CEE 212 – Solid and Structural Mechanics
Winter 2022

Instructor:
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Class meetings

Monday, Wednesday and Friday, 9:30 am – 10:20 pm, 2147 GGBL
Zoom link to class live stream: https://umich.zoom.us/j/97258079582; passcode: two12

All class meetings will be **live streamed via Zoom** and recorded. Students will not be expected to attend in person, and they are welcome to attend class remotely, if they prefer to do so and/or are not able to come to class for any reason; however, students will be expected to consistently participate synchronously (either in person or remotely); recordings will be provided to allow students who occasionally must miss class to catch up with the material.

Office hours and discussion board

Office hours will be held via Zoom, according to the following schedule

Enrica	Monday, 6pm to 7pm	Join URL: https://umich.zoom.us/j/95988691777
Emma	Wednesday, 6pm to 7pm	Join URL: https://umich.zoom.us/j/92902798723
Atila	Fridays, 7pm to 8pm	Join URL: https://umich.zoom.us/j/92419132531

We will use **Piazza** as discussion board. You can access the Piazza page from our Canvas website. Please sign up here: piazza.com/umich/winter2022/cee212001wn2022, and use Piazza to post any questions about the course contents, logistics, or homework, so that any question and answer can be beneficial for the entire class.

Prerequisite

CEE 211 "Statics and Dynamics" or equivalent.

Textbook

Timothy A. Philpot; Jeffery S. Thomas, *Mechanics of Materials: An Integrated Learning System*, Enhanced eText, 5th edition, Pearson.

Material

All announcements, homework, slides, handouts and other material, including Zoom link meetings and recording links, will be posted on Canvas.

Course description and objectives

The objective of this course is to explore the fundamental principles of solid and structural mechanics and their application in engineering disciplines. Covered topics are concepts of stress and strain in solids, axial, torsion, bending, shear and combined loading in members. Also, basics of design concepts for beams and columns will be introduced.

There are five main **expected outcomes** for this course:

1. To apply the basic concepts of statics to structural mechanics.
2. To learn the fundamental concepts of stress and strain.
3. To learn how to analyze statically determinate structural elements under axial, torsion, bending and combined loads.
4. To learn about beam deflections and the concept of buckling.
5. To further develop engineering problem-solving skills.

Tentative exam schedule and exam policy

Midterm exam 1: Friday, February 11; in our classroom, during normal class time
Midterm exam 2: Wednesday, March 23; in our classroom, during normal class time
Final exam: Thursday, April 21, 1:30 pm – 3:30 pm, location *TBD*

- A few days before the exams, the instructor will inform the students about the format of the exam and about which help sheets or other aids, if any, will be allowed.
- **Students requiring special accommodations –** Students with disabilities must contact the Services for Students with Disabilities (SSWD) Office before classroom accommodation can be provided. As the course instructor, I will then be notified electronically and do my very best to provide the necessary accommodations. As a general rule, exams for students requiring extra time and/or a quiet environment will be scheduled for the same day as the exam scheduled for the rest of the class.
- Please note that the date and time of the final exam is scheduled by the Office of the Registrar. The **examinations will not be rescheduled** unless an emergency (which has to be documented) occurs. Travel plans do not constitute a basis for rescheduling an exam.

Grading policies

- **Contributions to the final grade** – The final grade will result from the following contributions:
  Homework: 20%
  Midterm exam 1: 25%
  Midterm exam 2: 25%
  Final exam (cumulative): 30%
  All homework and exams will be graded on a scale out of 100.
- **Grading scheme** – A conventional grading scheme will be used to convert the final grades into letter grades: 100–90 (A+, A, A-), 89–80 (B+, B, B-), 79–70 (C+, C, C-), 69–60 (D+, D, D-), <60 (F). The instructor reserves the right to expand the limits of these categories if deemed necessary.

Homework policies

- **Due date** – All homework will have to be submitted by the due date, which will be indicated in each homework assignment and on Canvas. The homework due dates are also reported alongside the class schedule. These dates are tentative and the instructor reserves the right to change them as the semester progresses. The official window for submission will typically close at midnight of the day when the assignment is due, but there will be a grace period of a few hours after that, until the following morning at 8 am (you can submit, for example, at 2 am, without penalty but not after 8 am the next morning). Late homework will not be accepted. Exceptions to this rule can be made for particular cases when a request is made in advance and an acceptable excuse for a late submission is provided by the student.

- **How to submit** – The assignments will have to be submitted using the online system in Canvas. For the online submission, it is required that the students upload a single pdf file. Each student is responsible for checking the file after it is uploaded to ensure that there are no issues such as insufficient image resolution, incorrect page order and missing pages.
- **Other requirements** – Submitted homework must satisfy the following requirements:
  - Presentation must be neat: handwriting must be legible, drawings must be neat.
  - It is mandatory to use engineering paper, graph or blank paper (**no ruled paper**)
  - **Units** must be indicated wherever necessary.

Honor code

- **Homework**: Discussion of the homework assignments with other students is allowed at the conceptual level, but each student has to complete all calculations and write-up on their own.
- **Exams**: No discussion with other students is allowed for completing exams.

The University of Michigan honor code will be strictly enforced. The following constitutes a violation of the Honor Code:

- copying the work of another student or from another source (including solution manuals, homework solutions from previous years, websites such as Chegg and CourseHero), and
- communicating with someone else during an exam with the purpose of getting help.

Violations of the Honor Code will be reported to the Honor Council.

