

**Department of Materials Science and Engineering  
University of Maryland, College Park**

**ENMA362: Mechanical Behavior of Materials - FALL 2019**

**COURSE DESCRIPTION:** Overview of Mechanical Behavior, Elastic Behavior, Dislocations, Plastic Deformation, Strengthening of Crystalline Materials, Composite Materials, High Temperature Deformation of Crystalline Materials, Permanent Deformation of Noncrystalline Materials, Tensile Fracture at Low Temperatures, Engineering Aspects of Fracture, High Temperature Fracture, Fatigue, and Experimental determination of Mechanical Properties including Hardness and Strength of Metals, Polymers, Ceramics and Composites.

**Prerequisites:** Permission of the Materials Science & Engineering Department

**Text Book:** T. H. Courtney, "Mechanical Behavior of Materials ", Second Edition, Waveland Press, 2000, ISBN 1-57766-425-6.

**Course Objective:** The main objective of this course is to teach how various factors such as chemical composition and microstructure effect mechanical properties of various engineering materials including metals, ceramics, polymers, and composite materials, as well as the experimental methods used to determine various mechanical properties of these engineering materials. Satisfactory completion of this course should demonstrate ability to:

1. Understand how the chemical composition and microstructure affect mechanical properties of various engineering materials.
2. Understand the ways to alter the microstructure,
3. Learn how various factors such as temperature and strain rate affect mechanical properties,
4. Learn how to experimentally determine the mechanical properties.
5. Analyze and interpret the test data.

**Topics Covered**

- I. INTRODUCTION
- II. OVERVIEW OF MECHANICAL BEHAVIOR (CHAPTER 1)
- III. ELASTIC BEHAVIOR (CHAPTER 2)
- IV. DISLOCATIONS (CHAPTER 3)
- V. PLASTIC DEFORMATION IN SINGLE AND POLYCRYSTALLINE MATERIALS (CHAPTER 4)
- VI. STRENGTHENING OF CRYSTALLINE MATERIALS (CHAPTER 5)
- VII. HIGH TEMPERATURE DEFORMATION OF CRYSTALLINE MATERIALS (CHAPTER 7)
- VIII. DEFORMATION OF NONCRYSTALLINE MATERIALS (CHAPTER 8)
- IX. FRACTURE MECHANICS (CHAPTER 9)
- X. FATIGUE OF ENGINEERING MATERIALS (CHAPTER 12)
- XI. SPECIAL TOPICS (HANDOUTS)

ALSO COVERED: EXPERIMENTAL DETERMINATION OF MECHANICAL PROPERTIES

**Class Schedule**

**Lecture:** Monday, Wednesday, and Friday 12:00 PM - 12:50 PM, Computer Science Instructional Center (CSI), Room 2117

**LAB:** Tuesday and Thursday 9:00 - 11:00 a.m., Kim Engineering Building, Room 1135

### **GRADING**

Quizzes	10%
Class Homework	15%
2 Midterm Exam - Oct 4th & Nov 8th	15% each
Lab Grades	20%
Final Exam (Comprehensive) - Dec 16 <sup>th</sup> , 08:00-10:00 AM	25%

### **QUIZZES, HOMEWORKS AND LAB REPORTS**

**Quizzes:** Quizzes can be given on any lecture day at any time during the class.

**Homework:** The due date to submit the homework will be stated in the homework assignment. Homework submitted after the due date will be given NO CREDIT.

**Lab homework:** Each lab homework is due no later than 1 week after the lab date, and it should be submitted at the beginning of the following lab. Reports submitted after this time will receive NO CREDIT.

### **ATTENDANCE**

Attendance is mandatory for the lecture and the lab sections. Students are required to make every reasonable effort to inform the instructor by email before the start of class if they will be absent, as well as the reason for absence. In addition, if a quiz is given on that day, the student should submit a self-signed letter explaining the reason for their absence. The letter from the student is subject to the rules of the Student Honor Code of the University of Maryland. Such a letter must also be submitted for any absence occurring on the day of a lab. Further, the student is not allowed to submit a lab report when they are absent from the corresponding lab. However, the lab can be made up if the student follows the above instructions.

If a student is absent more than one time during the semester, the student is required to submit documentation signed by a health care professional justifying the absence.

**If a student is absent for Midterm 1, Midterm 2 or the Final Exam (Major Grading Events), he or she must provide documentation of illness from a health care professional, and make every reasonable effort to notify the instructor in advance. In emergency situations, the requirement of documentation from the health care professional may be waived by the instructor.**

If a student does not follow the above instructions, the student will receive ZERO CREDIT for any grading events missed while absent. Make-up of any grading event is subject to the discretion and convenience of the instructor.

### **Diversity**

The University of Maryland has embraced diversity as a central driver in all its activities and has supported and promoted pioneering scholarship of diversity in academic programs. Our diversity is fundamental to our excellence and has enriched our intellectual community. The University's capacity to educate students for work and life in the 21st century and to be a leader in research and scholarship is greatly enhanced by a community that reflects the

nation and world. Diversity is a core value and strength of the University of Maryland.

**Academic Integrity**

It your responsibility to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit

<http://shc.umd.edu/SHC/Default.aspx>

**Course Instructor: Dr. S. Ankem**

Bldg 090, Room 1105

Tel: (301) 405-5219

E-Mail: [ankem@umd.edu](mailto:ankem@umd.edu)

**Office Hours: M,W,F 11:00 AM -12:00 PM**

**Teaching Assistant 1: Zixiao Liu**

Bldg 089 EGL, Room 1207

E-Mail: [lzxmse91@umd.edu](mailto:lzxmse91@umd.edu)

**Office Hours: M, W 2:00 PM - 3:00 PM**

**Teaching Assistant 2: Nick Dzuricky**

Bldg 223 IREAP, Library (2<sup>nd</sup> floor)

E-Mail: [dzuricky@terpmail.umd.edu](mailto:dzuricky@terpmail.umd.edu)

**Office Hours: T, Th 2:00 PM - 3:00 PM**

Please contact your TA if you have any questions on quiz and homework grades and forward your messages to Dr. Ankem. If you have questions on the labs including lab grading, please contact Zixiao and Nick and forward your messages to Dr. Ankem. For questions about exam grades, please contact Dr. Ankem directly.