

Course number and name

MTSE 4010 - Physical Metallurgy

Credits and contact hours

3 Credits. MW 4:00pm - 5:20pm

Instructor's or course coordinator's name

Instructor: Sundeep Mukherjee

Text book, title, author, and year

Physical Metallurgy Principles, Abbaschian/Reed-Hill, 4th Edition, 2009, ISBN10: 0-495-43851-0

a. *Other supplemental materials*

Phase Transformations in Metals and Alloys, Porter and Easterling
Class Notes

Specific Course Information

a. *Brief description of the content of the course (catalog description)*

Physical metallurgy principles with a focus on understanding structure-property relationships in metals and alloys. Topics include crystal structure, thermodynamics, phases and phase-diagrams, diffusion, solidification, nucleation and growth, mechanical behavior, dislocations, grain boundaries, strengthening mechanisms, ferrous and non-ferrous systems. Emphasis on the basic structure-property-processing relationships in metals/alloys and how they differ from other material classes.

b. *Prerequisites or co-requisites*

MTSE 3010, MTSE 3030, MTSE 3040.

c. *Indicate whether a required, elective, or selected elective course in the program*

Required

Specific goals for the course

a. *Specific outcomes of instruction*

- Students will learn about impact of processing on microstructure and related mechanical properties
- Students will pick a research topic, write a term paper and present it in the class
- Students will be assigned assignments based on reading and analysis of published papers

- Students will be assigned assignments that require design of metallic alloys for desired mechanical design goals, like combination of strength and toughness
- b. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.*

This course addresses ABET Criterion 3 Student Outcome(s): a, b, e, g, i, k

Brief list of topics to be covered

- I. Structure-Property relationship in metals
- II. Crystal binding
- III. Thermodynamics
- IV. Phases and phase diagrams
- V. Diffusion processes
- VI. Solidification of metals
- VII. Nucleation and growth kinetics
- VIII. Defects and Dislocations
- IX. Elements of grain boundaries
- X. Strengthening mechanisms
- XI. Ferrous Systems
- XII. Non-Ferrous Systems