In general, looking up solutions of problems (including YouTube videos), different than those in the homework but which are on the same topic, with the purpose of understanding methods and procedures, is allowed.

Also, please note that any material published by the instructor (worked out problems, notes, PowerPoint presentations, syllabi and videos) is protected by copyright laws and cannot be shared without permission.

Classroom/Zoom policies

- **Late arrival** – Students are expected to arrive to class or, if attending remotely, to join the meeting on time. If a student is occasionally late due to an unforeseen circumstance, she/he is allowed to enter the classroom or join the meeting. However, being late to class on a regular basis is not allowed.
- **Electronics** – Laptops or tablets may be used in class only to take notes. Any use of electronics that is not related to the class is not allowed. Smartphone use is not allowed.
- **Zoom attendance** – If you attend the class via Zoom, you are expected to keep your camera on. Please keep in mind that for the instructor in the classroom it is easy to miss chat messages send via Zoom. If you have questions or comments, feel free to unmute yourself during class time and speak: our classroom is equipped with speakers that allow people in the classroom to hear remote attendees.

Expectations

1. **Attend class (in person or remotely)**: arrive on time, pay attention, **take notes**; if you attend via Zoom, you are expected to keep your **camera on**
2. Work on the material **regularly** as the semester progresses; make sure to turn in assignments on time; ask for extension in advance if you need it
3. **Ask for help** when needed; **ask questions** if something is not clear (during class, during office hours, using Piazza)

Diversity, equity, and inclusion

I consider the classroom a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. I am dedicated to helping each of you to achieve all that you can in this class. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Should I accidentally use language that creates offense or discomfort, please contact me and help me understand so that I can avoid making the same mistake again.

Class Schedule

Note: this schedule is tentative and may be adjusted as the semester progresses

#	Date		Topics	Textbook Sections	HW	
					Assign	Due
1	5-Jan	Wed	Introduction - Principles of statics			
2	7-Jan	Fri	Stress on solids; normal stress	1.1, 1.3, 1.6		
3	10-Jan	Mon	Shear stress and allowable stress design	Ch. 1, 4.3, 4.4	1	
4	12-Jan	Wed	Strain in solids	2.1 to 2.3		
5	14-Jan	Fri	Introduction to material properties	3.1 to 3.3		
	17-Jan	Mon	**No class - Martin Luther King, Jr. Day**			
6	19-Jan	Wed	Material strain energy and Poisson's ratio	Ch. 3, 17.1, 17.2	2	1
7	21-Jan	Fri	Introduction to axial members	5.1 to 5.4		
8	24-Jan	Mon	Indeterminate axial members	5.4, 5.5		
9	26-Jan	Wed	Stress concentrations; thermal strains*	5.6, 5.7	3	2
10	28-Jan	Fri	Introduction to torsion	6.1 to 6.3		
11	31-Jan	Mon	Torsion (cont'd) and SI torsion members	6.1 to 6.6, 6.9		
12	2-Feb	Wed	Torsion for non-circular and thin-walled elements	6.11, 6.12		3
13	4-Feb	Fri	Problems on torsion	Ch. 6	4	
R1	7-Feb	Mon	Review for Midterm Exam 1	--		
14	9-Feb	Wed	Drawing shear and moment diagrams (review)	Ch. 7		
	11-Feb	Fri	**MIDTERM EXAM 1**			
15	14-Feb	Mon	Flexural properties of beams	8.1 to 8.4	5	4
16	16-Feb	Wed	Bending about a non-principal axis of inertia	8.8		
17	18-Feb	Fri	Composite beams	8.6		
18	21-Feb	Mon	R/C flexural elements	8.1 to 8.8		
19	23-Feb	Wed	More on bending moment; Introduction to shear	8.1-8.8; 9.1, 9.2	6	5
20	25-Feb	Fri	The shear formula: derivation and discussion	9.3 to 9.5		
	28-Feb	Mon	**No class - Spring break**			
	2-Mar	Wed	**No class - Spring break**			
	4-Mar	Fri	**No class - Spring break**			
21	7-Mar	Mon	Applic. of shear formula; shear in thin walled members	9.7		
22	9-Mar	Wed	Design of fasteners in built-up sections	9.8		
23	11-Mar	Fri	Shear center**	9.10	7	6
24	14-Mar	Mon	Combined loadings and resulting stress	8.7, 15.4		
25	16-Mar	Wed	Elastic curve of beams	10.1 to 10.3		
26	18-Mar	Fri	Elastic curve of beams (continued)	10.1 to 10.3		7

R2	21-Mar	Mon	Review for Midterm Exam	--		
	23-Mar	Wed	**MIDTERM EXAM 2**			
27	25-Mar	Fri	Introduction to columns	16.1, 16.2		
28	28-Mar	Mon	Euler's formula for slender columns	16.1 to 16.3	8	
29	30-Mar	Wed	Plane stress transformations	12.1 to 12.7		
30	1-Apr	Fri	Principal stresses and Mohr's circles	12.7 to 12.10	9	
31	4-Apr	Mon	Extension to 3D, absolute max shear stress	12.11		8
32	6-Apr	Wed	Stress trajectories; theories of failure	15.5		
33	8-Apr	Fri	Theories of failure (continued)	15.5		
34	11-Apr	Mon	Theories of failure (continued)	15.5	10	9
35	13-Apr	Wed	Final review topics	--		
36	15-Apr	Fri	Final review topics	--		
R3	18-Apr	Mon	Final review	--		10

* Last topic for midterm exam 1

** Last topic for midterm exam 2