

**Smead Department of Aerospace Engineering Sciences  
University of Colorado Boulder**

**ASEN 3112 – Spring 2020  
Structures**

**Instructors:** Aaron Johnson  
Office: AERO N209  
Phone: (303) 735-5937  
Email: [aaronwj@colorado.edu](mailto:aaronwj@colorado.edu)  
Office Hours\*: See Canvas for most up-to-date information (during weeks of instruction)  
Location: See Canvas

Mahmoud Hussein  
Office: AERO 354  
Phone: (303) 492-3177  
Email: [mih@colorado.edu](mailto:mih@colorado.edu)  
Office Hours\*: See Canvas (during weeks of instruction)  
Location: See Canvas

\* to discuss personal matters, students may request a one-to-one meeting with one of the instructors

**Laboratory Coordinator:** KatieRae Williamson  
Office: AERO 141E  
Phone: 303-735-7976  
e-mail: [KatieRae.Williamson@colorado.edu](mailto:KatieRae.Williamson@colorado.edu)

**Teaching Assistants:** Armin Kianfar  
Office Hours: See Canvas for most up-to-date information  
e-mail: [armin.kianfar@colorado.edu](mailto:armin.kianfar@colorado.edu)

Mohammed Khanegahi  
Office Hours: See Canvas  
e-mail: [momo1035@colorado.edu](mailto:momo1035@colorado.edu)

Ajay Sharma  
Office Hours: See Canvas  
e-mail: [ajay.sharma@colorado.edu](mailto:ajay.sharma@colorado.edu)

**Teaching Fellow:** Kyle Marquis  
Office Hours: See Canvas  
e-mail: [kyle.marquis@colorado.edu](mailto:kyle.marquis@colorado.edu)

**Lectures:** Tu/Th: 1:00 – 2:15 pm, AERO 120

**Recitations & Labs:** Section 011 Th: 8:30 – 10:20 am, AERO N100 (co-PILOT)\*\*  
Section 012 Th: 2:30 – 4:20 pm, AERO N100 (co-PILOT)\*\*

\*\* if location for particular labs differs from the one stated above, the alternate location will be announced on Canvas.

**Class Web Sites:** Canvas, <https://canvas.colorado.edu/>, ASEN3112  
Gradescope, <http://gradescope.com>

**Class e-mail list:** Through Canvas only

**Texts:** Lecture notes are posted on CANVAS

**Prerequisites:** ASEN 2001-2003-2004 and APPM 2360, with grade of C 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, Elastic behavior of materials
2	Elastic behavior of materials, Torsion I
3	Torsion II & III
4	Deformation of beams I & II
5	<b>Exam I</b> , Energy methods I
6	Energy methods II & III
7	Energy methods IV, Finite element method I
8	Finite element method II & III
9	Finite element method IV, Structural dynamics and vibration I
10	<b>Exam II</b> , Structural dynamics and vibration II
11	Spring break
12	Structural dynamics and vibration III & IV
13	Structural dynamics and vibration V, Stability of structures I
14	<b>Exam III</b> , Stability of structures II
15	Stability of structures III, Design problems I
16	Design problems II & III

## Course Work:

Coursework consists of reading assignments, in-class clicker quizzes, homework, recitations, experimental/computer labs, three midterm exams and one final exam. Attendance to recitation is expected; **attendance to labs is mandatory**. Exams cover all material including lectures, recitations, laboratory work, and homework.

Recitations: Recitations are offered on Thursdays in AERO N100, in two sections of 1 hour 50 min each. The main objective is to review material covered during the week, especially that is helpful for the currently assigned homework. Recitations may also include additional exercise material, not covered in class, useful for midterm exam preparation. Recitations are replaced by lab demos (conducted at the same time, also in AERO N100, unless another location is announced) prior to laboratory and/or computer group work.

Reading Assignments: Reading assignments are to be completed before the lecture/discussion. The lecture/discussions should help to clarify and supplement what students have read.

Homework: Homework assignments are given most weeks and are due as specified in the assignment (typically Friday at 11:59 pm MST). No homework assignments are due in the week of midterm exams. 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. Homework problems may be also discussed in the recitation prior to the due date. All homework should be done on Engineering paper (the green-on-white ruled paper available at the bookstore). Homework assignments must be submitted electronically through Gradescope. **No hard copies will be accepted. No late homework will be accepted.** Be sure to leave time to upload your homework! Computer or internet issues are not acceptable excuses for missing the homework deadline.

