

## ENGR 54 PRINCIPLES OF MATERIALS SCIENCE AND ENGINEERING

(Required for AE, CE, ME and MSE; Elective for EE)

- Catalog Data:** **ENGR 54: Principles of Materials Science and Engineering (Credit Units: 4).** Materials--topics range from superconductors to biodegradable polymers. Structure and properties of materials, including metal, ceramics, polymers, semiconductors, composites, traditional materials. Atomic structure, bonding, defects, phase equilibria, mechanical properties, electrical, optical, and magnetic properties. Brief introduction to materials processing and synthesis. Prerequisites: Chemistry 1A and Physics 7B. Only one course from ENGR 54 and ENGR H54 can be taken for credit. (Design unit: 0)
- Textbook:** Callister Jr., William D., *Fundamentals of Materials Science and Engineering: An Integrated Approach*, 2<sup>nd</sup> Edition, John Wiley & Sons, Inc., 2005.
- References:**
- Coordinator:** James Earthman, Martha Mecartney, and Dan Mumm
- Course Objectives:** This course will serve as the common entry point for all undergraduate students in The Henry Samueli School of Engineering. It will cover the basic concepts of materials science and engineering including atomic bonding, crystallography, crystal imperfections, diffusion process, phase diagrams and phase transformations, and material behavior.
- Course Outcomes:** Students will:  
Apply principles from chemistry, physics, and mathematics to describe the basic phenomena that control the structure (crystalline or molecular structure, and defects such as vacancies and dislocations) and properties (strength, toughness, elastic modulus, conductivity, thermal expansion, etc.) of materials.  
Understand the design limitations for metal alloys, ceramics/semiconductors, and polymers and the major differences between these classes of materials.  
Understand basic materials design concepts along with professional and ethical responsibilities when selecting the material most suitable for a given application using data on materials properties.
- Prerequisites By Topic:** General background in Chemistry or Physics.
- Lecture Topics:** Atomic Bonding, Defects in Materials, Failure of Materials, Ceramics, Composites, Defects in Materials, Electrical Behavior, Magnetic Properties, Metals and Alloys, Crystal Structures, Diffusion, Phase Diagrams and Alloys, Polymers, Mechanical Properties, Thermal Behavior, Optical Behavior
- Class Schedule:** Meets for 3 hours of lecture and 1 hour of discussion each week for 10
- Computer Usage:** PC based software CD exercises provided with book

**Laboratory Projects:**

**Professional Component:** Contributes toward the Materials Science and Engineering Major design experience.

**Relationship to Program Outcomes:** This course relates to Program Outcomes a, c, and f as stated at: <http://undergraduate.eng.uci.edu/degreeprograms/materials/mission>

**Design Content Description**

*Approach:*

*Lectures: %*

*Laboratory Portion: %*

**Grading Criteria:**

Homework:	10%
Quizzes:	10%
Midterm I:	20%
Midterm II:	20%
Final Exam:	40%
	100%

**Estimated ABET Category Content:**

Mathematics and Basic Science: \_\_\_ credit units or \_\_\_%

Engineering Science: 4 credit units or 100 %

Engineering Design: \_\_\_ credit units or \_\_\_%

**Prepared by:** Martha Mecartney and Dan Mumm **Date:** July 2007

**CEP Approved:** Fall 2002