ASEN 3112 – Spring 2023

Structures

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* to discuss personal matters, students may request a one-to-one meeting with the instructor

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Teaching Assistants:
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Lectures: Monday, Wednesday, Friday: 09:35 AM – 10:25 AM, AERO 120

Recitations & Labs:
Section 011 Tuesday, 12:40 PM - 2:30 PM, AERO N100
Section 012 Thursday, 12:40 PM - 2:30 PM, AERO N100
Section 013 Friday, 2:45 PM - 4:35 PM, AERO N100

Class website: CANVAS, https://canvas.colorado.edu/ , ASEN3112

Class e-mail list: Through Canvas only

Texts: Lecture notes are posted on Canvas

Prerequisites: ASEN 2001-2003-2004 and APPM 2360, with grades of C or better in each; if the course was taken Spring 2020: with grades of C- (P+) or better in each

Course Objectives: The main objective of the course is to introduce modern structural analysis techniques based on understanding of the development of internal forces, stresses and deformations. These are essential to the design and verification of advanced aerospace structures and systems. The course offers an introduction to matrix and finite element methods for skeletal (truss and frame) structures, as well as to fundamental concepts in mechanical vibrations, structural dynamics, and structural stability.

Major Course Topics and Schedule:

Week	Topic	
1	Stress and Strain	Jan 18th – 20th (no recitation on the first week)
2	Stress and Strain – Material laws	Jan 23rd – 27th
3	Material laws – 2D Elasticity	Jan 30th – Feb 3rd
4	Stress Transformation – Pressure Vessels	Feb 6th – Feb 10th
5	Torsion	Feb 13th – 17th
6	Energy Methods	Feb 20th – 24th
7	Energy Methods	Feb 27th – Mar 3rd
8	Finite Element Method	Mar 6th – 10th
9	Finite Element Method	Mar 13th – 17th
10	Finite Element Method – Structural Dynamics and Vibration	Mar 20th – 24th
11	SPRING BREAK	Mar 27th – 31st
12	Structural Dynamics and Vibration	Apr 3rd – 7th
13	Structural Dynamics and Vibration	Apr 10th – 14th
14	Structural Dynamics and Vibration – Stability of Structures	Apr 17th – 21st
15	Stability of Structures	Apr 24th – 28th
16	Design Problems	May 1st – 4th (no recitation on May 5th)

Coursework consists of midterm exams, in-class activities distributed during the recitation, homework, experimental/computer labs, and one final exam. The exams cover all material including lectures, recitations, laboratory work and homework.

Recitations: Recitations are offered on Tuesdays, Thursdays and Fridays, in three sections of 1 hr. 50 min each. The main objective is to review material covered during the week, which can be especially helpful

for the currently assigned homework. Recitations may also include additional exercise material, not covered in class, useful for exam preparation. Recitations are replaced by lab demos (conducted at the same time) prior to laboratory and/or computer group work.

Note that during the recitation period, you are expected to be working on material related to the 3112 course. Please *do not* work on other material for other classes. Recitation time is YOUR time to ask questions about the material, get help on the homework, collaborate on the in-class activities, and work on your laboratory reports.

We hope to structure the recitations in such a fashion such that key ideas from the lectures are reinforced and that some time is allocated so the student laboratory groups can work on their reports. Four times during the semester, there are laboratory sessions (e.g., torsion lab, truss lab, etc.). On these days, **attendance is mandatory**.

Over the course of the 15-week semester, the instructors may distribute ~10 in-class activities, which are unannounced. To receive credit for these activities, you must attend the recitations. Thus, we highly encourage you attend each and every recitation session.

In-class activities: In order to provide more incentive, or structure, to the recitations, worksheets containing problems and/or conceptual questions shall be distributed at the discretion of the instructional team. The primary goal of these activities is to promote peer-to-peer learning. Students will be formed up into small teams (3-4 students) and they can work on the activities together. As the name implies, you must be present at the recitation to receive credit. The in-class activities shall be graded on completion instead of accuracy.

Homework: Homework assignments are usually assigned on a weekly basis and are due a week later, as specified in the assignment. Assignments generally cover 3 to 5 problems and are designed to help students become proficient in a subject. Before doing any homework, students should read the posted lectures and try to follow worked-out examples. This should give the student an idea of the principles involved and the solution method.

Written work should be neat and readable with adequate space and margins. Messy work will be left ungraded and a zero-score recorded. The main and essential steps of the solution approach need to be shown; failing to do so will result in a lower score. The final result needs to be indicated by an arrow, underline or box. Multiple answers when one is required will be counted as incorrect. Copying material from any resource (including solutions manuals and websites) and submitting it as one's own are considered plagiarism and are an Honor Code violation. Searching for help in a solution-repository website is also considered plagiarism.

