ME 305: Mechanics of Materials

Fall 2024, Section A2

Instructor: Prof. Abigail Plummer **Office:** 730 Commonwealth (EMA), 217 **Email:** plummer@bu.edu **Office Hour:** W 4:30–5:30pm **GST:** Hongrui Zhang **Email:** hz622@bu.edu	**Lecture:** 8 St. Mary's (PHO), 203 M & W, 2:30–4:15pm **Discussion:** 750 Commonwealth (EPC), 208/204 *According to your registration, either:* B3: F 12:20–1:10pm B4: F 10:10–11am

Big picture: We will quantitatively describe how forces deform materials. We will study stretching, compression, bending, twisting, shear, and inflation, focusing on simple geometries and applying lessons to engineered systems when possible.

Learning objectives:

- Understand **concepts** related to stress, strain, and mechanical properties of materials.
- Use external loads to **solve** for internal forces/stresses and deformations/strains in structures.
- Understand how to **design** structures that can withstand given external loads.

Textbook: *Mechanics of Materials* by Russell C. Hibbeler, 11th ed., Pearson

Course websites: Announcements and files will be posted to Blackboard (https://learn.bu.edu/). Gradescope (https://www.gradescope.com/) will be used for assignment submissions.

Assignments:

- Weekly homeworks (10%): With few exceptions, homeworks will be due Tuesday mornings at 9am via Gradescope. Solutions will be posted shortly afterwards so extensions will not be possible. In recognition of the fact that circumstances may arise which prevent students from submitting assignments, the lowest homework grade will be dropped at the end of the semester.
- Unannounced quizzes (5%): We will have approximately five unannounced 15-minute quizzes during Wednesday lectures. These quizzes will be based on the homework turned in the day prior. Your problem sets will not be graded and returned to you before the quiz, so we recommend that you study the posted solutions to the problem sets in order to prepare. Students arriving 5+ min late without a valid excuse can take the quiz during lecture breaks, but they will forfeit 25% of points. The lowest quiz grade will be dropped. Please be sure to bring a calculator to class as laptops will not be allowed during quizzes.
- Lab reports (15% total): There will be labs during the weeks of 9/16, 10/7, and 11/11.
- Midterms (two tests, 18% each): Midterms are scheduled for 10/9 and 11/13.
- Final exam (30%): Date to be set by registrar—please do not make travel plans before the end of the exam period.
- Participation (4%): During lecture, you will often work through problems in small groups while instructors circulate. Please come to class ready to enthusiastically participate in these exercises.

Discussion sections: Discussion sessions are optional and will focus on Q&A related to homework and worked examples beyond those in lecture.

Collaboration Policy:

- Discussion and the exchange of ideas are essential to working as an engineer. For homework assignments in this course, you are encouraged to consult with your classmates. However, after discussions with peers (or course instructional staff), make sure that you can work through the problem yourself and ensure that any answers you submit for evaluation are the result of your own efforts. In addition, you must cite any books, articles, websites, lectures, etc. that have helped you with your work using appropriate citation practices. Similarly, you must list the names of students with whom you have collaborated on problem sets.
- No collaboration is permitted on exams and quizzes.
- See the BU Academic Conduct Code (https://www.bu.edu/academics/policies/academic-conduct-code/) for general information on academic integrity. Behavior inconsistent with the Academic Conduct Code will be referred to the Academic Conduct Committee.

Accommodations for students with documented disabilities: If you are a student with a disability or believe you might have a disability that requires accommodations, requests for accommodations must be made in a timely fashion to Disability & Access Services, 25 Buick St, Suite 300, Boston, MA 02215; 617-353-3658 (Voice/TTY). If you qualify for extended time on exams, please provide your documentation at least a week before the first exam. If you expect to receive extended time based off previous semesters, please let us know at the beginning of the semester, even if you haven't received your documentation yet.

Schedule

Class Number	Date	Topic (subject to shift)	Readings & Assignments
1	9/4	Statics review	*Homework 0 out, due 9/10*
2	9/9	Stress	1.1–1.4
3	9/11	Stress; strain	1.1–1.4; 2 *Homework 1 out, due 9/17*
4	9/16	Material behavior	3.1–3.5
5	9/18	Axial loading	4.1–4.7 *Homework 2 out, due 9/24*
6	9/23	Axial loading	4.1–4.7
7	9/25	Axial loading	4.1–4.7 *Homework 3 out, due 10/1*
8	9/30	Torsion	5.1–5.5; 5.8
9	10/2	Torsion	5.1–5.5; 5.8 *No homework; study for midterm*
10	10/7	Torsion	5.1–5.5; 5.8
11	10/9	**Midterm** *covering homeworks 0-3*	*Homework 4 out, due Thurs. 10/17*
12	10/15	Bending stresses in beams	6.1–6.5; 6.9
13	10/16	Bending stresses in beams	6.1–6.5; 6.9
14	10/21	Bending stresses in beams	6.1–6.5; 6.9
15	10/23	Shear stresses in beams	7.1–7.2 *Homework 5 out, due 10/29*
16	10/28	Combined loadings	8.1–8.2
17	10/30	Combined loadings	8.1–8.2 *Homework 6 out, due 11/5*
18	11/4	Beam deflection	12.1–12.2; 12.5–12.7; 12.9
19	11/6	Beam deflection	12.1–12.2; 12.5–12.7; 12.9 *No homework; study for midterm*
20	11/11	Beam deflection	12.1–12.2; 12.5–12.7; 12.9
21	11/13	**Midterm** *covering homeworks 4-6*	*Homework 7 out, due 11/19*
22	11/18	Stress transformations; 2D stress states	9.1–9.5
23	11/20	Stress transformations; 2D stress states	9.1–9.5 *Homework 8 out, due 11/26*
24	11/25	Strain transformations; 2D strain states	10.1–10.3
25	12/2	Buckling	13.1–13.3
26	12/4	Buckling	13.1–13.3 *Homework 9 out, due 12/10*
27	12/9	Energy and fracture	