

**King Fahd University of Petroleum & Minerals**  
**MECHANICAL ENGINEERING DEPARTMENT**  
**ME 217: Materials Lab**

**Catalogue Description:** (0-3-1)

Metallography, sectioning, polishing, etching. Microstructure analysis using optical microscopy and x-ray diffraction. Determination of mechanical properties (hardness, tensile, fatigue and creep properties) of steels, cast irons and non ferrous as well as some polymeric materials and their structure properties relationship. Phase diagrams. Heat treatment. Cold work. Importance of properties in manufacturing and design. Simple spread sheet based data analysis using the hardness, tensile, fatigue and creep tests results.

**Status in Curriculum (Required or Elective):** Required (offered Fall & Spring)

**Prerequisites:**

**Co-requisites:** ME 216 Materials Science and Engineering

**Prerequisites by Topics:**

**Textbook:** **Materials Science and Engineering: An Introduction**, William Callister, 9<sup>th</sup> Edition, John Wiley & Sons, Inc., 2014.

**References:**

- 1) **Experimental Techniques in Materials and Mechanics**, C. Suryanarayana, CRC Press, 2011.
- 2) **Foundations of Materials Science and Engineering**, William Smith and Javad Hashemi, 5<sup>th</sup> Edition, McGraw-Hill, 2009.

**Coordinator:** **Dr. Saheb Nouari**, Associate Professor

**Goals:**

This course provides practical aspects of crystal structure determination, optical, phase diagrams, heat treatment, and different types of mechanical testing methods. The course emphasizes on how to derive useful information from experimental results.

**Course Outline (Lectures and Laboratory Experiments):**

1. Safety issues and safety regulations. (1 hour lecture and 2 hours Lab)
2. Metallography and grain size determination. (1 hour lecture and 2 hours Lab)
3. X-ray diffraction and identification of unknown samples. (2 hour lecture and 4 hours Lab)
4. Tensile testing and its application in design. (1 hour lecture and 2 hours Lab)
5. Hardness testing and its application in design. (1 hour lecture and 2 hours Lab)
6. Fatigue testing and its application in design. (1 hour lecture and 2 hours Lab)
7. Creep testing and its application in design. (1 hour lecture and 2 hours Lab)
8. Flexural testing and its application in design. (1 hour lecture and 2 hours Lab)
9. Heat treatment and its application in design. (1 hour lecture and 2 hours Lab)
10. Cold working and its application in design. (1 hour lecture and 2 hours Lab)
11. Hardenability and its application in design. (1 hour lecture and 2 hours Lab)
12. Impact testing and its application in design. (1 hour lecture and 2 hours Lab)

**Design Activities/Projects:**

Students will learn how to design appropriate treatments to obtain specific microstructures and mechanical properties. This includes heat treatment of steels, cold work, and hardenability.

**Computer Usage:**

Students are encouraged to use simple spreadsheet based data analysis using the hardness, tensile, fatigue and creep tests results.

**Assessment Tools:**

- i- Lab Reports
- ii- Final Exam

**Course Learning Outcomes:**

- I- Students shall demonstrate the ability to recognize safety issues and adhere to safety regulations.
- II- Students shall demonstrate the ability to identify microstructural characteristics of materials.
- III- Students shall demonstrate the ability to perform basic mechanical testing, determine mechanical

- characteristics, and understand mechanical behavior of materials.
- IV- Students shall demonstrate the ability to design appropriate treatments to obtain specific microstructures and mechanical properties.
  - V- Students shall demonstrate the ability to analyze and interpret experimental data.
  - VI- Students shall demonstrate the ability to write technical laboratory reports.

**Course Learning Outcomes mapped to Student Outcomes:**

Student Outcomes	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
Course-to-Student outcome mapping		I, II III, IV, V					V, VI				
Emphasis*		S					S				

\* L:: Little/None                      M: Moderate                      S: Strong

**Status of Continuous Improvement review of this Course:**

**Date reviewed:** -----  
**Prepared by:** Dr. Saheb Nouari

**Reviewed by:** Materials and Manufacturing Group  
**Date prepared:** March 20, 2014