Introduction to Materials Science [MENG 285]
Syllabus

Course Description:
This course will provide an introduction to materials science for engineering and science majors. The first part of the class will introduce basic topics including atomic and molecular bonding, crystal structure, deformation, and stress, strain, and failure. The second part of the course will cover a selection of materials, including metals, ceramics, polymers, emulsions, and dispersions. Discussion will include “soft materials” that dominate our daily experiences with consumer products, including food, pharmaceuticals, personal care products, and biological materials.

Instructor: Sara Hashmi
Office: 9 Hillhouse, Mason Lab 208A
Email: sara.hashmi@yale.edu
Office hours available by appointment.

Required Textbook:

Non-textbook Readings:
Why Things Break, by Mark Eberhart
Cats’ Paws and Catapults, by Steven Vogel
Stuff Matters, by Mark Miodownik

Optional Text:

***All books are available at the Yale Bookstore

Prerequisites: Introductory physics and chemistry, and freshman-level math.

Class Meetings: Monday, Wednesday, Friday: 1-3:15 pm
*Exams will be held outside of lecture, on June 7, 19, and 29, times TBA.

Classroom Location: Mason 104 (to be confirmed)

Assignments: There will be eight Problem Sets. Short in-class quizzes will be held on Wednesdays, to assess non-textbook readings in addition to lecture material. **Quizzes will be held at the beginning of lecture, and will not be re-administered if students are late to class.** Each student will give an in-class presentation on the last class day, on a materials science topic of their choice, to be assessed by their peers.

Collaborative Work: Students are encouraged to work together on Assignments, but must turn in their own work.
**In-Class Participation:** Students are expected to be active participants in class. Lecture will include in-class discussions, activities, and demos.

**Exams:** There will be three non-cumulative exams. They will be closed book, and arranged for a mutually convenient time outside of lecture.

**Grading:**

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<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Problem Sets</td>
<td>20%</td>
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<tr>
<td>Exams I, II, III</td>
<td>20% each*</td>
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<tr>
<td>Presentations</td>
<td>10%</td>
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<tr>
<td>Participation</td>
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*Exam grades will each include contributions from the 1 or 2 preceding quizzes.

**Course Outline/Weekly Agenda:**

**Week 1:** Atomic & Molecular Bonding, Crystal Structure, Defects

- Reading: C&R Chapters 1-4
- Reading: *Why Things Break*, Chapters 1-3, p. 1-54
- Assignment: PS1 due June 1; PS2 due June 4
- Quiz 1: Wednesday May 30, including *Why Things Break*

**Week 2:** Diffusion, Materials Testing, Deformation & Failure

- Reading: C&R Chapters 5-8
- Reading: *Cats’ Paws & Catapults*, Chapters 5-7, p. 82-152
- Assignment: PS3 due June 8; PS4 due June 11
- Quiz 2: Wednesday June 6

**Exam I: Thursday, June 7, time TBA.**

**Week 3:** Deformation & Failure cont.; Phase Diagrams & Kinetics

- Reading: C&R Chapters 8-10
- Assignment: PS5 due June 15
- Quiz 3: Wednesday June 13, incl. *Cats’ Paws & Catapults:*

**Week 4:** Focus on Materials: Metals, Ceramics, Glasses, Polymers

- Reading: C&R Chapters 12-15
- Reading: *Stuff Matters*, Chapters 4 & 7, p. 73-90 & 139-158
- Assignment: PS6 due June 18; PS7 due June 22
- Presentation drafts by appointment June 20

**Exam II: Tuesday, June 19, time TBA.**

**Week 5:** Focus on Materials: Suspensions, Emulsions, Gels

- Assignment: PS8 due June 25
- Quiz 4: Wednesday June 27, including *Stuff Matters*

**Exam III: Thursday, June 28, time TBA.**

Presentations will be held in class June 29.