**MSE 2001: Principles and Applications of Engineering Materials**

**Credit hours and contact hours:** 3-0-0-3

**Instructor:** Valeria Milam

**Textbook:** James P. Schaffer, Ashok Saxena, Stephen D. Antolovich, Thomas H. Sanders, Jr. and Steven B. Warner, *The Science and Design of Engineering Materials*, Irwin, 1999.

**Specific course information**

**Catalog description:** The structure-property-processing-performance relationships of engineering materials are described. Materials selection is treated as a part of engineering design.

**Prerequisites:** CHEM 1310 - General Chemistry I or CHEM 1211K - Chemical Principles I

**Course:** Required

**Specific goals for the course**

Outcome 1: The student will possess the fundamental knowledge and skills to function effectively in materials science and engineering- related positions in industry and government, or to successfully pursue advanced studies.
1.1 The student will demonstrate a basic understanding of the five structural elements-atomic/molecular structure, defects, solutes, precipitates, grain boundaries and noncrystalline structures and how they manifest themselves in each class of material.
1.2 The student will demonstrate a basic understanding of how the key microstructural elements are controlled by composition, temperature, and deformation.
1.3 The student will demonstrate a basic understanding of how material structure relates to mechanical performance.

Outcome 2: The student will demonstrate technical competence using current engineering techniques, skills and tools.
2.1 The student will demonstrate the ability to calculate parameters that describe the structure, chemical composition, and phase fractions in solids
2.2 The student will demonstrate the ability to calculate materials properties from empirical data.

**Student Outcomes:**

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

**Topics covered:**

1. Atomic bonding
2. Crystal structures
3. Imperfections in crystalline solids
4. Diffusion
5. Non-crystalline and semi-crystalline solids
6. Phase equilibria and phase diagrams
7. Elastic and plastic deformation
8. Ductile and brittle fracture

**Correlation between Outcomes of Instruction and Student Outcomes:**

| Outcomes of Instruction | Student Outcomes | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Describe basic materials types and relate their significance in everyday use. | X | | | | | | |
| 2. Be able to provide technical communication about a material issue. | | | X | | | | |

**School of Materials Science and Engineering Student Outcomes:**

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(3) An ability to communicate effectively with a range of audiences.
(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.