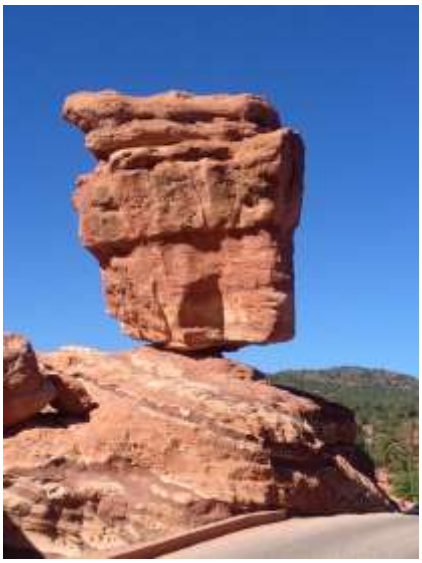

University of Colorado Boulder
Mechanics of Solids
MCEN 2063
Course Syllabus: Spring, 2023

Instructor:
Prof. Rong Long
Office: Engineering Center, ECME 273
Phone: 303-492-3295
email: rong.long@colorado.edu

Time and location:
Monday, Wednesday, and Friday 10:10-11am in EKLC E1B20.

Teaching Assistants
Seyed Hodaei Esfahani
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Hendrik Kohlwes
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Office hours:
Wednesday: 11:30am - 1pm
Thursday: 1:30-3:00pm
Office hours will be on Zoom and in-person. Please use the class Zoom link given below.
https://cuboulder.zoom.us/j/97787414159

TA Help Sessions (starting date 1/31)
Tuesday and Thursday: 6:30-8:30 on Zoom and in-person at the ME Community Space.
Please use this zoom link: https://cuboulder.zoom.us/j/92715407638

Consulting with faculty:
I encourage you to discuss questions with me after class or during office hours. If the office hours are not at a convenient time, please email me to set up an appointment (either in-person or Zoom).

Prerequisites:
To enroll this course, you must have passed Statics (MCEN 2023) with a grade of at least a C. Our course, MCEN 2063, is a prerequisite for Senior Lab and Component Design.

Course Website:
Homework assignments and solutions, lecture notes, and general announcements will be posted on Canvas (canvas.colorado.edu).

Text: R.C. Hibbeler, *Mechanics of Materials* (11th Edition), Pearson Prentice Hall (2022) ISBN-13: 978-0-13-760552-1

Reference Texts:
In addition to the recommended text, the reference texts listed below may prove useful. I will also provide some handouts through Canvas during the semester.

Beer, Johnson, DeWolf, and Mazurek, *Mechanics of Materials*
Philpot, *Mechanics of Materials: An Integrated Learning System*

Course Description and Objectives

The overall objective of this course is to take the next step along the path of mechanical design. We will take the knowledge that you gained in Statics, force and moment determination, and add on the ability to determine the internal stresses and strains caused by those forces. Understanding these internal forces and deformations will allow you to design mechanical systems so that they do not fail, cause injury and possibly death. Our responsibility as engineers is immense and courses like this one help us to design safe and robust structures.

Learning objectives for this course include:
Traditionally, the purpose of this class has been to teach some of the analytical techniques used to ensure that a particular structural design is safe and durable. The most effective way to teach these techniques is to have the students work lots of short drill problems like the ones in the textbook. These problems represent only a small part of the structural analysis (one joint or member in the structure), and the structural analysis represents only one part of the overall design process. The analytical techniques should be learned or understood in the context of the overall design process.

Specific course objectives are:

1. To understand the axial, shear and bearing stresses associated with simple truss design and analysis.
2. To understand normal and shear strains and how they relate to deformation.
3. To understand the difference between applied loads and allowable loads and how to calculate (or apply) factor of safety.
4. To interpret a stress-strain diagram and understand elastic constants.
5. To understand the stress-strain and load-displacement relationships for axial force members.
6. To learn to calculate the stresses, strains and angular displacements for torsion members (shafts), and to understand how power is transmitted through a gearbox.
7. To recall how to calculate the shear-force and bending-moment diagrams for beams.
8. To learn to calculate the stresses, strains and displacements for beams under various loading configurations.
9. To learn to calculate the stresses, strains and displacements for pressure vessels.
10. To understand the concepts of stress and strain as second order tensors.

