MATSCEN 5605 Quantitative Introduction to Materials Science

Course Description

A quantitative survey of the key elements related to the processing, structure and properties of materials. Structural materials and core aspects are emphasized. Intended for advanced non MSE majors.

Prior Course Number: 605
Transcript Abbreviation: Quant Intro MatSci
Grading Plan: Letter Grade
Course Deliveries: Classroom, Less than 50% at a distance
Course Levels: Graduate
Student Ranks: Masters, Doctoral
Course Offerings: Autumn, Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Graduate standing in MATSCEN or WELDENG; or permission of instructor
Exclusions: Not open to MSE undergraduates. Not open to students with credit for MATSCEN-605, 6605, or 2010
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1801
Subsidy Level: Baccalaureate Course

Programs

Abbreviation	Description
MATSCEN	Materials Science and Engineering

General Information

This course provides a gateway for the study of materials science at an advanced level by providing the essential ideas in this field in a single quantitative course. The traditional physical metallurgy approach is used as the basis and extended.

Course Goals

Provide student the essential vocabulary in materials science.
Provide quantitative tools for description of the structure of crystalline solids.
Provide descriptions of the key tools in understanding materials transformations, such as phase diagrams, thermodynamic driving forces as well as kinetic limitations through diffusion and nucleation.
Link the mechanical properties of crystalline solids to dislocations and defect structure.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Crystal Properties: structure, atomic bonding and characterization	10.0							
Deformation: dislocations, plastic deformation, defects, vacancies, grain boundaries.	10.0							
Structure manipulation: annealing, recovery, recrystallization; solid solutions; phases, phase diarams and diffusion; solidification nucleation and growth	12.0							
Practical Examples: Precipitation hardening alloys; twinning and martensite; steels; application of broad concepts to non-metallic systems.	10.0							

Representative Assignments

Weekly homework assignments.
Midterm and Final.

Grades

Aspect	Percent
Homework	15%
Midterm Exam	35%
Final Exam	50%

Representative Textbooks and Other Course Materials

Title	Author
Physical Metallurgy Principles	Abbaschian, Abbaschian, and Reed-Hill

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
***	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
*	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.

Course Contribution		College Outcome
*	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
*	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
*	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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