ME 582/ MS 582 Mechanical Behavior of Materials

Instructor:
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Time and location:
Tuesday and Thursday 10:00-12:00 in EMB 105 (Exception: On September 15, the class will meet at Room 205 at 730 Commonwealth Avenue instead of EMB 105)

Office hours:
By appointment

Prerequisites:
The prerequisites for this course are Structural Mechanics (ENG ME309 or equivalent) and Engineering Mathematics (EMG ME400 or equivalent).

Courseinfo site:
Homework assignments, supplemental readings, and selected lecture notes will be posted on Courseinfo (http://courseinfo.bu.edu/).

Recommended Text:

M.A. Meyers and K.K. Chawla, *Mechanical Behavior of Materials*

It is suggested that you purchase this text for the course as it will serve as a reference throughout the semester and beyond.

Reference Texts/ Handouts:
In addition to the recommended text, the reference texts listed below will prove useful. I will also provide handouts in class and/or on Courseinfo throughout the semester.

R.W. Hertzberg, *Deformation and Fracture Mechanics of Engineering Materials*

T.H. Courtney, *Mechanical Behavior of Materials* (2^{nd} Edition)

G. Dieter, *Mechanical Metallurgy*

F.A. McClintock and A.S. Argon, *Mechanical Behavior of Materials*

K. Bowman, *Mechanical Behavior of Materials*

A. Kelly, G.W. Groves, and P. Kidd, *Crystallography and Crystal Defects*

J.F. Nye, *Physical Properties of Crystals: Their Representation by Tensors and Matrices*

Course Overview:
This course covers the deformation and fracture of materials under applied forces, with an emphasis on analytical and numerical methods for predicting material properties and behavior. Topics include the elastic properties (isotropic and anisotropic materials) and the origin of elastic behavior, viscoelasticity, plasticity (dislocation mechanisms, yielding criteria, strengthening mechanisms), creep, fracture, and fatigue. Specific examples from ceramics, metals, polymers, and composites are given. Finally, several experimental techniques for evaluating materials properties are introduced.

Grading:
Homework 20%
Presentation 15%
Exams 40%
Final Exam 25%

Grading Policy:

Homework:
Homework will be given throughout the semester. Homework solutions must be neat and well-written. If you use computer programs to solve HW problems, the code/script must be included with the solutions. Any reference materials used in the HW problems must be cited. Late homework will receive a maximum of 50% credit, and will be accepted only if an extension was given prior to the due date.

Presentations:
Each student will give a presentation covering a journal article in the general area of mechanical behavior of materials. The presentations will be 12 minutes long followed by a 10 minute class discussion. Presentations will begin mid-way through the semester. The article must be approved by the instructor and emailed to the instructor one week before the presentation for posting on Courseinfo. Topics may include, for example, new composite materials, nanoindentation testing, thin films or hard coatings, mechanical properties of biological media, etc.

Exams:
Two in-class exams will be given during the semester. Each exam will be worth 20% of the final grade.

Final Exam:
A comprehensive final exam will be given during the exam period.

Schedule:

A nominal timeline and outline of topics to be covered in this course is given below. As the semester unfolds there will likely be changes to this schedule. The sections covered in the text are listed and additional reading (handouts) will be given.

Week	Date	Topics	Reading
1	9/3	Introduction Overview of mechanical behavior Crystals-Miller Indices	Ch.1,2
2	9/8-9/10	Scalars, Tensors, Vectors Stress and strain	Ch.2
3	9/15-9/17	Microscopic basis for elastic modulus Elastic behavior of materials	Ch. 2
4	9/22-9/24	Viscoelasticity Plasticity	Ch. 2,3
5	9/29-10/1	Plastic deformations	Ch. 3
6	10/6-10/8	Imperfections	Ch. 4,5
7	10/15	Strengthening mechanisms	Ch. 5
8	10/20-10/22	Strengthening mechanisms	Ch.7
9	10/27-10/29	Fracture mechanics	
10	11/3-11/5	Fracture mechanics	Ch. 8
11	11/10-11/12	High temperature deformation	Ch. 9,10
12	11/17	Creep *Fall Recess*	
13	12/1-12/3	Fatigue, embrittlement	Ch.12
14	12/8-12/10	Special Materials	CH. 12, 13