Boston University College of Engineering

Introduction to Materials Science

Spring 2020

Instructor: Prof. Keith A. Brown
Office: 8 St. Mary's Street, Rm 920
Email: brownka@bu.edu
Phone: 617-353-4841
Office Hours: Thursday 12:30 to 1:30 pm or by appointment

Lecture: MW 12:20-2:05pm in EPC 207

Laboratory Coordinator: Kara Mogensen
Email: karam@bu.edu
Phone: 617-358-1565

Lab Hours:

Monday	10:10-11:55am, 2:30-4:15pm
Tuesday	9:00-10:45am, 3:30-5:15pm
Wednesday	10:10-11:55am, 2:30-4:15pm
Thursday	9:00-10:45am, 3:30-5:15pm
Friday	10:10-11:55am

Labs take place in EPIC

Teaching Assistants: Alison Lanzi (lanzia@bu.edu)
Lu Ping (luping@bu.edu)

Course Materials:

Textbook: *Materials Science and Engineering: An Introduction (Tenth Edition or Etext),* by William D. Callister, Jr., John Wiley and Sons 2018
Website: Blackboard (http://learn.bu.edu)
Prerequisites: PY 212 and CH 131 recommended

Course Description: Structure and properties of solids; crystalline structure; defect structures; atom movement and diffusion; nucleation and growth; deformation; phase diagrams; strengthening mechanisms; heat treatment; ferrous/nonferrous alloys; ceramics; polymers; composites. Includes lab.

Course Topics:

Section 1: Atoms to Elasticity
Section 2: Slip Planes and Plasticity
Section 3: Microstructure and the Strength/Ductility Compromise
Section 4: Defects, Diffusion, and Advanced Properties

Course Outcomes:

As an outcome of completing this course, students will:

Gain an understanding of the fundamental principles of materials science.
Gain exposure to different classes of engineering materials.
Gain laboratory experience in the area of processing/structure/property correlations in materials.
Gain a clear understanding of laboratory safety issues and practices.

Course Grading:
Grading for ME 306 is broken down as following:

Homework	10%
Lab Reports:	20%
Quizzes:	20%
Exam 1:	25%
Exam 2:	25%

It is the student's responsibility to check with the Professors to make sure that all grades have been recorded correctly, and that you are not missing any points on the grade sheet. Inquiries about test and lab scores will be accepted up to 2 weeks after the assignment is returned. Beyond that, there will be no change in grades.

Homework: One of the best methods to learn the material is to read the text before the material is presented in class, attend and pay attention in class, and work through the assigned problem sets. The course is structured to give you ample feedback regarding your understanding of the material through the problem sets and quizzes. By working through the problem sets, you will prepare yourself for the in-class quizzes and exams. Assistance will be provided in the homework review sections, so please seek out help if you need it!

Another helpful practice is to alternate teaching the problems to your classmates, which will force you to think about how to tackle and solve a problem. It is common for engineers to work in groups, so keeping in mind the Ethics Code, we encourage you to form groups to work out (but not copy) the problem sets. The quizzes and exams are solo efforts, however, so it is in your best interest to make sure you understand the problem set and not rely too heavily on your classmates or the GST.

Each problem will be graded on a 10/7/0 scale. A high score of 10 indicates that you worked through the entire problem and came to a correct or mostly correct solution. A score of 7 indicates that you made a valiant effort and a 0 will be given for a minimal attempt or lack thereof. Please indicate the final solution by drawing a solid box around it.

Problem sets are due Thursdays at 11:59 PM. Submission is via blackboard. Clearly legible photographs of hand-written solution sets are acceptable.

Communication: The course website is on BlackBoard (learn.bu.edu). Electronic materials will be posted periodically throughout the semester, so check the website often for updates. These will include the course syllabus, quiz solutions, homework solutions, and lab documents.

Quizzes: (~15 mins) will be *based* on the homework problems, and will be given on the lecture *following* the homework due date. Each quiz will be graded on a 10-point scale. Your problem sets will likely not be graded and returned to you before the quiz, so please study the posted solutions to the problem sets in order to prepare for the quiz. The lowest score will be dropped, but if you miss a quiz **without prior arrangement**, you will be given a zero that cannot be dropped.

Exams: There will be 2 examinations. They will take up the entire class period.

Exam 1: Covering Lectures 1-12	Wednesday 3/4
Exam 2: Covering Lectures 14-26	TBD during final exam week

DO NOT MAKE TRAVEL PLANS FOR THESE DATES.

Make-up exams will be given only in extreme circumstances. It is your responsibility to let your instructor know as far in advance as possible of an unavoidable conflict or medical emergency.

If you qualify for extended time on exams, per evaluation from the Office of Disability Services, it is your responsibility to present your documentation to your instructor at **least** a week before the first exam. If you expect to receive extended time based off previous semesters, please let your instructor know at the beginning of the semester, even if you haven't received your documentation yet. We cannot accommodate last-minute requests (less than a week prior to the first exam) for extended time.

