ENG ME 306/MS 306 Introduction to Materials Science

2008-2009 Catalog Data:
ENG ME 306/MS 306 Introduction to Materials Science Prereq: CAS PY 212; CAS PY 313 recommended. Structure and properties of solids; crystalline structure; defect structures; atom movement and diffusion; nucleation and growth; deformation; phase diagrams; strengthening mechanisms; heat treatment; ferrous/nonferrous alloys; ceramics; polymers; composites. Includes lab. 4 cr., either sem.

Class/Lab Schedule: : 4 lecture hours per week; Lab - 4 structured labs of 2 hours per week + project

Status in the Curriculum: Required

Textbook(s) and/or Other Required Material: D. R. Askeland and P.P. Phule, Essentials of Material Science and Engineering, Thompson, 2004.

Coordinator: Vinod Sarin, Professor, Mechanical Engineering

Prerequisites by topic:
1. Electronic configuration of atoms.
2. Constructive and destructive interference of waves.

Goals:
1. To develop a basic understanding of the principals of materials science and engineering.
2. Familiarity with process/structure/property relationships and how to use these to tailor properties for specific engineering applications.
3. Develop an awareness of state of the art materials available for design of structural and engineering components.

Laboratory Experience:
1. Laboratory Safety Training
2. Metallography and Microstructures
3. X-ray Diffraction Analysis
4. Solid Solutions and Diffusion
5. Phase Diagrams

Project: Teams of 2-4 students study the effect of processing on the microstructure and processing of engineering materials.

Course Learning Outcomes:
As an outcome of completing this course, students will:

i. Gain an understanding of the fundamental principles of materials science.
ii. Gain exposure to different classes of engineering materials.

iii. Gain laboratory experience in the area of processing/structure/property correlations in materials.
iv. Gain experience in working in a team environment.
v. Gain experience in communicating key engineering results in the form of class presentations and project reports.
vi. Gain a clear understanding of laboratory safety issues.

Course Learning Outcomes Mapped to Program Outcomes:

Program:	**A**	**B**	C	D	E	F	G	H	I	J	K	L	M	N
Course:	i.ii	iii	ii	iv	iii	-	v	-	i, ii, iii	i, ii	iii	i, ii, iii	-	ii
Emphasis:	5	4	2	3	3	1	4	1	2	2	3	3	1	2

Topics (time spent in weeks):

1. Introduction to Materials (0.5)
2. Atomic Structure and Bonding (1)
3. Crystal Structure and Crystal Geometry (1)
4. Crystalline Imperfection (1)
5. Diffusion (1)
6. Mechanical Properties (1)
7. Strain Hardening and Annealing (0.5)
8. Solidification and Solid Solution Strengthening (1)
9. Phase Diagrams (1.5)
10. Dispersion Strengthening by Solidification (0.5)
11. Dispersion Strengthening by Phase Transformation (0.5)
12. Ferrous and Nonferrous Alloys (1 week)
13. Ceramics (0.5)
14. Polymers (0.5)
15. Composites (0.5)
16. Presentations (1)
17. Exams (0.5)

Contribution of Course to Meeting the Professional Component:
Engineering topics: 100%

Status of Continuous Improvement Review of this Course:
Date Last Reviewed: Fall 2008 **Reviewed by:** Lab Committee
Prepared by: Soumendra Basu **Date:** February 10, 2009