Written work should be neat and readable with adequate space and margins. Messy work will be returned 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 submitting it as one's own are considered plagiarism and are an Honor Code violation.

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 attend an orientation and safety course presented by the co-PILOT staff in the first week of the semester. 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 about seven students. 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 one of the instructors in advance if the student cannot 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:	Clicker Quizzes	10%
	Homework	15%
	3 Midterm Exams	30% (= 3 times 10%)
	Final Exam	<u>20%</u>
		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.

If the score of any of the 3 midterm exams is lower than the score of the final exam, the midterm grade is dropped, and the weighting of the final is increased by adding 10% for each dropped midterm. For example, if Midterm 1 is dropped, Midterms 2 and 3 will each weigh 10%, and the final exam will weigh 30%.

Notes:

- Clicker quizzes gauge the student’s level of preparation for a lecture and the conceptual understanding of course material, and provide the instructors with important feedback. The scores of the two lowest clicker quizzes are dropped. The quiz questions are discussed after the quiz during the lecture. No makeup quizzes are offered under any circumstances. Please be sure to register your iClicker in the Buff Portal.
- 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 submitted electronically through Gradescope. No hard copies will be accepted, nor will late homework be accepted under any circumstances. Computer or internet issues are not an acceptable excuses for missing the homework deadline.

- Midterms cover material discussed in the weeks prior to the exam. They provide a gauge to determine what an individual student has learned. The midterm exams are given at regular lecture hours in AERO 120. All midterm exams are closed-book, but a crib sheet is permitted.

The maximum number of pages of the crib sheet will be announced separately for each midterm. No makeup exams will be offered.

- The final exam spans the entire course but with additional emphasis on material covered since the third midterm.
- 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 need to be made within this period. These requests must be made in email to **both** instructors. The subject line of the email should read:

**ASEN 3112 - Request for score change for <exam/lab/homework> <Id>**

- We reserve the right to make minor changes to the above distribution of weight for each assignment based on variations in assignments.
- Homework will be returned through Gradescope. Midterms may be returned through Gradescope or in recitation. For homework/midterms returned through Gradescope, students have **2 weeks** to check the assignment for grading correctness and request a change of score if incorrect grading is found. For midterms returned in recitation sessions, students can check the midterm during the recitation session. Once a midterm returned in recitation is taken outside the recitation classroom (co-PILOT) or the room used for office hours, no change of score can be requested.

### Letter Grading Scheme:

The exact letter grading scheme used in the course will be determined at the end of the semester. However, grade cutoffs will not be moved higher than they are in the following scheme:

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

### Exam Times and Locations:

- Midterm 1: Tuesday, February 11, in class
- Midterm 2: Tuesday, March 17, in class
- Midterm 3: Tuesday, April 14, in class
- Final exam: Saturday, May 2, 1:30 – 04:00 pm, AERO 120

## Course Policies and Procedures:

1. The instructors will be committed 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 exams or any due dates are not guaranteed to be responded to.
2. The instructors may make changes to the weekly course schedule based on occurring events that require different dispositions. The instructors 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 instructors 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 daily/weekly comments to students on class activities, and to provide general information about course assignments. It is strongly recommended that all students setup their Canvas account such that they receive automatically a notification about new announcements and updates to the Canvas course page.
4. No makeup clicker quizzes, makeup homework, and makeup exams will be offered. A zero-score is recorded for each missed clicker quiz, homework, and exam. Note that the two clicker quizzes and homework assignments with the lowest scores are dropped. If the score of a midterm is lower than the one of the final, the midterm is automatically dropped and the weighting on the final is increased by 10% (see details above).
5. 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](mailto:dsinfo@colorado.edu) for further assistance. If you have a temporary medical condition or injury, see [Temporary Medical Conditions](#) under the Students tab on the Disability Services website.
6. 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 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 policies on [classroom behavior](#) and the [Student Code of Conduct](#).
7. 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.
8. All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: 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 the Honor Code ([honor@colorado.edu](mailto:honor@colorado.edu); 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic

sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the [Honor Code Office website](#).

9. The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct, intimate partner abuse (including dating or domestic violence), stalking, or protected-class discrimination or harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or [cureport@colorado.edu](mailto:cureport@colorado.edu). Information about the OIEC, university policies, [anonymous reporting](#), and the campus resources can be found on the [OIEC website](#). Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.
10. 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, students must let the instructors know of any such conflicts within the first two weeks of the semester so that reasonable arrangements can be worked out. See [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 academe, etc., to determine the content and level 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 (engineers, 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 acceptable level of proficiency.