

## ME 438

### INTRODUCTION TO PHYSICAL METALLURGY

**1999-2000** ME 438: Introduction to Physical Metallurgy. 3-0-3  
Catalog Data:Crystalline Structures Material Transport in Solids. Material Properties. Ferrous and Non Ferrous Materials. Powder Metallurgy. Composite Materials. Prerequisites: Chem.116, ME 215.

**Text book:** Herman W. Pollack Materials Science & Metallurgy. 4-th Edition, Regents/Prentice Hall, Inc., Englewood, NJ, 1988.

**Reference:** W.D. Callister, Jr. Fundamentals of Materials Science & Engineering/An Interactive e.Text. John Wiley & Sons, Inc. New York, 2001  
S. H. Avner. Introduction to Physical Metallurgy, 2 Ed., McGraw Hill, 1974.

**Coordinator:** Dr. R. Dubrovsky, Associate Professor of ME.

**Location:** MEC 309

**Tel:** 973-596-3337

**Goal:** This course is designed to give students in ME an ability to understand the principles of metal alloying and heat treatment and integrate this knowledge in machine design.

**Prerequisites Topics:**

1. Solidification of liquids.
2. Imperfection in Crystals.
3. Equilibrium diagrams.

<b>Topics:</b>
1. Role of Materials in Engineering, (3 h.; * 1.5 h.).
2. Elements of Crystalline Structures, (3 h.; * 1 h.).
3. Material Transport in Engineering Solids, (3 h.; * 0 h.).
4. Mechanical Testing , Selection, and Failure of Engineering Materials, ( 3 h.; * 2h.).
5. Strengthening Mechanisms and Response to Thermal Treatment, (3 h.; *1 h.)
6. Basic Relationship in Single and Multiphase Materials. Iron-Iron Carbide Diagram,(3 h.; * 1 h.).
7. Non-equilibrium cooling processes, ( 3 h.; * 1 h.).
8. Heat Treatment Processes. Surface and Diffusion Heat Treatment Processes, (3 h.; * 1 h.).
9. Classification of Ferrous Materials. Steels, microstructures, properties, and application, ( 3 h.; 1 h.).
10. Cast Irons, microstructure, properties and application, (3 h.; * 1 h.).
11. Non-ferrous materials, properties, and application, (3 h.; * 1 h.).
12. Powder Metallurgy and Engineering Ceramics, (3 h.; * 1 h.).
13. Composite Materials, properties and application, ( 3 h.; * 1 h.).
14. Microstructure and Properties of Engineering Materials. Principles of Metallography, (3 h.; * 1 h.).
15. Exams ( 6 h.; * 2 h.)

**Laboratory Projects:**

1. Microstructure Studies.Optical Microscopes, Image Analyzer, Samples preparation equipment
2. Ferrous Alloys. Optical Microscopy, Image Analyzer.
3. Non Ferrous Alloys. Optical Microscopy, Image Analyzer.
4. Heat Treatment Heating Furnaces, Hardness Testers (Rockwell, Brunell)
5. Quenching and Tempering. Heating Furnaces, Hardness Testers
6. Plasma Treatment. Glow Discharge Machine.
7. Movie related to Physical Metallurgy and Testing of Engineering Materials.

**ABET** category content as estimated by faculty member who prepared this course description:  
Engineering Science: 2 credits or 66%.  
Engineering Design: 1 credit or 33%.

Note: \* Design content

**The NJIT Honor Code and Professional Conduct will be strictly enforced.**

**(F05)**