

1. Department, Course Number, and Course Title:

ENGINEERING

ENGR 207 MATERIAL SCIENCE AND ENGINEERING

2. Designation: Required Elective
Lower Division Upper Division

3. Course Description: Understanding structure and fundamental atomic and molecular mechanisms of behavior of engineering materials, atomic and electronic movement, physical, mechanical, and electrical properties; overview of engineering materials, semiconductors, metals, ceramics, polymers, and composites.

4. Prerequisites: CHEM 101 (General Chemistry), MATH 206 (Calculus I)

5. Text and Materials: Materials Science and Engineering: An Introduction, 6th ed., William D. Callister, Jr., John Wiley and Sons, Inc. 2003.

6. Course Objectives: This course gives engineering students fundamental understanding of materials' structures and their effects on physical and engineering properties. The methods of controlling microstructure to obtain desired mechanical properties in materials and influence of material processing on material behavior are discussed. Broad categories of engineering materials are reviewed.

Course Outcomes

- the ability to distinguish between different types of materials, their use, effect of environment on behavior
- an appreciation of influence of material on human development, and its sustainability
- the understanding of the atomic structure, bonding and arrangement of atoms and their influence on properties
- the understanding of influence of imperfection on material properties and deformation of materials
- the understanding of diffusion of atoms and application on the strengthening of the material and sintering
- the knowledge of mechanical properties and testing of materials, interpretation and analysis of experiments
- the understanding of influence of processing and methods of obtaining desired properties of materials
- the knowledge of interpretation of phase diagrams and their use in achieving the desirable properties
- the understanding of equilibrium and non-equilibrium iron-carbon phase diagram
- an introductory knowledge of other engineering materials
- the ability to read and understand materials literature and to continue studying on their own
- the ability to write answers, and critically think
- the ability to critically analyze, and interpret experimental data.

7. Topics Covered: (in Order of Presentation)

- Atomic Structure and Interatomic Bonding Chapter 2
- Crystal Structures, Crystal systems, Crystallographic Points, Directions, and Planes, Crystalline and Non-crystalline Materials Chapter 3
- Point Defects, Miscellaneous Imperfections, Microscopic Examination Chapter 4
- Diffusion Chapter 5
- Mechanical Properties of Materials Chapter 6
- Dislocations and Strengthening Mechanisms Chapter 7
- Failure Chapter 8
- Phase Diagrams Chapter 9
- Phase Transformations Chapter 10
- Structure and Properties of Ceramics Chapter 12
- Corrosion and Degradation of Materials Chapter 17
- Electrical properties of Materials Chapter 18
- Optical Properties of Materials Chapter 21

8. Class Schedule: Number of Sessions per week: 2
Duration of each session: 1 hour 40 minutes

9. Contribution of course to meeting the professional component:

This course is part of the lower division required classes for Mechanical and Civil Engineering programs and Electrical Engineering students on old catalog.

Engineering Design 4 units

10. Relationship of course to program objectives:

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

Knowledge outcomes:

- an ability to apply knowledge of mathematics, science, and engineering (abet a)
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)
- a knowledge of how mechanical engineering integrates into inter-disciplinary systems

Skill outcomes:

- an ability to communicate effectively (abet g)
- an ability to think in a logical sequential process

Attitudes Outcome:

11. Prepared by:

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05/2005