ME 306: Materials Science

Spring 2013

Instructor and Class Information

Instructor: Dr. Harold Park, Associate Professor of Mechanical Engineering
Office: 730 Commonwealth, ENA 212 (i.e. kind of above CVS)
Email: `parkhs@bu.edu`
Phone: 617.353.4208
Office Hours: Wednesdays 12-1 PM; email to set up other times. Note that Prof. Ryan, who teaches the other ME 306 section, will have office hours on Mondays from 12-1 PM.
Class Hours: Tuesdays and Thursdays 12-2 PM
Classroom: PHO 203
Lab Coordinator Kara Mogensen (karam@bu.edu, 617.358.1565)
Lab Hours: Monday 10-12 and 2-4, Tuesday 10-12 and 2-4, Wednesday 10-12 and 2-4, Thursday 10-12 and 2-4, Friday 10-12
Midterm Date: (Tentatively) Thursday, March 7, 12-2 PM (in class)
Final Date: TBD
Lab Location: 730 Commonwealth, Room 307
Discussion Section: Friday 1-2 PM (PHO 202); Friday 2-3 PM (PHO 202), Friday 3-4 (PHO 202), Friday 4-5 (PHO 202)
Course Website: Blackboard Learn `http://learn.bu.edu`

GTF Information

(1) Deniz Cetin
Office: EMB (15 St. Mary's Street) 121
Office phone: (610) 739-1922
Office hours: TBD (arrange via email)
Email: `dcetin@bu.edu`

(2) Debangshu Mukherjee
Office: PHO 517
Office phone: (617) 501-7316
Office hours: TBD (arrange via email)
Email: `dbngshm@bu.edu`

Course Outcomes

As an outcome of completing this course, students will:

1. Gain an understanding of the fundamental principles of materials science.
2. Gain exposure to different classes of engineering materials.
3. Gain laboratory experience in the area of processing/structure/property correlations in materials.
4. Gain experience in working in a team environment.

5. Gain experience in communicating key engineering results in the form of class presentations and project reports.
6. Gain a clear understanding of laboratory safety issues.

Textbook

Materials Science and Engineering: An Introduction by William D. Callister, Jr., eighth edition, John Wiley and Sons 2008

Reference Book

Essentials of Materials Science and Engineering by Donald R. Askelund and Pradeep P. Fulay, second edition, Cengage Learning 2009

Class Policies

- Homework not turned in by the end of class (i.e. 2 PM) on the due date, either to myself in class, in the dropbox outside my office, or in my mailbox at 15 St. Mary's Street will be considered to be late. Late homework will receive a maximum of 80% of the available score. Homeworks that are more than one class late will not be accepted. For example, assume that the homework is due Thursday at 2 PM. If it is not turned in by that time, it is late. If the homework is not received by 2 PM the following Tuesday, then it will receive a 0.
- Laboratory reports are due at the beginning of the next scheduled laboratory session. As with homeworks, late laboratory reports will receive a maximum of 80% of the available score, and laboratory reports that are more than one lecture class late will not be accepted.
- It is your responsibility to check with the GTF (who will be in charge of the grade sheet on blackboard) to make sure that all homeworks and labs have been recorded correctly, and that you are not missing any points on the grade sheet. I will accept complaints about homework scores, test scores and lab scores up to 2 weeks after the assignment is returned. Beyond that, there will be no change in grades.
- One midterm and one final exam will be given.
- Making up of missed examinations will be permitted only when the exam is missed for a valid reason. Valid reasons include serious illness or observance of a religious holiday. Except in cases of extreme emergency, this must be approved by the professor BEFORE the regularly scheduled exam.
- **Cheating and collaboration**. Homework assignments should be done individually; it is OK to consult other students, but the work you turn in should reflect your own work. Lab projects will be collaborative, in that they will be group projects - each group should work together to complete the labs and the lab project. Consulting other groups is acceptable; however, the work that is turned in should be unique and reflective of the groups work.
- A group project (4-6 people in each group) will be assigned. A pre-proposal, outlining the design of your experimental work and the objective of your project, needs to be submitted to Kara Mogensen before you can begin project related experiments. An intermediate project report (Introduction, including a detailed literature review, and experimental design) is due prior to the final report submission as detailed in the laboratory schedule. The group project will require a final oral presentation and submission of a typed final report.

Laboratory Schedule

- January 21-25: Lab safety/metallography demo, start Lab #1
- January 28-February 1: Lab #1 (Metallographic Procedure)
- February 4-8: Lab #2 (Structural Analysis by X-Ray and SEM), Lab #1 due
- February 11-15: Lab #3 (Diffusion), Lab #2 due
- February 18-22: No Labs; Lab #3 due
- February 25-March 1: No Lab; project pre-proposals due
- March 4-8: Discuss project pre-proposals during lab times
- March 11-15: No lab - spring break
- March 18-22: Lab #4 (Phase diagrams), project proposals due
- March 25-29: Lab #4 due, start work on projects
- April 1-5: Work on projects
- April 8-12: Work on projects
- April 15-19: Work on projects
- April 22-26: Project presentations (in class)
- April 29-May 3: No lab

Project Information

- Each project group needs to submit a project pre-proposal to Kara Mogensen (due about the 6th week of class). It should be 1 page or less, and contain the following information: (1) Project title, (2) Group members, (3) Major objective of the project, (4) A very brief description of the proposed experiments, preferably in a list format that includes details such as materials, temperatures, times, mechanical and microstructural characterizations planned, and number of samples
- A project proposal will be due about 2-3 weeks after the pre-proposal. It should be about 3 pages in length, and should be written only after Kara has approved the details in the pre-proposal. The proposal should include: (1) Title, (2) Group members, (3) Introduction that includes (a) Objectives, (b) Literature review, and (4) Experimental design in descriptive detail

Approximate List of Topics to be Covered

- Chapter 1: Introduction to Materials.
- Chapter 2: Atomic Structure and Interatomic Bonding.
- Chapter 3: The Structure of Crystalline Solids
- Chapter 4: Imperfections in Solids
- Chapter 5: Diffusion

- Chapter 6: Mechanical Properties of Metals
- Chapter 7: Dislocations and Strengthening Mechanisms
- Chapter 8: Failure
- Chapter 9: Phase Diagrams
- Chapter 10: Phase Transformations in Metals
- Chapter 12: Structure and Properties of Ceramics
- Chapter 14: Polymer Structures
- Chapter 15: Characteristics, Applications, and Processing of Polymers
- Chapter 16: Composites

Grading

- Homeworks: 5%
- Labs: 20%
- Midterm: 30%
- Final: 30%
- Lab project: 15%