

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

1. **ENMA 460 – Physics of Solid Materials**

2. **Credits and contact hours – 3 credits.** The University of Maryland follows the Maryland Higher Education Commission's policies on "contact hours;" specifically, one semester hour of credit will be awarded for a minimum of 15 hours, of 50 minutes each of actual class time, exclusive of registration, study days, and holidays.

Schedule: meets two 75 minute periods (lecture)

3. **Instructor's or course coordinator's name:** **Prof. Ichiro Takeuchi and Luz Martinez-Miranda**

4. **Text book, title, author and year:** Introduction to Solid State Physics, Eighth Edition by Charles Kittel.
 - a. **Other supplemental materials:** Supplemental reading materials will be made available from time to time. They will either be distributed or posted online.

5. **Specific course information**
 - a. **Brief description of the content of the course (catalog description):** Classes of materials; introduction to basic ideal and real materials' behavior 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.
 - b. **Pre-requisites or co-requisites:** PHYS271, PHYS270, and MATH241.
Restriction: Junior standing or higher; and must be in Engineering: Materials Science program.
 - c. **Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program:** ENMA 460 is a required course for Materials Science and Engineering majors.

6. **Specific goals for the course:**
 - a. **Specific outcomes of instruction:** 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.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed in this course.

ABET A: Ability to apply mathematics, science and engineering principles

ABET E: Ability to identify, formulate and solve engineering problems

ABET J: Knowledge of contemporary issues.

ABET K: Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

7. Brief list of topics to be covered.

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