Manufacturing Systems Engineering and Management
Fall 2020

MSE 528. PRINCIPLES OF MATERIALS ENGINEERING AND LAB (2/1)
Prerequisite: Instructor Consent. Co-requisite: MSE 528L.

Course Description: Study of the principles governing the selection, treatment, and use of metals and alloys. Introduction to crystal structures, their imperfections and the effect on diffusion, phase transformations. The application of thermodynamic laws to metallic alloys; solid solutions; alloying and solubility in solids, metal/metal, metal/liquid, and metal/gas interactions. 2 hours of lecture-discussion and 2 hours of lab per week.
(Design units: 1.0)

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Office Hour: Tuesday, 5:20-5:50PM

The main techniques used in this course, center around the application of scientific principles to real-life situations. Library research is necessary in order to develop and achieve most of the topic discussions. The course covers principles of Physical Metallurgy in order to explain materials behaviors. This course requires extensive design problems solving, technical presentation, and a term paper on a current topic in materials application or design.

Textbook: R. E. Reed Hill and R. Abbaschian, Physical Metallurgy Principles, Cengage Learning, 4th ed, 2009.

Time: Tuesday, 18:00 -19:40 PM, Online (Zoom) Room JD1504

Course Syllabus:

Date	Topic	Chapters	Homework
Aug. 25	Intro	Chapter 1	1.1, 1.6
Sept.1	Crystal structures		1.2, 1.5
Sept. 8	Defects	Chapter 4, 6	4.2, 6.6
Sept 15	Analytical Tech	Chapter 2	2.2, 2.10
Sept 22	Diffusion	Chapter 12	12.2, 12.10
Sept 29	Annealing	Chapter 8	8.8, 8.12
Oct 6	Intro to Thermo	Chapter 7	7.10
Oct 13	**MidTerm Exam**		
Oct 20	Solid Solution	Chapter 9	9.8
Oct. 27	Phases	Chapter 10	10.5
Nov. 3	Phase diagram	Chapter 11	11.4, 11.8
Nov 10	Phase diagram	Chapter 11	11.10
Nov 17	Solidification	Chapter 14, 15	14.4, 15.10
Nov 24	TTT Diagram	Chapter 18, 19	18.7, 18.15
Dec 1	Ferrous Alloy	Chapter 19	19.3, 19.11
Dec 8	Non-Ferrous Alloy	Chapter 20	20.4, 20.11
Dec 15	**Final**	**8:00-10:00pm**	

Course Method and Expectations:
The main techniques to be used in this course center on the application of scientific principles to real-life situations. Library research is necessary in order to develop and achieve most of the topic discussions.

Grading Policy

Homework	10%
Mid-term Exam	30%
Term project (due on Dec. 8)	**10%**
Final Exam	50%

Grading System: Plus/Minus Grading

References:
1. A. G. Guy, Elements of Physical Metallurgy, 1984.
2. D. Callister, Jr. Materials Science and Engineering, J. Wiley & sons, NY, 5th Ed. 2000.
3. R. A. Swalin, Thermodynamics of Solids, Wiley, NY 1972.
4. P. G. Shewmon, Diffusion in Solids, McGraw-Hill, NY 1963.
5. M. C. Flemings, Solidification Processing, McGraw-Hill, 1974.
6. D. A. Porter & K.E. Easterling, Phase Transformations in Metals and Alloys, Nelson Thornes, UK, 1992.
7. P. G. Shewmon, Transformation in Metals, McGraw Hill, 1989.

Course Objectives

1. This course will increase your ability to apply your knowledge of mathematics, chemistry, and physics in the Physical Metallurgy of materials.
2. This course will increase your ability to design structural components base on proper knowledge of materials properties, manufacturing processes and environmental effects.
3. This course will increase your ability to identify, formulate, and solve engineering problems and develop solutions that are competitive and economical.
4. This course will increase your ability to understand ethical responses and to address contemporary issues and civic responsibilities and to develop an involvement in the professional roles.
5. This course will increase your ability to design processes for manufacturing and influence designers for manufacturing.

Standard Operating Procedures

1. Class members are expected to maintain personal and professional standards consistent with the Code of Ethics of the National Society of Professional Engineers, the Preamble and Fundamental Canons of which are as follows:

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

- using their knowledge and skills for the enhancement of human welfare,
- being honest and impartial, and serving with fidelity the public, their employers and clients;
- striving to increase the competence and prestige of the engineering profession; and
- supporting the professional technical societies of their disciplines.

2. Class members are expected to submit original work except in joint projects in which the activities are cooperative and collaborative.
3. Class members are expected to attend class except when circumstances are outside the member's control.
4. Class members are responsible for material in the reading assignments, class presentations, discussions, and homework examples.
5. Homework sets and project reports are due at the time requested
6. Class members are expected to be cooperative with other class members and to collaborate when appropriate with colleagues.
7. Class members are expected to participate in the oral presentations.
8. Class members are expected to comply with University regulation governing intellectual property, origin of work, and honesty. Failure to maintain these standards will result in student disciplinary action and a grade of F in the course.

Formats for Work

1. Homework problems should be submitted on engineering paper, written on one side, numbered, stapled, and identified by name and course number.
2. The members of the class will make a presentation to the class on a selected topic on mechanical behavior of materials or design for mechanical testing.
3. The format for the project design report is described in the MSE 227L laboratory manual.