Discussion Sections: There are no discussion sections for this course.

Homework help sections: There will be homework help sections before the deadline of every problem set. These are staffed by GSTs who will be available to answer questions about the problem sets. The date and time of these will be determined through student poll.

Labs: There will be one laboratory assignments that is done throughout the semester.

- 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 documented illness or observance of a religious holiday.
- Except in cases of extreme emergency, any absence must be approved – in writing – by Prof. Brown prior to the scheduled laboratory time.
- Students will not receive credit for turning in a laboratory report if they have not physically completed the laboratory exercise.
- Instead of turning in separate laboratory assignments for each exercise, all exercises and information will contribute toward a single "Material Report," which will be due in two phases.
- Preliminary Material Report is due 3/18 at 11:59 PM
- Final Material Report is due 4/28 at 11:59 PM
- Submission is via blackboard.
- Late reports WILL NOT be accepted without prior approval of the course instructor.
- It is the responsibility of the student to make sure that submitted files can be opened without issue.

Laboratory Schedule

Week 1	1/21-1/24	No Lab
Week 2	**1/27-1/31**	**Safety Training**
Week 3	**2/3-2/7**	**Mechanical Testing 1**
Week 4	**2/10-2/14**	**Mechanical Testing 2**
Week 5	2/17-2/21	No Lab
Week 6	**2/24-2/28**	**X-Ray Diffraction**
Week 7	3/2-3/6	No Lab
Week 8	3/9-3/13	No Lab – spring break
Week 9	3/16-3/20	No Lab
Week 10	3/23-3/27	No Lab
Week 11	**3/30-4/3**	**Annealing and Testing 1**
Week 12	**4/6-4/10**	**Annealing and Testing 2**
Week 13	4/13-4/17	No Lab
Week 14	4/20-4/24	No Lab
Week 15	4/27-4/30	No Lab

Classroom Courtesy: To preserve an open and distraction-free learning environment for all students, the following policies apply:

- Cell phone use is not permitted in class or during exams. This includes calls, texting, web browsing, games, etc.
- Quiet, odor-free snacks and closed drinks are permitted during class; students who arrive late having purchased food, or are consuming noisy, crunchy, etc. food will be asked to leave the classroom.
- Students disrupting class or distracting their classmates will be asked to leave the classroom.

Boston University Academic Conduct Code*:* Honesty is a core value of Boston University. Any violations of the BU academic honesty and integrity standards ***will be pursued*** through appropriate University channels. This includes, but is not limited to: cheating, plagiarism and misrepresentation. If you have any questions as to what constitutes an honor code violation, please ask. ***Ignorance is not an excuse for cheating***. You may access the BU Academic Conduct Code at: http://www.bu.edu/academics/policies/academic-conduct-code/

ME 306 Spring 2020 Semester Schedule				
Section 1		Atoms to Elasticity		
Section 2		Slip planes and Plasticity		
Section 3		Annealing and the Strength/Ductility Compromise		
Section 4		Defects, Diffusion, and Advanced Properties		
L #	**Reading**	**Date**	**Topic**	**Notes**
1	C1	1/22	Introduction and Materails Design	HW1 (1-4) out, due 2/6
2	C6:1-5	1/27	Elastic Mechanics	
3	C2:1-4	1/29	Atomic Structure & the Periodic Table	
4	C2:5-10	2/3	Atomic Bonding	
5	C3:1-8	2/5	Crystal Strurctures and Points	HW2 (5-6) out, due 2/13
6		2/10	Emergence of Elasticity	Quiz 1
7	C6:6-12	2/12	Plastic Mechanics	HW3 (7-10) out, due 2/27
8	C3:9-12	2/18	Crystallographic Directions and Planes	Quiz 2
9	C3:11-17	2/19	Planes pt 2 and X-Ray Diffraction	
10	C7:1-7	2/24	Dislocations and Slip	
11	C7:8-13	2/26	Strengthening Mechanisms in Metals	
12	C15:1-9	3/2	Plasticity in Polymers	
13		3/4	Exam 1	
14	C8:1-6	3/16	Fracture	HW4 (13-16) out, due 3/26
15	C9:1-7	3/18	Phase Diagrams: Part 1	
16	C9:18-20	3/23	Phase Diagrams: Part 2	
17	C10	3/25	Phase Transformations	HW5 (17-20) out, due 4/9
18	C8:7-15	3/30	Fatigue	Quiz 3
19	C6:10,C17,C4:4-11	4/1	Surface Properties	
20	C5:1-5	4/6	Diffusion and Fick's Laws	
21		4/8	Case Hardening	HW6 (21-23) out, due 4/23
22	C19	4/13	Thermal Properites	Quiz 4
23	C4:1-3	4/15	Imperfections in Solids	
24	C12:1-7	4/22	Structure and Defects of Ceramics	
25	C18	4/27	Conductivity and Defects	
26		4/29	Lab and Course Review	
		TBD	Exam 2	