11. To learn how to calculate the principal stresses, and how they are related to the failure of various materials.
12. To use the mechanics of materials technique to analyze complex structures.

A nominal timeline and outline of topics to be covered in this course is given below. As the semester unfolds there will likely be changes to this schedule.

week	dates	Topics	reference
1	1/18, 20	Introduction and Stress	1.1-1.3
2	1/23, 25, 27	Stress / Strain	1.4-1.7, 2.1-2.2
3	1/30, 2/1, 3	Mech. Properties/Axial Deformation	3.1-3.6, 4.1-4.2
4	2/6, 8, 10	Axial Deformation/ Torsion	4.3-4.7, 5.1-5.2
5	2/13, 15, 17	Torsion, Bending, Exam 1 (2/10)	5.3-5.5 6.1-6.2
6	**2/20**, 22, 24	**Exam 1 (2/20)**/ Bending	6.3-6.4
7	2/27, 3/1, 3	Transverse Shear	6.5, 7.1-7.2
8	3/6, 8, 10	Transverse Shear, Combined Loading	7.2-7.4, 8.1-8.2
9	3/13, 15, 17	Combined Loading	8.1-8.2
10	**3/20**, 22, 24	**Exam 2 (3/20)** / Stress Transformations	9.1-9.3
11	3/27, 29, 31	Spring Break	
12	4/3, 5, 7	Stress and Strain Transformations	9.4, 10.1-10.5
13	4/10, 12, 14	Design of Beams and Shafts	11.1-11.2
14	4/17, 19, 21	Deflection of Beams and Shafts	12.1-12.5
15	**4/24**, 26, 28	**Exam 3 (4/24)**/ Deflection of Beams and Shafts	12.6-12.9
16	5/1, 3	Review	

Learning Activities

Lectures

Lectures meet every Monday, Wednesday, and Friday in person. Lectures will be interesting, interactive, and lively and attendance at lectures is strongly encouraged. Workshop sessions may also occur during lecture period.

Homework and Reading Assignments

Homework and reading assignments will be posted on the course website and homework will generally be due on Fridays at the start of class. The assignments will be posted a minimum of one week before they are due. Please read the Late Policy listed below. Although the point total on the individual assignments may vary, they will be normalized such that each carries equal weight when calculating the final homework grade. If you feel that a homework problem was graded unfairly, please contact me to appeal.

Homework Format and Grading Guidelines

Homework assignment graded will consist of three parts: (1) general assignment format, (2) zero to one problems graded rigorously in depth, and (3) cursory grading of all other problems on the assignment. The choice of the problems for in-depth grading will be done arbitrarily for each assignment and will not be known ahead of time. Grading details are outlined below.

1. **General assignment format** (4 points total credit: 1pt. each per assignment)
    a) Write your name, homework #, and due date on the upper right corner of the first sheet
    b) Write your name on the upper right hand corner of each sheet.
    c) Do only one problem per side of a sheet of paper. You may continue a problem on more than one sheet but do not put two problems on the same side of a sheet.
    d) Submit on Canvas in a single PDF file

2. **Problems graded in depth** (20 pts each): these problems will be graded as follows:

General Problem Format (5 points per problem: 1 pt. each)
a) Give the problem statement along with a "physical diagram" (when given).
b) List any assumptions used in your solution.
c) Use correct units throughout solution procedure.
d) Use a reasonable number of significant figures.
e) Place a box around the final answer.

Free Body Diagram (5 pts per problem)
For all equilibrium problems you must show a correct free body diagram with labeled right hand coordinate systems.

Method and Execution (10 pts per problem)
In addition to solving the problem and finding the correct answer, you must denote vectors correctly, state and use assumptions correctly, and carefully draw any graphs that may be required in the solution.

3. **All Other Problems on an Assignment** (4 points per problem): Cursory grading: the problems will be graded based on overall progress towards a solution. You must give the problems a good effort in order to receive full credit.

Exams
There will be three exams during the semester and a final exam. Exam solutions will be posted following the exam. If you think that a problem on an exam was graded unfairly, please contact me to appeal.

