

## ChE 245 – MATERIALS SCIENCE

Type (check one): Required:   X   Elective:         

**2005-2006 Catalog Data:** ChE 245. Material Science. (Formerly ChE 244 and ChE 445) Materials classification, behavior, properties and selection. Relationship between internal structure of materials and their observed properties and behaviors. Methods of controlling properties and behavior of materials by manipulating internal structures. Prerequisite: CHEM 113 or CHEM 115. Offered in the Fall semester. *One semester; three credits.*

**Prerequisites:** CHEM 113 or CHEM 115

**Co-Requisites:** None

**Textbook:** William D. Callister, Jr., *Material & Engineering, an Introduction*, Fifth Edition, Wiley, 2000.

**Other Required Materials:** None

**Other References:** Pat L. Mangonon, *The Principles of Materials Selection for Engineering Design*, Prentice Hall, 1999.  
James F. Shackelford, *Introduction to Materials Science for Engineers*, Fourth Edition, McMillan Publishing Co., 1996.

**Instructor:** Dr. Asit K. Ray, Professor of Chemical Engineering

**Course Objectives:**

1. Introduce the science and engineering of materials.
2. Familiarize internal structure and properties relationships of different types of materials.

**Prerequisites by Topics:**

1. Introduction to the principles of chemistry including electronic structure, periodic table, bondings, molecular structure, etc.

**Topics:**

1. Introduction of material science and engineering.
2. Atomic structure and interatomic bonding.
3. The structure of crystalline solids.
4. Imperfections in solids.
5. Diffusion.
6. Mechanical properties of metals.
7. Dislocations and strengthening mechanisms.
8. Phase diagrams.
9. Structure and properties of ceramics.
10. Polymer structures.
11. Corrosion.
12. Electrical properties.
13. Material selection.
14. Examinations.

**Class Schedule:** Three 50-minute sessions per week

**Prepared by:** Asit K. Ray, Ph.D. **Date:** September 2005

**Professional Component:  
ChE 245 – MATERIALS SCIENCE**

Category (check one)	<input checked="" type="checkbox"/> Math/Basic Science <input type="checkbox"/> Engineering <input type="checkbox"/> General Education <input type="checkbox"/> Other
Design (check one)	<input type="checkbox"/> Significant <input type="checkbox"/> Some <input checked="" type="checkbox"/> None
Realistic Constraints (check all that apply)	<input type="checkbox"/> Economic <input type="checkbox"/> Environmental <input type="checkbox"/> Sustainability <input type="checkbox"/> Manufacturability <input type="checkbox"/> Ethical <input type="checkbox"/> Health & Safety <input type="checkbox"/> Social <input type="checkbox"/> Political

**Relationship to Program Outcomes:**

Check all that apply:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs
- (d) an ability to function on multi-disciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) a recognition of the need for and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice