



## ME211 Materials Science and Engineering (Required Course)

**Code and Name:** ME211 Materials Science and Engineering

**Credit Hours:** 3 (Lecture: 3, Tutorial: 1)

**Textbook:**

- Fundamentals of Materials Science and Engineering, William D. Callister, and David G. Rethwisch, 4<sup>th</sup> Edition, John Wiley & Sons, Inc., 2013.

**Other References:**

- Principles of Materials Science and Engineering, William F. Smith, 3<sup>rd</sup> Edition, McGraw Hill, 1995.

**Course Description:**

Introduction to Materials Science and materials engineering, Different applied materials (metals, polymers, ceramics and composites). Atomic structure and inter-atomic bonding. Polymer structure and polymer processing and properties. Mechanical properties of metals, polymers, ceramics and composites. Material solidification, microstructures, dislocations and defects. Phase diagrams and phase transformations. Strengthening mechanisms in materials. Classification of Metal Alloys. Basics of Corrosion and corrosion prevention.

**Pre-requisites:** CHEM103 General Chemistry, MATH105 Calculus I.

**Co-requisites:** None

**Course Learning Outcomes:**

With relation to ABET Student Outcomes (SOs: 1-7)

1. Know different materials types. (1)
2. State the effect of the materials structure on the on the physical and mechanical properties (1)
3. Describe with sketch the different materials processing techniques (4)
4. Explain the failure sequence failed materials (1)
5. Compare the different materials failure mechanisms and fracture (1)
6. Develop a flow diagrams showing the classification of different materials (1)
7. Judge the different materials selection to avoid metal corrosion (1, 4)
8. Evaluate the results of mechanical tests (1)
9. Analyses the iron-carbide phase diagram (1)
10. Justify the cause of failure for failed materials (1)
11. Calculate the number of atoms, materials density, phase content (1)
12. Illustrate the differences between single and polycrystalline materials (1)

**Topics to be covered:**

- Introduction to Materials Science
- Atomic Structure and Interatomic Bonding
- Structures of Metals and Ceramics
- Polymer structures, properties & processing
- Mechanical Properties and Testing
- Solidification of Metals and Alloys
- Imperfections in Metals and Alloys
- Phase Diagrams
- Strengthening Mechanism in Materials
- Classification of Metals and Alloys
- Basic of corrosion and corrosion prevention

**Grading Policy:**

The grading for the course are 60% coursework and 40% Final Exam. The course work consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes quizzes, homework, and projects for the remaining 20% that is modified by the course instructor.