Grading Policy

Your final grade will be based on the following distribution:

- 15% Homework assignments (lowest will be dropped)
- 60% Midterms (20% each)
- 25% Final Exam

Final course letter grades will be assigned based on your overall score in the class and will be curved based on the difficulty level of the exams and assigned homework.

Important Dates
Exam 1: Monday, February 20th 6:30-8:30 (there will be no class during the day)
Exam 2: Monday, March 20th 6:30-8:30 (there will be no class during the day)
3/27-3/31: Spring Break
Exam 3: Monday, April 24th 6:30-8:30 (there will be no class during the day)
Final Exam: TBD

Late Policy
Assignments are due on Canvas at the start of class on the posted due date. If an assignment is submitted after the start of class on the day it is due, it is considered late. Late homework will be accepted up until 8pm on the day it is due. There will be a −10% penalty. No late homework will be accepted after that time, because solutions will be posted by then.

Academic Climate

In Class Expectations
It is our expectation that each of you will be respectful to your fellow classmates and instructors at all times. In an effort to create a professional atmosphere within the classroom, it is requested that you:

- Arrive to class on time
- Turn off your cell phone
- Display professional courtesy and respect in all interactions related to this class

Compliance with these expectations will assist us with the creation of a ***learning community*** and a high quality educational experience. The University of Colorado Classroom behavior policy will complement the outlined classroom expectations.

University of Colorado Classroom Behavior Policy
Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to

discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Discrimination and Harassment

Discriminatory and harassing behavior will not be tolerated in the Department of Mechanical Engineering. A safe and inclusive environment will be created and maintained by the students and instructing faculty member. Students with concerns about discrimination or harassment actions should immediately contact the instructor, the Department Chair or their academic advisor, or contact the Office of Discrimination and Harassment (below).

The University of Colorado Discrimination and Harassment Policy is stated below.

University of Colorado Discrimination and Harassment Policy

The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. The University of Colorado does not discriminate on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation, or veteran status in admission and access to, and treatment and employment in, its educational programs and activities. (Regent Law, Article 10, amended 11/8/2001). CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, or veteran status. Individuals who believe they have been discriminated against should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Student Conduct (OSC) at 303-492-5550. Information about the ODH, the above referenced policies, and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://www.colorado.edu/odh

Accommodation of Disabilities or Religious Commitments

If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu.

If you have a temporary medical condition or injury, see guidelines at:
http://www.colorado.edu/disabilityservices/go.cgi?select=temporary.html.

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have

conflicts with scheduled exams, assignments or required attendance. In this class, please provide at least two weeks notice of occasions that conflict with course due dates, so that other arrangements can be made.

Out of Class Expectations

Though many of the above stated policies address academic climate within the classroom, these policies should also be upheld outside of the classroom. As a member of the ME community you are expected to consistently demonstrate integrity and honor through your everyday actions. Furthermore, faculty and staff members are very willing to assist with your academic and personal needs. However, multiple professional obligations make it necessary for us to schedule our availability. Suggestions specific to interactions with faculty and staff include:

- Respect posted office hours. Plan your weekly schedule to align with scheduled office hours
- Avoid disrupting ongoing meetings within faculty and staff offices. Please wait until the meeting concludes before seeking assistance. Respect faculty and staff policies regarding use of email and note that staff and faculty are not expected to respond to email outside of business hours. Send emails to faculty and staff using a professional format. Tips for a professional email include:
    - Always fill in the subject line with a topic that indicates the reason for your email to your reader.
    - Respectfully address the individual to whom you are sending the email (e.g., Dear Professor Smith).
    - Avoid email, chat room or text message abbreviations.
    - Be brief and polite.
    - Add a signature block with appropriate contact information.
    - Reply to emails with the previously sent message. This will allow your reader to quickly recall the questions and previous conversation.

Policy on Privacy of Graded Work

Federal law requires that your grades be communicated to you privately. You have been assigned a unique, private ME ID number for this purpose, and it will be the same for all your ME courses. Put this number on all work that you hand in, instead of, or in addition to, your name. You can pick up your graded work filed under this number.