

# MATSCEN 5761.71 (Approved): Mechanical Behavior of Crystalline Solids at Lower Temperature

## Course Description

Strength and Deformation Mechanisms in Crystalline Solids at Low Temperatures

**Transcript Abbreviation:** Mech Beh Low 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 for 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 including metals and ceramics focusing on inelastic deformation mechanisms via dislocation motion or twinning with a focus on low temperature behavior.

## Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction/Motivation	3.0							
Fundamentals Motion of Isolated Dislocations Release of Pinned Dislocations Dislocation density & multiplication Dislocation reactions Work hardening & the development of substructure Effects of diffusion Stress redistribution & backstress Twinning	6.0							
Macroscopic phenomenology Stable & unstable flow Strain hardening and rate sensitivity Yield surfaces Single crystal plasticity and analysis Constitutive equations Power-law Activation Isotropic & Kinematic hardening & the Bauschinger effect	6.0							
Overview of Deformation and Strengthening Mechanisms Deformation mechanism maps Low temperature plasticity/creep; Solute Strengthening Precipitate Strengthening Grain size Strengthening	6.0							

## Grades

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

## Representative Textbooks and Other Course Materials

Title	Author
<i>Deformation and Fracture Mechanics of Engineering Materials</i>	Hertzberg, Vinci and Hertzberg
<i>Dislocations in Solids</i>	Hull and Bacon
<i>The Plastic Deformation of Metals</i>	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.

### Additional Notes or Comments

5761.71 will be a "new" course request; the previous 3 credit, full-term course--MSE 5761--will be changed into MATSCEN 5761.72

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