



Mechanical Engineering Dept. Department

Syllabus

ME 474: Physical Metallurgy (3-0-3)

Course Catalog Description:

Review of crystal structures, dislocation and slip phenomena, plastic deformation. Metals and alloy systems. Diffusion in solids Strengthening mechanisms. Heat treatment of metals, phase transformations. Metallurgical aspects of failure.

Course Pre-requisites:

- ME 216: Materials Science and Engg.
- ME 217: Materials Lab

Course Objectives:

1. To develop students ability to correlate crystal structures and deformation mechanism in metals and alloys.
2. To develop students understanding on microstructural features and atomic diffusion process in the strengthening mechanism of metals and alloys.
3. To integrate students' knowledge on the factors affecting the structural properties of metal and alloys to economically design metal and alloys for safe durable application.

Course Learning Outcomes:

CLO1. Be able to gain knowledge of establishing relationship between crystal structures, slip and deformation mechanism in metals and alloys.

CLO2. Be able to gain knowledge of the role of diffusion process in strengthening mechanism conduct proper and simple analysis of strength of metals and alloys.

CLO3. Be able to conduct laboratory experiments, analyze data and interpret results related to strength and failure of metals and alloys in structural application.

CLO4. Be able to understand the factors affecting the structural properties of metal and alloys and design necessary procedure to economically produce metal and alloys for safe durable application.

CLO5. Be able to analyze, understand the contemporary issues and emerging technologies related to the in metallic materials.

Learning Resources:

- None
- None

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Midterm	8	30.0%
Homework	None	15.0%
Quiz	None	15.0%
Project/Term Paper	None	10.0%
Final	None	30.0%

Lecture Weekly Schedule:

Week#	Topics
1	Review of crystal structures analytical methods.
2	Dislocation and plastic deformations
3	Dislocation and plastic deformations (Continue) Solid solution, solute atoms and dislocation interaction and effect
4	Solid solution, solute atoms and dislocation interaction and effect (Continue)
5	Solid solution, solute atoms and dislocation interaction and effect (Continue) Binary phase diagram
6	Binary phase diagram (Continue)
7	Diffusion in substitutional solid solution
8	Diffusion in substitutional solid solution (Continue)
9	Solidification of metals
10	Solidification of metals (Continue) Precipitation hardening
11	Precipitation hardening (Continue) The iron carbon alloy system
12	The iron carbon alloy system (Continue) Hardening of steel
13	Hardening of steel (Continue)
14	Failure analysis of metals
15	Failure analysis of metals (Continue)