

ASEN 5212 – Mechanics of Aerospace Structures

Fall 2026

Instructor: Francisco López Jiménez.
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Teaching Assistant:

Lecture times and location: Tuesday and Thursday, 8:30am – 9:45am

AERO 232 and Zoom
Lectures will be recorded and posted on Canvas

Office hours times and location: TBD

Zoom link for the semester:

Prerequisites: APPM 2360, ASEN 2001 or 2701, ASEN 2003 or 2703, and ASEN 3112 or 3712, or equivalent, or instructor consent required.

Online discussion forum:

To facilitate discussions on the material discussed in this course, including homework assignments and exams, this course will use the following Slack Workspace:

Note that students are not required to use this Slack Workspace, and all course notifications will be sent out via email and posted on Canvas. The Slack channel is primarily set up to help improve communication and collaboration within the course. While the teaching team aim to regularly monitor the Slack Workspace you should not expect communication outside of regular business hours.

References:

This course does not use a single textbook. Instead, students can choose one or more of the following books as resources:

1. W. M. Lai, D. Rubin, and E. Krempf, “Introduction to continuum mechanics”, 4th ed., Butterworth-Heinemann/Elsevier, Amsterdam, 2010*,+

2. J. N. Reddy, "An Introduction to Continuum Mechanics", Cambridge University Press, 2013*,+
3. A. F. Bower, "Applied Mechanics of Solids", Taylor and Francis, 2010*,+
4. A. P. Boresi and K. P. Chong, "Elasticity in Engineering Mechanics", 2nd edition, Wiley Interscience Publications, New York, 2010*,+
5. Y. C. Fung and P. Tong, "Classical and computational solid mechanics (Advanced series in engineering sciences)", World Scientific Publishing, Singapore, 2001*
6. M. E. Gurtin, "An introduction to continuum mechanics (Mathematics In Science and Engineering)", Academic Press, 2003+
7. Y. C. Fung, "A first course in continuum mechanics", Englewood Cliffs, N.J. : Prentice Hall, 1994L. E. Malvern, "Introduction to the mechanics of a continuous medium", Englewood Cliffs, N.J. :Prentice-Hall, 1969

* recommended; + available electronically through CU library

Grading:

Homework (10%)**, two mid-term exams (25%+25%), and an in-class final exam (40%). The homework assignments with the lowest score will be dropped. If the score of any of the two midterm exams is lower than the score of the final exam, the midterm is dropped, and the weighting of the final is increased from 40% to 65% (or 90% if both midterms score lower than the final).

No make-up homework assignments and make-up exams will be offered. If a student does not turn in a homework assignment (in time) or does not take an exam, a zero score will be assigned. Please, see policy on grading homework assignments and exams. A make-up final will be offered if the student provides a valid justification for missing the final.

All students enrolled in ASEN 5012, the midterm exams and the final exams need to be taken during scheduled times, i.e., during lecture for the two midterms and the time schedule by the registrar's office for the final. Students enrolled in ASEN 5012-002 – Distance Section – can either take the exams with the students enrolled in ASEN 5012 on campus or at a different time within a given time window. In the latter case, the student needs to provide a proctor.

All homework assignments need to be uploaded to [Gradescope](#). Students will receive an email to sign up with their CU email address. Students will need to upload their assignments. In case of hand-written assignments, students can use a smartphone or use scanners at the CU library. Should a student not have access to either, please, contact the instructors. Instructions how on to upload assignments can be found [here](#). Instructions on how to upload assignments can be found at: [How to upload PDF assignments](#). Instructions on how to view scores and feedback after an assignment is graded can be found at: [How to view scores and feedback](#).

Requests to re-grade any item need to be submitted within two weeks of the date in which the assignment or exam is returned to students. Regrade requests will be submitted through

Gradescope. Note: this procedure can only be used in the case of mistakes during grading, not to argue about the rubric.

** Each student needs to submit the homework assignments individually. Homework will be graded for completeness only; solutions for all homework problems will be posted.

