

Mechanical Engineering Department
ME 215 - Engineering Materials and Processes
(Required)

Catalog Description: **ME 215 (2-2-3)**

Combined lecture and laboratory relating to the study of engineering materials. Basic atomic structure and crystalline solids. Processes of formation from liquid and particle state, plastic forming, molding deformation and metal removal. Effect of heat treatment on metal properties. Laboratory exercises involve basic machine tools and computer-controlled equipment.

Prerequisite(s): Chem 126 – General Chemistry II

Textbook(s)/Materials Required:

1. E. Paul De Garmo, J.T. Black, R.A. Kohler. Materials and Processes in Manufacturing, 8th Edition, MacMillian, NY, 1997.

Reference(s) (Not Required):

1. R. Dubrovsky, Laboratory Manual for ME 215A, CAPCO Pub., Oklahoma, 1998.
2. William D. Callister, Jr., Materials Science and Engineering. An Introduction. John Wiley and Sons, Inc., NY, 3 Edition, 1994.

Course Supervisor: **Dr. Kwabena A. Narh**

Prerequisites by Topic:

1. Mass Equilibrium
2. Chemical Kinetics
3. Thermodynamics
4. Electrochemistry

Course Objectives¹:

Objective 1: Students will learn principles of alloy design and classification of engineering materials, including basic atomic structure and crystalline solids.

Objective 2: Students will learn principles of manufacturing and classification manufacturing processes.

Objective 3: Students will learn principles of interchangeable manufacturing, inspection and equality control.

Topics²:

1. Introduction: Basic Atomic Structure & Crystalline Solids; The Solid State; Forming of Engineering Materials from the Elements (3 hours).
2. Fundamentals of Metal Alloys; Equilibrium Diagrams (3 hours).
3. Testing of Engineering Materials (3 hours).
4. Heat Treatment of Metals (3 hours).
5. Classification of Steels. Material Selection for Designed Product (3 hours).
6. Manufacturing Processes. Material Deformation Processes (3 hours)
7. Casting, Welding, Powder Metallurgy and Their Influence on the Design Aspects of Machine Components (3 hours).

8. Measurement, Inspection, System of Fits, Computer Controlled Inspected Stations (3 hours).
9. Theory of Cutting (3 hours).
10. Machining Processes: Conventional and Computer Controlled (3 hours).
11. Laboratory (25 hours)

Evaluation Method:

4. Classroom Participation
5. Quizzes
6. Exam
7. Homework
8. Lab Report

Schedule: Lecture/Recitation: 3 hours, per week
Laboratory: 2½ hours, per week

Professional Component: Engineering Science/Engineering Design

Program Objectives Addressed: A, B, C, E

Course Outcomes³:

Objective 1:

- 1.1 Students will demonstrate ability to design new alloys or select new alloy for required application (1, 2, 3, 5) (a, c, d, k).
- 1.2 Students will demonstrate ability to select a desired material for part design (1, 2, 3, 5) (b, c, d, k).
- 1.3 Students will demonstrate ability to define the mechanical properties of different steels and cast iron (1, 2, 3, 5) (a, c, d, k).

Objective 2:

- 2.1 Students will demonstrate ability to select appropriate manufacturing process & bring selected material to manufacturing (1, 2, 3, 5) (a, c, d, k).
- 2.2 Students will demonstrate ability to plan the sequence of operation in order to achieve final part configuration (1, 2, 3, 5) (b, c, d, k).
- 2.3 Students will demonstrate ability to define the manufacturing process required achieving desired part configuration (1, 2, 3, 5) (a, c, d, k).

Objective 3:

- 3.1 Students will demonstrate ability to define tolerances, allowance and difference between clearance & allowance (1, 2, 3, 5) (a, c, d, k).
- 3.2 Students will demonstrate ability to select required tolerance using tables in the System of Limits & Fits (1, 2, 3, 5) (b, c, d, k).
Students will demonstrate ability to use different measuring tools and take readings from them with required accuracy (1, 2, 3, 5) (a, c, d, k)

Prepared by: Kwabena A Narh

Date: October 6, 2006

¹ Capital Letters in parenthesis refer to the Program Objectives of the Mechanical Engineering

Department. Listed in Sec 2 d Tables B-2-9, B-2-12. Table B-2-8 links Program Objectives with the ABET a-k Criterion.

² Topic numbers in parenthesis refer to lecture hours. (three hours is equivalent to 1 week)

³ Outcome numbers in parenthesis refer to evaluation methods used to assess the student performance. Lower case letters in parenthesis refer to ABET a-k outcomes.