Labs: Safety is the first priority for lab work involving experiments or use of computers. If students have not done so, they are required to complete the Pilot Tour Canvas Guide. Contact the Laboratory Coordinator if you have trouble completing the guide. Anyone violating rules of safe conduct may be restricted from accessing the co-PILOT facilities. The four experimental labs are carried out in groups of varying size. The groups are created randomly among students of the same lab section. Attendance is mandatory; missing part of a lab (demo, experiment) without cause or notification results in 50% of the student's report score being deducted. A student should contact the instructor in advance if the student cannot make attend part of a lab to make appropriate arrangements (see also section on Course Policies and Procedures).

Computer Use: Several assignments and labs may require computer access and basic programming skills in languages such as MATLAB and Excel. As part of the introduction to finite element methods the use

of the commercial FEM package ANSYS is taught for the computer component of Lab 2. Students will have access to the PILOT and co-PILOT computers to do computer work, once they have completed the PILOT orientation.

Grading Guidelines:

Group work: *	4 Lab reports	25% (= 5% + 10% + 5% + 5%)

Individual:

In-class activities	5%
Homework	10%
3 midterm exams	45% (15% each)
Final Exam	15%
	100%

*Group work only counts toward final grade if the total individual grade is C or better. If the individual grade is below C, the final grade equals the total individual grade.

Notes:

- Each homework assignment includes a set of several problems. The assignment is partially graded for completeness (20 pts), while one randomly selected problem is graded in detail for technical content and presentation (30 pts). Thus, the final score for each homework set is out of a total of 50 pts and computed based upon the numeric breakdown below:

$$HW\,\frac{Score}{50} = 30pts\ (Rand.Problem) + 20pts \times \frac{\#\ of\ Remaining\ Problems\ Completed}{\#\ of\ Remaining\ Problems\ in\ Set}$$

  Solutions for all homework problems are posted on CANVAS after the due date. The homework assignments with the two lowest scores are dropped. Homework needs to be turned in by a specified due date. All homework should be submitted electronically via Gradescope; see information below. Late homework will not be accepted.

- Exams cover material discussed in the weeks prior to the assessment. The exams may contain several conceptual questions (T/F, multiple choice) and several work-out, or computational problems. They provide a gauge to determine what an individual student has learned. The exams are given at regular lecture hours in AERO 120. All exams are closed book, but the instructional staff shall publish equation sheet(s) on Canvas which can be downloaded, printed out, and brought to the exam.
  - **Please note that there are no makeup exams**. If a student misses an exam for *any* reason (travel, illness, injury, etc.) a grade of zero shall be recorded.
  - However, the final exam score shall replace the lowest midterm exam grade.
    - Example → a student earns a grade of a 40% on the second midterm but earns a score of 80% on the final exam. The second midterm grade is now 80%.

- Example → a student misses the second midterm due getting injured and is not feeling well. A grade of 0 shall be recorded. This student earns an 80% on the final exam. The second midterm grade is now 80%.

- The final exam is comprehensive but tends to focus on material covered in the second half of the course.
- All your scores and grades will be posted on CANVAS and need to be checked within **2 weeks** after they are posted; requests to change a score on CANVAS need to be made within this period. These requests must be made directly in Gradescope.
- Graded homework and lab reports are returned via Gradescope; see information below. Students should check the assignment for grading correctness and request a change of score via Gradescope if incorrect grading is found.
- Exams will be scanned and added to Gradescope. Students can request to have the paper version of the exam returned. Once they are returned, only the scanned version will be used for grading.
- About Gradescope: Students will receive an email to sign up. Students will need to upload their assignment. 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 instructor within the first two weeks of the semester. Instructions on how to upload assignments can be found at help.gradescope.com.
  Instructions on uploading assignments can be found at:
  https://www.youtube.com/watch?v=KMPoby5g_nE.
  Instructions on viewing scores and feedback after an assignment is graded can be found at: https://www.youtube.com/watch?time_continue=2&v=TOHCkI12mh0.

