

Course number and name

MTSE 4010 - Physical Metallurgy

Credits and contact hours

3 Credits. TR 10:00 am - 11:20 am

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

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*

Specific Course Learning Outcome
1. Learn about impact of processing on microstructure and related mechanical properties
2. Pick a research topic, write a term paper and present it in the class
3. Acquire and apply metallurgy concepts based on reading and analysis of published papers
4. Engineer metallic alloys and structures 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 Student Outcome [1]:
an ability to identify, formulate, and solve complex engineering problems by
applying principles of engineering, science, and mathematics**

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. Physical Metallurgy of Ferrous Systems
- XII. Physical Metallurgy of Non-Ferrous Systems