

**Class Syllabus**  
ENMA460/PHYS431 – Introduction to the Physics of Solid Materials  
Fall 2003

**Class Hours:**

Mondays and Wednesdays 3:30PM-4:45PM  
Classroom: CHE 2116

**Course Instructor:** Prof. Ichiro Takeuchi

Department of Materials Science and Engineering  
and Center for Superconductivity Research, Department of Physics  
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**Office Hours:** TBA, second week

**TA (for grading the HW):** Xianli Zhang

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

**Course Website** on ajconline ([www.ajconline.umd.edu](http://www.ajconline.umd.edu))

**Grading Scheme:**

Homework: 30%  
Midterm I: 20% **(10/6 Monday)**  
Midterm II: 20% **(11/5 Wednesday)**  
Final: 30% **(12/17 Wednesday, 1:30-3:30PM)**

**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 To Be Covered in Class**

| <b>Topics</b>                                                                    | <b>Approximate # of lectures</b> | <b>Chapter</b> |
|----------------------------------------------------------------------------------|----------------------------------|----------------|
| 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,<br>Ferroelectric/Dielectric Materials, etc. | 2                                | Others         |
| Total number of lectures                                                         | 26                               |                |

**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.

**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.