

CBEMS50L PRINCIPLES OF MATERIALS SCIENCE AND ENGINEERING

- Catalog Data:** **CBEMS50L Principles of Materials Science and Engineering (Credit Units: 1) S.** Introduction to the experimental techniques to characterize the properties of engineering materials. Emphasis on understanding the influence of microstructure on elastic, plastic, and fracture behavior. Topics include microstructure characterization, heat treatment, grain size effect, precipitation hardening, and impact loading. Corequisite: ENGR54. (Design units: 0)
- Textbook:** Callister, William D. Jr., *Materials Science and Engineering, An Introduction*, 6th edition, John Wiley & Sons, Inc., New York, 2000.
- References:** Barrett, Craig R., Nix, William D., and Tetelman, Alan S., *The Principles of Engineering Materials*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1973.
- Coordinator:** Farghalli A. Mohamed
- Course Objectives:** This is a laboratory course in which the basic principles of engineering, chemistry, physics and materials science are incorporated in order to permit students to relate the properties of materials to their internal structure.
The course will stress enhancing the ability of the student to conduct experiments in multidisciplinary groups (students from different majors). Also, the course aims at improving the effectiveness of the student's communication skills through laboratory reports and oral presentations. Ethics and professional responsibilities are discussed in reference to collecting and analyzing data and conducting basic research. The students will participate in an exercise in the selection and design of advanced material systems. The need to continually educate themselves over the span of their career will be discussed.
- Course Outcomes:** Students will be able to:
Prepare metallographic specimens for microstructural analysis.
Identify, microstructurally and behaviorally, the effects of cold working, recrystallization and grain growth.
Completely familiar with all seven microconstituents of plain carbon steel and their corresponding effects on mechanical behavior.
Calculate the affect of flaw size on the mechanical properties of brittle materials.
Conduct tension tests, compression tests, impact tests and three point bend tests with the latest industrial equipment.
Be familiar with the ductile to brittle transition temperature of some metals.
Be familiar with superplasticity and its dependence on grain size.
Understand the general correlations between microstructure (grain size, dislocation density, etc.), mechanical behavior, and electrical behavior of materials.
Design and conduct experiments, and analyze and interpret data appropriately in the selection and design of advanced material systems.

Function on multi-disciplinary teams.
Understand and deal with issues of professional and ethical responsibility in performing tests and reporting results.
Communicate effectively, both orally and in writing, regarding scientific and engineering principles.
Recognize the need for life-long learning in order to remain effective as a scientist or engineer

Prerequisites By Topic: ENGR 54

Lecture Topics:

Class Schedule: Each class meets 3 hours of lab per week for 10 weeks.

Computer Usage: Computer usage is required for data analysis.

Laboratory Projects: Effects of cold working and recrystallization (2 lab period)
Heat treatment of Fe-C alloys (2 lab period)
Tensile testing of materials (1 lab period)
Effect of surface flaws on brittle materials (1 lab period)
X-ray Diffraction (1 lab period)
Materials Selection (3 lab period/including oral presentation)

Professional Component: Contributes toward the Chemical Engineering Topics Courses.

Relationship to Program Outcomes: This course relates to Program Outcomes 1, 2, 4, and 7 as stated at: http://www.eng.uci.edu/dept/objective_materials_science

Design Content Description

Approach:

Lectures:

Laboratory Portion:

Grading Criteria:

Laboratory exercises and reports: 85%

Final exam: 15%

100%

Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%

Engineering Science: 1 credit units or 100%

Engineering Design: 0 credit units or 0%

Prepared by: Farghalli A. Mohamed **Date:** July 2005

CEP Approved: Fall 2001