ME 306: Introduction to Materials Science
Spring 2015

Instructor and Class Information

Instructor: Dr. Emily Ryan, Assistant Professor of Mechanical Engineering
Office: 110 Cummington Mall, Room 416
Email: ryanem@bu.edu
Phone: 617-353-7767
Office Hours: Thursdays from 2-3pm; email to set up other times. Note Prof. Gopalan, who teaches the other ME 306 section will have office hours Mondays from 11-12.
Class Hours: Tuesday and Thursday 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: Thursday, March 5, 12-2pm (in class)
Final Date: TBD ***NOTE It May not be during the BU scheduled time ***
Lab Location: EPIC (750 Commonwealth) Room 101
Discussion Section: Friday 1-2 PM (PHO 205); Friday 2-3 PM (PHO 205), Friday 3-4 (PHO 202), Friday 4-5 (PHO 202)
Course Website: Blackboard Learn http://learn.bu.edu

GTF Information

Ruofan Wang:
Email: wangrf@bu.edu
Office: EMB 121
Office hour: 12:00-1:00 pm Wednesday

Yiwen Gong:
Email: yiwen@bu.edu
Office: EMB 121
Office hour: 1:00 - 2:00 pm Wednesday

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 (Ninth Edition), by William D. Callister, Jr., John Wiley and Sons 2013

Reference Book

Essentials of Materials Science and Engineering (Second Edition), by Donald R. Askelund and Pradeep P. Fulay, 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, or in the dropbox outside my office will be considered late. Late homework will receive a maximum of 80% of the available score. Homework that is more than one class late will not be accepted. For example, assume that the homework is due Tuesday at 2 PM. If it is not turned in by that time, it is late. If the homework is not received by 2 PM on Thursday, then it will receive a 0.
- Laboratory reports are due at the beginning of the next scheduled laboratory session. As with homework, late laboratory reports will receive a maximum of 80% of the available score, and laboratory reports that are more than two days late will not be accepted.
- Students should attend their scheduled laboratory times. Making up of missed labs will be permitted only when the lab 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 Kara BEFORE the regularly scheduled lab.
- 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 homework 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.
- At the beginning of every class we will have a video presentation by three students on an interesting materials science topic.

- 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.
- Cell phone use is not permitted in class or during exams. This includes calls, texting, web browsing, games, etc.
- **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 group's work.
    - Students are expected to follow the BU Code of Student Responsibilities (http://www.bu.edu/dos/policies/student-responsibilities/)

Laboratory Schedule

- January 26-30: Lab safety/metallography demo, start Lab #1
- February 2-6: Lab #1 (Metallographic Procedure)
- February 9-13: Lab #2 (Structural Analysis by X-Ray and SEM), Lab #1 due
- February 16-20: No Lab; Lab #2 due
- February 23-27: Lab #3 (Diffusion); project pre-proposals due
- March 2-6: Discuss project pre-proposals during lab times
- March 9-13: No lab -spring break
- March 16-20: Lab #3 due; Start work on projects; project proposals due
- March 23-27: Work on project
- March 30-April 3: Lab #4 (phase diagrams)
- April 6-10: Lab #4 due; Work on projects
- April 13-17: Work on projects
- April 20-24: Project presentations (in class)
- April 27-May 1: Project presentations (in class)

Video Presentation

- At the beginning of each class a group of three students will present a video on materials science. The video should be 10 minutes or less and should discuss or present an interesting topic of materials science.
- A link to the video needs to be submitted to Prof. Ryan (ryanem@bu.edu) by 10pm the day before your presentation.

- Every student in the class will present once and will receive a grade equivalent to one homework assignment.
- In addition to showing the video, each group will discuss why they chose the video and what aspect(s) of materials science are covered.

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

- Homework and Video Presentation: 5%
- Labs: 20%
- Midterm: 30%
- Final: 30%
- Lab project: 15%