Notes:

- All communication outside the classroom will be done via the course Canvas website and email. It is the student's responsibility to check regularly for updates to the Canvas website. It is strongly recommended to activate the option in Canvas to receive automatic notifications whenever the course website is updated. The Slack channel is only used for discussing questions among students and the instructor.
- All homework needs to be turned in electronically via Gradescope prior to class the day the homework is due (usually Thursdays).
- No late homework will be accepted.
- Students are allowed to discuss homework assignments with each other. However, it is strongly recommended that students first work independently on homework assignments before discussing the assignment with other students and/or the instructor.
- Office hours should be used to discuss specific questions with the instructor. Students are expected to have attempted to work through homework assignments and practice exam questions before discussing these questions with the instructor. Office hours are not meant as time to work on assignments for the first time.
- Students with accommodation should contact the instructor as soon as possible. Accommodations letters should be received at least five business days before an exam to guarantee that they can be implemented.

Exam dates:

- Mid-term Exam 1: Thursday, October 1st, 2026
- Mid-term Exam 2: Thursday, November 12th, 2026
- Final Exam (comprehensive): TBD by Campus.

Dates might change due to unexpected circumstances. The instructors will try to communicate this changes as early as possible.

Course content:

The following list of topics is not comprehensive. The instructor reserves the right to adapt the course content to adapt to the progress of the course and the interest of the students.

1. Scalar, Vector, and Tensor Algebra

- (a) Concept of scalars, vectors, and tensors
- (b) Some basic operations of scalars, vectors, and tensors
- 2. Stress and Strain Tensors
 - (a) Traction and stress tensor
 - (b) Equation of static equilibrium
 - (c) Linear and nonlinear kinematics, finite deformation, strain tensor
 - (d) Compatibility of strain fields
 - (e) Plane stress and plane strain
 - (f) Transformation of stress and strain tensor
 - (g) Stress invariants and stress deviations
- 3. Constitutive Equations
 - (a) Classification of materials
 - (b) General Hooke's law
 - (c) Concept of hyperelasticity
- 4. Conservation Laws
 - (a) Material derivatives
 - (b) Equations of continuity
 - (c) Equations of motion
- 5. Linear Elasticity
 - (a) Governing equations and uniqueness of boundary value problems
 - (b) Plane stress and plane strain models
 - (c) Saint Venant's theory of torsion
 - (d) Airy stress function in Cartesian coordinates
- 6. Energy Theorems and Variational Methods
 - (a) Principle of virtual displacement, strain energy, complementary energy, potential energy
 - (b) Variational method
- 7. Nonlinear Elasticity ***
 - (a) Finite deformation
 - (b) Principle of virtual work applied to geometrically nonlinear problems
 - (c) Elastic buckling
- 8. Advanced Topics ***
 - (a) Elasto-Plasticity and models for material failure
 - (b) Thermo- and viscoelasticity
 - (c) Method of Lagrange multipliers

*** covered only if time permits

Course expectations

This is a graduate course, and as such, professionalism, initiative and self-sufficiency are expected from students. Deadlines (for assignments, for regrading requests, to give notice of conflicts) will

be enforced, if nothing else to ensure fairness among students. Students are encouraged to attend office hours and receive all the help needed to complete assignments; however, they will be expected to come up with specific questions after having already attempted to solve the assignments.

The grading for the assignments, particularly when it relates to dropping those with low scores, is designed to add flexibility and allow students to deal with short term emergencies without affecting their grade. Please, do not ask for an extension for the homework assignments, even if it is short. Be on time or let that be the assignment that is dropped.

This is also a course based on previous material (e.g., basics in stress and strain, constitutive laws) that will be reviewed only briefly if at all. Students are expected to review independently if they need to refresh concepts; suggested reading will be provided if needed/requested.

However.

I understand that life happens. If you have an emergency (loss of job, sickness in family, mental health issues), particularly one that affect you during a significant amount of time please let me know as soon as possible. Even if you are just overwhelmed by your life situation, please let me know as soon as possible. I expect professional, serious, focused students, not robots. I believe we can all distinguish between minor issues or troubles with planning (which are the reason for the flexibility in grading), and major difficulties (that require a different, more substantial response). But I can only help you if you give me enough warning, and we can take action when it is still possible to do so (not, say, after the solution for an assignment is posted). So, if something happens, let me know, and we will figure something out.

