MATSCEN 5761.72 (Proposed): Mechanical Behavior of Crystalline Solids at Higher Temperature

Course Description

Strength and Deformation Mechanisms in Crystalline Solids at High Temperatures

Transcript Abbreviation: Mech Beh High Temp
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Junior, Senior, Masters, Doctoral, Professional
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 7 Week
Credits: 1.5
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: MSE 3261, MSE 3332, or permission of instructor.
Exclusions: Not open to students with credit in MATSCEN 5761
Cross-Listings:

Course Rationale: Content of existing course, MSE 5761, is being split into two portions and taught as

independent, 7 week courses, MSE 5761.71 and MSE 5761.72

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: 14.3101
Subsidy Level: Baccalaureate Course

Programs

Abbreviation	Description
MATSCEN	Materials Science and Engineering

Course Goals

Quantitative survey of the deformation characteristics of crystalline solids at higher temp, focusing on time and temp dependent deformation mechanisms, and microstructure-based approaches for designing materials for high temperature service.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction/Motivation	1.0							
Review of Fundamentals Basics of Dislocation Theory Strain hardening and rate sensitivity	2.0							
Deformation Mechanisms at High Temperature Dislocation Creep Sherby-Dorn Phenomenology Weertman and other models Jogged Screw Creep Class I vs. Class II alloy creep Diffusion Creep & Harper Dorn creep	6.0							
Prediction of Creep and Failure of Materials Larson-Miller approach projection approach	3.0							
High Temperature Deformation of Engineering Materials Oxide dispersion strengthened alloys Precipitate strengthened alloys Superalloys Titanium alloys Metal matrix composites Deformation of intermetallics Creep of ceramic-based materials	6.0							
Superplasticity Phenomenology Models and open questions	3.0							

Grades

Aspect	Percent
Exams (1 Midterm and 1 Final)	70%
Homework	30%

Representative Textbooks and Other Course Materials

Title	Author
Deformation and Fracture Mechanics of Engineering Materials	Hertzberg, Vinci and Hertzberg
Dislocations in Solids	Hull and Bacon
The Plastic Deformation of Metals	Honeycomb

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.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.

Course Contribution		College Outcome
*	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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