Introduction to Solid Mechanics (Fall 2018)

Jump to Today

ME C85/CE C30 – Section 1

Introduction to Solid Mechanics

Faculty: George Johnson 6149 Etcheverry Hall, **gcjohnson@berkeley.edu** **(mailto:gcjohnson@berkeley.edu)**

Office Hours: Monday 11:30-1:00; Wednesday 11:00-12:30; Friday 3:00-4:00

and by appointment if none of these work.

Graduate Student Instructors: (GSI Office Hours are held in 136 Hesse Hall)

Milad Shirani **milad_shirani@berkeley.edu (mailto:milad_shirani@berkeley.edu)** Office Hours: Mon. 1-2, Tue. 5-6, Wed. 10:30-11:30

Fri. 12-1

Magda Ntetsika **ntetsika@berkeley.edu (mailto:ntetsika@berkeley.edu)** Office Hours: Thur. 1-2

Lectures: Monday, Wednesday and Friday 2 – 3, 106 Stanley Hall

Discussion Sections: (Discussions will begin on August 28; one additional discussion section may be added)

Tuesday 9-10, 103 Moffitt Library (discussion section 1)

Thursday 12-1, 3113 Etcheverry Hall (discussion section 2)

Thursday 4 – 5, 247 Cory Hall (discussion section 3)

Course Content: A review of equilibrium for particles and rigid bodies. Application to truss structures. The concepts of deformation, strain and stress. Equilibrium equations for a continuum. Elements of the theory of linear elasticity. The states of plane stress and plane strain. Solution of elementary elasticity problems (beam bending, torsion of circular bars). Euler buckling in elastic beams.

Course Objectives: By the end of this course, students should be able to:

- Correctly draw free-body diagrams (yes, this really is important enough to include here!)
- Apply the equations of equilibrium to two- and three-dimensional solids
- Understand the concepts of stress and strain
- Solve simple boundary value problems in linear elastostatics (tension, torsion, beam bending)

Learning Goals: This course should support students in achieving the following student learning outcomes associated with the Department's ABET Accreditation. By the time that they graduate, students should have:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to identify, formulate, and solve engineering problems

Prerequisites: Physics 7A; Math 53 & 54 (Math 54 may be taken concurrently). It is expected that you are familiar with and can readily perform basic vector manipulation in 2D and 3D (addition, dot product, cross product, scalar triple product, component representation, angle between vectors, etc.) so we will move quickly into problems involving equilibrium of rigid bodies.

Text: *Statics and Mechanics of Materials, 5e,* R.C. Hibbeler, Pearson (2017), Student Value Edition. The version available at the bookstore has an access code for Mastering Engineering, the software developed to accompany this text. You may also purchase access to Mastering Engineering separately. Whether you have a code or want to purchase access diectly, click on the "MyLab and Mastering" link in the bCourses site for this course and follow the instructions. If you are purchasing, you will have the option of getting the e-book as well, but in any event, you will have to purchase access to Mastering.

Reading: The calendar for this course has a (tentative) list of chapters and sections in the text that are to be addressed in each lecture. You are expected to have read this material prior to attending the lecture so that you are prepared to intelligently engage in in-class discussions that may occur.

Classroom Electronics: Students will not be permitted to use laptops, notebooks or cell phones in class unless they have a documented need. What?!? Am I a Luddite?? No. But I have become convinced that these "tools," when used in the classroom, are more of a distraction that something that supports deep learning.

Here's a link to an article describing recent research in this area: **https://www.insidehighered.com/news/2018/07/27/class-cellphone-and-laptop-use-lowers-exam-scores-new-study-shows (https://www.insidehighered.com/news/2018/07/27/class-cellphone-and-laptop-use-lowers-exam-scores-new-study-shows)** . The top line for this story is "New study shows that splitting attention between lecture and cellphone or laptop use hinders long-term retention, and those in class suffer from others' use of devices." So save the texting, shopping and social media until after class.

Mastering Engineering: "Mastering" is an online learning system that is directly associated with the text and is integrated into the bCourses website. It is where students will find most of their homework, an electronic copy of the text, and a "Study Area" with a large number of problems whose solutions are available in print or video form.

Homework: Solving problems is the most effective way to learn the material and techniques covered in this course. As such, homework with as many as 10 problems will be assigned weekly. The main homework assignments will usually be due on Fridays. Your answers are to be entered in Mastering Engineering by 11:59 pm on the day that it is due, and you must upload to bCourses a PDF file of the work that allowed you to arrive at your answers. Be sure to give yourself enough time to convert your work to PDF format and do the upload. Finally, some shorter problem sets, usually involving mainly conceptual questions, will also be assigned. These will not be scored and you will not need to upload your work, but you are strongly encouraged to do these "warm ups". Overall, homework will account for 20% of the course grade.