Let's try to have the best semester possible.

Acceptable Use of AI in This Class

In this course, you are allowed to use AI as a tool to practice and help you learn. However, take the usual precautions regarding wrong answers, hallucinations, wrong citations, etc. You should use these tools to help you develop your understanding of the material, and maybe occasionally to ask for specific help with assignments, but you should be careful that they do not prevent from the struggle necessary to truly learn complex material. Over relying on them every time you have difficulties with a problem will give a false sense of confidence, that will end up hurting your performance in exams and, more importantly, prevent you from learning the material. Furthermore, any work you submit should be your own, and directly submitting a solution provided by a gen AI tool will result in failing the course. Finally, keep in mind your own and others' privacy implications and security risks when using gen AI tools.

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the [Honor Code](#). Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Understanding the course's syllabus is a vital part of adhering to the Honor Code.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: StudentConduct@colorado.edu. Students found responsible for violating the Honor Code will be assigned resolution outcomes from Student Conduct & Conflict Resolution and will be subject to academic sanctions from the faculty member. Visit [Honor Code](#) for more information on the academic integrity policy.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or DSinfo@colorado.edu for further assistance. If you have a temporary medical condition, see [Temporary Medical Conditions](#) on the Disability Services website.

If you have a temporary illness, injury or required medical isolation for which you require adjustment, please contact the instructor as soon as possible. Deadlines in this course should be flexible enough to accommodate most conflicts; otherwise, we will discuss alternatives.

Accommodation for Religious Obligations

Instructional faculty members must make every reasonable effort to accommodate all students who have conflicts with scheduled exams, assignment deadlines or required attendance due to a religious observance. Whenever possible, students must notify the instructional faculty member at least two weeks in advance of the expected exam, assignment deadline, or attendance conflict to request an accommodation for religious observance. If the start date of the course is less than two weeks before the date of requested accommodation, students must notify the instructional faculty member on the start date of the course. See the [Student Academic Accommodations for Religious Observances Policy](#) for more information.

In this class, deadlines should be flexible enough to accommodate most conflicts; otherwise, we will discuss alternatives. See the [campus policy regarding religious observances](#) for full details.

Student Names and Pronouns

CU Boulder recognizes that students' legal information does not always align with how they identify. If you wish to have a name other than your legal name appear on your instructors' class rosters and in Canvas, or if you wish to choose pronouns to appear on your instructors' class rosters and in Canvas, visit the [Registrar's website](#) for instructions on how to change your personal information in university systems.

Classroom Behavior

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure 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 race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, marital status, political affiliation, or political philosophy.

Additional classroom behavior information

- [Student Classroom and Course-Related Behavior Policy](#).
- [Student Code of Conduct](#).
- [Office of Institutional Equity and Compliance](#).

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

CU Boulder is committed to fostering a productive and welcoming learning, working, and living environment. University policy prohibits [protected-class](#) discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- or off-campus. Denial of an approved accommodation for disability, religious observance, or pregnancy or pregnancy related medical conditions may be discriminatory.

The [Office of Institutional Equity and Compliance \(OIEC\)](#) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email OIEC@colorado.edu. Information about university policies, [OIEC reporting options](#), and [OIEC support resources](#) including confidential services can be found on the [OIEC website](#).

Faculty and graduate instructors are required to inform OIEC when someone discloses misconduct regardless of when or where it occurred. This is to ensure that those impacted receive outreach from OIEC about resolution options and support resources. To learn more about reporting and support options for a variety of concerns, visit the [Don't Ignore It page](#).

Mental Health and Wellness

The University of Colorado Boulder is committed to supporting students' mental health and overall wellbeing. If personal, academic, or emotional challenges are affecting your wellbeing or success, [Counseling and Psychiatric Services \(CAPS\)](#), is here to help. CAPS offers counseling, referrals, psychiatric care, crisis support, and much more. Visit CAPS in the C4C, or call (303) 492-2277, 24/7.