CBEMS 160
ADVANCED LABORATORY IN CHEMISTRY AND SYNTHESIS OF MATERIALS
(Required for MSE; Elective for ChE)

Catalog Data:

CBEMS 160 Advanced Laboratory in Chemistry and Synthesis of Materials (Credit Units: 4) Lecture, two hours; laboratory, eight hours. Synthesis and characterization of organic and inorganic materials including polymers, oxides, metal alloys, electronic materials. Techniques include electron microscopy, solid-state NMR, gel permeation chromatography, photolithography, x-ray diffraction, porosity, and thermal analysis. Prerequisite: ENGR54 or Chemistry 130A-B or 131A-B. Same as Chemistry 156. (Design units: 0)

Textbook:

There is no required textbook for this class. Reserve books will be in the Science Library. Extensive handouts will be available for purchase in the Engineering Center Copy Center, Room 203 Engineering Tower (plaza level).

Reference:

Books on Reserve in Science Library
F.W. Billmeyer, *Textbook of Polymer Science,* Wiley Interscience
George Odian, *Principles of Polymerization,*Wiley Interscience
I.M. Campbell, *Introduction of Synthetic Plymers,* Oxford Science Pub.
H Allcock and F. Lampe, *Intro to Polymer Chemistry,* Academic Press.
W.D. Callister, *Introduction to Materials Science and Engineering,* Wiley.
W.F. Smith, *Principles of Materials Science & Eng.,* McGraw Hill.
M.F. Ashby and D.R.H. Jones, *Engineering Materials 2: An introduction to microstructure, processing and design,* Pergamon Press.

Coordinator:

Martha L. Mecartney

Course Objectives:

This course focuses, from the perspective of a chemist/chemical engineer, on the synthesis and characterization of properties of polymers, ceramics, metal alloys, and microelectronic materials. Lectures each week will be designed, principally, to provide introduction to the materials chemistry and background for the laboratory exercises. 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 need to continually educate themselves over the span of their career will be discussed.

Course Outcomes:

Students will:
Apply science (basic and advanced), mathematics, and engineering fundamentals in the context of materials science engineering to understanding synthesis and properties of materials.
Design and conduct experiments in materials science as well as analyze and interpret data**.**
Function on multi-disciplinary teams, with students from Chemistry, Chemical Engineering, and Materials Science and Engineering.
Communicate effectively, both orally and in writing as evidenced by written reports, memos, and oral presentations.

Understand that materials are continually evolving requiring continuing education to learn about advances in characterization of materials.

Prerequisites by Topics: Fundamentals of materials science or chemistry

Lecture Topics:
Polymer Chemistry and Gel Permeation Chromatography (GPC)
Sol-Gel Chemistry for Ceramic Oxides
Phase Transitions in Polymers, Crystallization, Differential Scanning Calorimetry (DSC) and Thermogravimetric Analysis (TGA)
Characterization of Porosity, Surface Area
NMR Analysis of Polymers and Ceramics
Crystallization and X-ray Diffraction Techniques
Scanning Electron Microscopy (SEM)
Energy Dispersive Spectroscopy (EDS)
Kinetics and Thermodynamics of Phase Transformations in Metals
Microlithography
Atomic Force Microscopy (AFM)

Class Schedule: Meets for 2 hours of lecture and 8 hours of lab each week for 10 weeks.

Computer Usage: Basic computer skills

Professional Component: This course is designed to contribute towards the Materials Science Engineering major through the engineering topics that are related to the synthesis and characterizations of different types of materials (metals, polymers, ceramics, and microelectronics).

Relationship to Program Outcomes:
This course relates to Program Outcomes a, b, d, f, g and i as stated at: http://undergraduate.eng.uci.edu/degreeprograms/materials/mission

Design Content:
Approach:
Lectures:
Laboratory Portion:

Grading Criteria:

Laboratory Report:	50%
Lab Quizzes:	20%
Class & Lab Participation:	10%
Class Presentation:	20%
	100%

Estimated ABET Category Content:
Mathematics and Basic Science: 0 credit units or 0%
Engineering Science: 4 credit units or 100%
Engineering Design: 0 credit units or 0%

Prepared by: Martha L. Mecartney **Date:** July 2007

CEP Approved: Fall 2003