Letter Grading Scheme:

Letter grades will be assigned as follows:

Letter	Grade Percent Grade	4.00 Scale
A	93.00 – 100.00	4.00
A-	90.00 – 92.99	3.67
B+	87.00 – 89.99	3.33
B	83.00 – 86.99	3.00
B-	80.00 – 82.99	2.67
C+	77.00 – 79.99	2.33
C	73.00 – 76.99	2.00
C-	70.00 – 72.99	1.67
D+	67.00 – 69.00	1.33
D	63.00 – 66.99	1.00
F	Below 63.00	0.00

Course Policies and Procedures:

1. The instructor and TAs/TFs reserve the right to reply to email questions only in business hours, i.e. Monday through Friday, 8:00 am – 5:00 pm. Emails received 24 hours or less before the assessments or any due dates are not guaranteed to be responded to.
2. The instructor reserves the right to make changes to the weekly course schedule and the syllabus based on occurring events that require different dispositions. The instructor will give sufficient advanced notice through announcements in class and posting on CANVAS. Changes to this syllabus and assignments may be announced at any time during class periods. The instructor will post the current syllabus and assignments on CANVAS. Both are dated in the footnote.
3. This course exclusively uses CANVAS to send out announcements, to provide comments to students daily on class activities, and to provide general information about course assignments. It is **strongly recommended** that all students set up their CANVAS account such that they automatically receive a notification about new announcements and updates to the CANVAS course page.
4. Homework and lab reports need to be uploaded to Gradescope (https://www.gradescope.com/). Students should create an account on Gradescope using the CU Boulder email address.
5. No makeup exams, makeup homework, and makeup in-class activities will be offered. A zero-score is recorded for each missed exam, in-class activity, and homework. Note that the two lowest in-class activities and the two lowest homework assignments with the lowest scores are dropped.
6. **Classroom Behavior**: Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. 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 race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.
7. **Requirements for COVID-19**: As a matter of public health and safety, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements and all public health orders in place to reduce the risk of spreading infectious disease. CU Boulder currently requires COVID-19 vaccination and boosters for all faculty, staff and students. Students, faculty and staff must upload proof of vaccination and boosters or file for an exemption based on medical, ethical or moral grounds through the MyCUHealth portal.

   The CU Boulder campus is currently mask-optional. However, if public health conditions change and masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policy on classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please follow the steps in the "Accommodation for Disabilities" statement on this syllabus.

   If you feel ill and think you might have COVID-19, if you have tested positive for COVID-19, or if you are unvaccinated or partially vaccinated and have been in close contact with someone who has COVID-19, you should stay home and follow the further guidance of the Public Health Office

(contacttracing@colorado.edu). If you are fully vaccinated and have been in close contact with someone who has COVID-19, you do not need to stay home; rather, you should self-monitor for symptoms and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). In this class, if you are sick or quarantined, please, alert the instructor about your absence due to illness or quarantine. Please, note there is no need to state the nature of their illness. In this class, if you are sick or quarantined, please, alert the instructor about your absence due to illness or quarantine. Please, note there is no need to state the nature of their illness.

8. **Accommodation for Disabilities**: 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.

9. **Preferred Student Names and Pronouns**: CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

10. **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, 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. All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution (honor@colorado.edu); 303-492-5550). Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found on the Honor Code website.

11. **Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation**: CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, protected-class discrimination and harassment, and related retaliation by or against members of our community on- and off-campus. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these policies, and individuals who believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and support resources can be found on the OIEC website.

    Please know that faculty and graduate instructors have a responsibility to inform OIEC when they are made aware of any issues related to these policies regardless of when or where they occurred to ensure that individuals impacted receive information about their rights, support resources, and resolution options. To learn more about reporting and support options for a variety of concerns, visit Don't Ignore It.

12. **Religious Holidays**: 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 contact the instructor in the first two weeks to find alternatives to possible conflicts with exams and other major assignments. See the campus policy regarding religious observances for full details.

Final Comments

The grading scheme in this course is not assigned to reward or punish. It is designed to indicate the student's level of competency compared to the standards set by the AES faculty. Does the student meet the minimum level of competency? Does the student exceed the minimum? Is the student below the minimum? This should be indicated by the final grade. The instructors are professionals and it is their job to set and maintain standards. The instructors are expected to use their education, experience, and interactions with industry, government laboratories, others in academia, etc., to determine the content of these standards. Because the CU Aerospace Engineering program is accredited by ABET (Accreditation Board for Engineering and Technology), the AES curriculum meets that board's requirements. As with any other professionals (doctors, lawyers, etc.) the students must trust that the instructors know what they are doing and that they are obliged to uphold standards.

The final grade indicates the student's readiness to continue to the next level of courses. Meeting the minimum requirements indicates that the student is prepared to continue at least at the minimum level required for the next in the sequence of courses. Exceeding the minimum means the student is ready to enter the next course and that the student has mastery of material beyond the minimum, i.e., the student shows some level of proficiency.

In addition to technical competence, 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 with specific questions after having already attempted to solve the assignments.

However, we understand that life happens. If you have an emergency (loss of job, sickness in family, mental health issues, other unforeseen and significant difficulties), please let the instructor know as soon as possible. Even if you are just overwhelmed by your life situation, please let us know as soon as possible. We expect professional, serious, focused students, not robots. But we can only help you if you give us 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 us know, and we will figure something out.

Let's try to have the best semester possible.