

# **Syllabus for MTSE 4010 - Physical Metallurgy**

## **Course number and name**

MTSE 4010 - Physical Metallurgy

## **Credits and contact hours**

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

## **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, metallurgical 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*
- b. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.*

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<b>Specific Course Learning Outcome</b>
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

This course addresses ABET Student Outcome 1

**Brief list of topics to be covered**

- I. Structure-property relationship in metals
- II. Metallic structure and bonding
- III. Metallurgical thermodynamics
- IV. Alloy phase diagrams
- V. Phase transformations in Metals and Alloys
- VI. Diffusion processes
- VII. Solidification of metals and alloys
- VIII. Nucleation and growth kinetics
- IX. Defects and Dislocations
- X. Strengthening mechanisms
- XI. Physical Metallurgy of Ferrous Systems
- XII. Physical Metallurgy of Non-Ferrous Systems