The campus expectation is that students will spend about two hours studying for every hour of lecture for a class. This matches, more or less, my expectation of work that you should be doing as we progress through the term. As such, you should expect that doing the homework will take some time. Don't wait until the last minute to start. I strongly encourage you to establish study groups for this course. Your group may meet to discuss the homework problems, but every member of the group should have tried to solve the problem(s) individually before meeting to discuss the solutions. You should not expect that your group will provide the solutions to problems for you. Doing so will likely result in good homework grades, and poor exam grades. Note that many problems in Mastering Engineering have different problem parameters for each student, so knowing the "correct" numerical solution for one student may not work for others.

For almost all problems assigned in this course, at least one free-body diagram (FBD) and appropriate equations are both required to receive full credit. FBD's are critical elements that indicate your understanding of the problems assigned and guide you toward the appropriate equations. You may (somehow) get the right answer to a problem, but the FBD provides key information regarding your understanding. Similarly, correct identification and use of relevant equations are necessary to both obtain a solution and demonstrate your understanding. This is what you are communicating in your PDF submissions.

A structured approach to solving problems in this class will be presented and followed in the examples given. Basically, if consists of five steps: understand the problem, develop a model and plan, write the equations to be solved, solve the equations, and finally check the results. Following this approach will increase your likelihood of success in solving the problems, and should help prevent aimless attempts to use whatever equations first come to mind.

Piazza: We will be using Piazza as our primary tool for communication, so please don't send homework or concept questions to the GSIs or me via email. Post questions on Piazza using the link in bCourses. Students will be able to collectively come up with an answer. Faculty may weigh in as well or will "validate" a student response. It is set up so that you can remain anonymous to your fellow classmates, though the faculty will know who posts what in order to moderate the discussions.

Exams: There will be two midterm exams, both in class, on Wednesday Sept. 26 and Wednesday Oct. 31. Each midterm is worth 20% of the course grade. There will also be a 3-hour final exam from 3:00 – 6:00 pm on Thursday, December 13. The final exam is worth 40% of the course grade.

To request reconsideration of the score that you receive on an exam problem you must: (1) Clearly solve the problem on a separate sheet of paper; (2) Provide a clear statement indicating why you think that we have taken points off incorrectly. In this, you should identify specific areas of concern that we should pay attention to in reviewing your problem; (3) Submit your request for reconsideration in lecture or discussion within one week of getting the exam back.

Honor code: The student community at UC Berkeley has adopted the following Honor Code: 'As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others.' It is my expectation is that you will adhere to this code.

This is an admirable aspiration, but it's easy to lose sight of what 'honesty, integrity, and respect for others' really means. Here's a suggestion, paraphrased from a colleague:

If even a small voice within you says "I would not want my fellow students, parents, or professor to know about this," then stop! Ask yourself what matters more, the short-term gain you were about to grab, or the respect of others, and your own self-respect and honor, all of which must be earned and jealously guarded over the long term.

As noted above, you are encouraged to work in groups in completing your homework assignments, so there is no problem in adhering to the honor code there. More problematic for this course are the exams, where there have in the past been cases of students sharing information during an exam, or of one student looking at another student's paper in order to "get the right answer." Such cases are very serious, and will be treated as such under the policies described in the Student Affairs web page on student conduct: **http://sa.berkeley.edu/code-of-conduct (http://sa.berkeley.edu/code-of-conduct)** .

Grading Policies:

Course Element Contribution

Homework	20%
Midterm Exams	2 @ 20% each
Final Exam	40%

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- It is our intention to grade and return material that you submit within one week.
- The lowest two homework grades will be dropped in calculating your overall course grade.

Course Summary:

Date	Details	
Fri Aug 31, 2018	**Homework 1** (https://bcourses.berkeley.edu/courses/1472179/assignments/7923160)	due by 11:59pm
Sat Sep 1, 2018	**Backup Material for HW 1** (https://bcourses.berkeley.edu/courses/1472179/assignments/7912636)	due by 11:59pm
Fri Sep 7, 2018	**Homework 2** (https://bcourses.berkeley.edu/courses/1472179/assignments/7923161)	due by 11:59pm
	Supplement to HW 2 (https://bcourses.berkeley.edu/courses/1472179/assignments/7918772)	due by 11:59pm
Sat Sep 8, 2018	**Backup Material for HW 2** (https://bcourses.berkeley.edu/courses/1472179/assignments/7912639)	due by 11:59pm
Fri Sep 14, 2018	**Homework 3** (https://bcourses.berkeley.edu/courses/1472179/assignments/7925950)	due by 11:59pm
Sat Sep 15, 2018	**Backup Material for HW 3** (https://bcourses.berkeley.edu/courses/1472179/assignments/7912642)	due by 11:59pm
Fri Sep 21, 2018	**Homework 4** (https://bcourses.berkeley.edu/courses/1472179/assignments/7926839)	due by 11:59pm
Sat Sep 22, 2018	**Backup Material for HW 4** (https://bcourses.berkeley.edu/courses/1472179/assignments/7921603)	due by 11:59pm