

MECHANICAL ENGINEERING PROGRAM

ABET COURSE SYLLABUS

ME 301: Structure and Properties of Solids (3 credit): Required Course

Course Description (2008-2010 Catalog):

Electronics structure and bonding in solids, crystalline and noncrystalline solids, defects and their relation to properties, phase transformations, diffusion in solids, and corrosion.

Prerequisite Course: CHEM 121, PHYS 182

Prerequisite by Topic:

- General Chemistry I – Fundamental principles of chemistry and their correlation with the properties of the elements.
- Physics for Scientists and Engineers III – Lectures in fluid mechanics, thermodynamics, optics, sound, temperature, thermometry, heat, gases, intermolecular forces, kinetic theory, entropy, light.

Textbook: Foundations of Materials Science and Engineering, Smith and Hashemi, 4th ed., McGraw Hill

Other Reference Material: N/A

Course Coordinator: Daniel Cook, Assistant Professor

Course learning outcomes:

- (a) Describe the electronic structure of atoms, the bonding types in the three main material groups, and how this effects their macroscopic properties such as strength, ductility, thermal and electrical conductivity.
- (b) Describe the major crystalline systems in metals and ceramics.
- (c) Calculate the free energy of formation of nuclei from homogeneous and heterogeneous solidification.
- (d) Identify and describe the various crystalline imperfections commonly found in solids.
- (e) Determine the diffusion properties of atoms in a solid solution due to concentration and temperature gradients.
- (f) Identify common metallic failure modes such as ductile, brittle, fatigue, creep, and corrosion failure.
- (g) Use phase diagrams to determine the microstructure of metals and ceramics.
- (h) Select or design appropriate processing methods to produce materials with specified combinations of properties.

Relationship of Course to Mechanical Engineering Program Educational Outcomes:

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| Goal 1: Provide mechanical engineering graduates with technical capabilities. | | | | | Goal 2: Prepare the mechanical engineering graduates to have effective workplace skills. | | | | Goal 3: Instilling a sense of responsibility as a professional member of society. | | | |
| 1.a | 1.b | 1.c | 1.d | 1.e | 2.a | 2.b | 2.c | 2.d | 3.a | 3.b | 3.c | 3.d |
| H | | L | | | | | | M | | M | M | |
| (L)ow | | | | | (M)edium | | | | (H)igh | | | |

Topics Covered:

1. Atomic Structure and Bonding
2. Crystal and Amorphous Structure in Materials
3. Solidification and Crystalline Imperfections
4. Thermally Activated Processes and Diffusion in Solids
5. Mechanical Properties of Metals
6. Phase Diagrams
7. Engineering Alloys
8. Polymeric Materials
9. Ceramics
10. Corrosion

Laboratory Projects: None

Class/Laboratory Schedule: 75 minutes lecture two sessions per week

Assessment of Student Progress toward Course Objectives

Two written exams, home-works, quizzes, and final exam

Class/Laboratory Schedule: MW 1:00-2:15 PM (Spring Semester)

Contribution of Course for meeting Professional Component:

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| (a) Mathematics and basic sciences: | 0 credit |
| (b) Engineering Topics (Design/Science): | 2 credit |
| (c) General Education: | 0 credit |
| (d) Others: | 0 credits |

Prepared By:

Daniel Cook

Date:

October 11, 2009