

# **MET412/MSE412 Syllabus: Mechanical Behavior of Materials**

## **Course Information:**

Course title: Mechanical Behavior of Materials

Course number: MET412/ MSE412, Spring semester

Course credits: 3 credits

Prerequisites: Physical Metallurgical

Classroom: McClure 415 (M, W, F; 10:30am-11:30am)

## **Instructor Information:**

Instructor: Dr. Fusheng Sun; Office: McClure 409; Office Tel: 885-4284; Office Time: (M, W, F; 2:00pm-4:00pm).

**Assigned Text:** Mechanical Behavior of Materials, Thomas Courtney, (2nd Edition, McGraw-Hill, 2000)

## **Reference Texts:**

1. Mech. Behavior of Materials, M.A. Meyers and K.K. Chawla (Prentice-Hall, 1999)
2. Mechanical Metallurgy, George Dieter (McGraw-Hill)
3. Materials Science and Engineering, William Callister, Jr. (Wiley)
4. Engineering Materials 1, Michael Ashby and David Jones (Pergamon)
5. Deformation and Fracture Mechanics of Engineering Materials, Richard W. Hertzberg, 4th Edition (Wiley & Sons, NY, 1996)

## **Course Scope:**

The course will address the fundamentals of elastic, viscoelastic and plastic deformation of materials; the elementary theory of static and dynamics dislocations; fracture, fatigue, and creep, as well as strengthening mechanisms and behavior of composites.

## **Course Learning Goals:**

1. To know the generic behavior of stress-strain in metals, ceramics, and polymer (M-C-P), as well as the various similarities and differences of response in M-C-P.
2. To know the atomic-scale origin for specific aspects of stress-strain responses in M-C-P (e.g., Poisson effect, independence of elastic moduli on defects).
3. To connect materials response under specific conditions to actual experimental set-ups.
4. To know differences and similarities of tensile and compressive stresses (or strains) in M-C-P and utilize concepts in plastic or brittle materials for expected stress-strain response.
5. To utilize knowledge of stress-strain response in M-C-P in application to simple types of processing and pre-stress/strain conditions (e.g., drawing and rolling, geometric and thermal constraints).

6. To introduce general states of stress and transformations of stress (including stress and strain invariants) for yielding and failure, necking, and response behavior of crystalline materials, as well as important differences in polymers.
7. To relate point, line, and planar defects to materials response in M-C-P, and to utilize this knowledge to understand and control properties. To know how such defects can be created.
8. To introduce and understand simple polymer, metal-matrix and ceramic-matrix composites and their response to stress and strains.
9. To introduce and apply fracture and fatigue behavior in M-C-P materials, with brief introduction into its use for materials design.

**Course Topics:**

1. Material Response to Stress
2. Linear Elastic Behavior
3. Viscoelasticity Behavior
4. Elements of Plasticity
5. Dislocation Theory
6. Strengthening Mechanisms
7. Composite Behavior
8. Fracture
9. Fatigue Behavior
10. Creep Behavior

**Course Calendar/Schedule:**

Lesson	Topic
1.	Course Introduction
2.	Material Response to Stress.
3.	Material Response to Stress.
4.	Mechanical Prop.
5.	Mechanical Prop.
6.	Linear Elastic Behavior
7.	Viscoelasticity Behavior
8.	Elements of Plasticity
9.	Elements of Plasticity

10.	Elements of Plasticity (Polymers)
11.	Dislocations
12.	Dislocations
13.	Dislocations
14.	Dislocations
15.	Dislocations
16.	Dislocations
17.	Dislocations
18.	First Exam
19.	SPRING BREAK
20.	Plastic deformation
21.	Plastic deformation
22.	Plastic deformation
23.	Strengthening
24.	Strengthening
25.	Strengthening
26.	Strengthening
27.	Second Exam
28.	"
29.	"
30.	Composites
31.	Composites
32.	Composites

33.	Creep
34.	Creep
35.	Creep
36.	Creep
37.	Toughing
38.	Toughing
39.	Toughing
40.	Fracture
41.	Fracture
42.	Fatigue
43.	Fatigue
44.	Fatigue
45.	Fatigue
46.	<b>FINAL EXAM</b> (comprehensive)

### Getting Help:

Need help, or have a question, perhaps of interest to the whole class? Want to offer feedback, or get more explanation of a concept (in or out of class)? Take advantage of the classroom. Come to office hours. Whether individuals or groups, office hours are there to help. You can also send e-mail.

### Grading Policy and Tentative Grade Scale:

- **Homework (and any Quizzes) 15% of total grade** : Homework will be collected weekly (ONLY IN CLASS). Students may work in **groups of no more than 3** and turn in one Group Homework for grading. Homework turned in late will receive a ZERO grade. Homework answers may come from sources other than the required text. **ONLY A SUBSET of Homework Questions will be graded, which will not be announced.**
- **One exam and one presentation in Semester each 25% of Grade.**  
**Tentative Dates: (1st hourly- 28 Feb.) and (presentation- March 27- April 2)**

- **Final is 35% of total grade.** Exam questions are mostly taken from homework with modification, extensions, etc. You should do well if you have done the homework (not copied) and understand concepts through individual efforts, asking questions in class or office hours.

**NOTE:** Students caught cheating will receive failing grade. You may come to office hours to clear up concepts or errors in homework or Exams.

### **Accumulative Grade Assignment**

There are guaranteed floors for letter grades.

- 86-100 A (A-, A, A+)
- 75-85 B (B, B+)
- 71-74 C/B- (flexibility)
- 60-70 C (C, C+)
- 56-59 D/C- (flexibility)
- 45-55 D (D, D+)
- 41-44 F/D- (flexibility)
- < 41 F

"Grey areas" between letter grades are added to add flexibility to decide higher or lower grade based on upward and downward trends in test scores, class participation, improvements, and natural gaps in final grades.

### **Disability Support Services Reasonable Accommodations Statement:**

**Reasonable accommodations are available for students who have a documented disability. Please notify the instructor during the first week of class of any accommodation(s) needed for the course. Late notification may mean that requested accommodations might not be available. All accommodations must be approved through Disability Support Services located in the Idaho Commons Building, Room 333.**

- **885-7200**
- **email at <dss@uidaho.edu>**
- **website at <www.access.uidaho.edu> or <www.webs.uidaho.edu/aap>**