on to advanced topics in materials science such as electronic materials. The course will also serve as a good prerequisite to the graduate level solid state physics/electronics course taught in physics, electrical engineering and/or materials science departments.

Class Schedule:

Mondays and Wednesdays 3:30PM-4:45PM

Classroom: CHE 2116

Course Instructor: Prof. Ichiro Takeuchi

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Office Hours: TBA, second week

Prepared by Prof. Takeuchi, August 2003