# ASEN 3112 – Fall 2020

## Structures

**Instructors:** Alireza Doostan
Office: AERO 356
Phone: (303) 492-7572
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Zoom Office Hours*: Tuesday, 3:00-4:00 PM (during weeks of instruction)
Location: Zoom – see information below

Kurt Maute
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Phone: (303) 735-2103
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Zoom Office Hours*: Tuesday, 3:00-4:00 PM (during weeks of instruction)
Location: Zoom – see information below

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

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

**Teaching Assistant**: William O'Connell
Zoom Office Hours: Th 11:00 - noon, see Zoom link below.
Fr 5:00 - 6:00 PM, see Zoom link below.
e-mail: William.Oconnell@colorado.edu

**Teaching Fellow:** Emma Markovich
Zoom Office Hours: M 6:00 - 7:00 PM, see Zoom link below.
e-mail: Emma.Markovich@Colorado.EDU

Kyle Marquis
Zoom Office Hours: Th 6:00 - 7:00 PM, see Zoom link below.
e-mail: Kyle.Marquis@colorado.edu

**Lectures:** M/W: 08:30 – 9:45 AM, Zoom – see information below

**Recitations & Labs:**
Section 011 T: 10:40 AM - 12:30 PM, AERO 120**
Section 012 T: 12:50 PM - 02:40 PM, AERO 120**

Section 013 T: 10:40 AM - 12:30 PM, AERO N240
Section 014 T: 12:50 PM - 02:40 PM, AERO N240

** also available via Zoom – see information below; only students who registered for an in-person section can attend the recitation/lab section on campus.

**Zoom link:** for lectures, lab/recitations, and office hours
https://cuboulder.zoom.us/j/93360011311
Meeting ID: 933 6001 1311, Passcode: 846011

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

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

**Online discussion forum:** Piazza, https://piazza.com/colorado/fall2020/asen3112

Note: All technical questions about homework assignments, lab assignments, etc. should be posted on Piazza first, before contacting one of the instructors or TA/TFs. Students should use the link above to sign up at piazza.com.

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

**Prerequisites**: ASEN 2001-2003-2004 and APPM 2360, with grades of C or better in each; if 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 | The concept of stress and strain |
| 2 | Elastic behavior of materials, Torsion I |

| | |
|---|---|
| 3 | Torsion II |
| 4 | Torsion III, Deformation of Beams I |
| 5 | Deformation of Beams II |
| 6 | Energy Methods I & II |
| 7 | Energy Methods III & IV |
| 8 | Finite Element Method I & II |
| 9 | Finite Element Method III |
| 10 | Finite Element Method IV, Structural Dynamics and Vibration I |
| 11 | Structural Dynamics and Vibration II & III |
| 12 | Structural Dynamics and Vibration IV & V |
| 13 | Stability of Structures I |
| 14 | Stability of Structures II & III |
| 15 | Design Problems I - II |
| 16 | Design Problems III |

**Course Work:**

Coursework consists of reading assignments, online quizzes on lecture material currently being discussed, lab quizzes, homework, recitations, experimental/ computer labs, three midterm exams and one final exam. Exams cover all material including lectures, recitations, laboratory work and homework.

The delivery mode of the different components of the course work is detailed in Section **Course Delivery Modes.**

Recitations: The main objective is to review material covered during the week, especially those that are helpful for the currently assigned homework and labs. Recitations may also include additional exercise material, not covered in class, useful for midterm exam preparation. Students will work with the help of an instructor and TA/TFs through practice problems. The solutions to the practice problems will be discussed as part of recitations. Recitations also provide students with the opportunity to discuss questions with the instructor and the TA/TFs, in addition to office hours.

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 on Wednesday and are due at the start of the following class on Wednesday, as specified in the assignment. 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.

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: The four experimental labs are carried out in groups of about four students. The groups are created randomly among students of the same lab section. As the first step of working on lab assignments, students will watch videos of lab setup and data taking process in an online mode. Experimental data will be provided to students. To ensure the student's familiarity of the lab material, students will take an online lab quiz.

Computer Use: Several assignments and labs may require computer access and basic programming skills in languages such as MATLAB. 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 can either download these software packages to their personal computers, using campus or free student licenses. Access to virtual desktops will also be provided. Detailed information will be provided with homework and lab assignments.

**Grading Guidelines**:

| | | |
|---|---|---|
| Group work: * | 4 Lab Reports | 15% = ⅜ (5% + 10% + 5% + 5%) |
| Individual: | Lecture Quizzes | 10% |
| | 4 Lab Quizzes | 10% = ⅖ (5% + 10% + 5% + 5%) |
| | Homework | 15% |
| | 3 Midterm Exams | 30% (= 3 times 10%) |
| | Final Exam | 20% |
| | | 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 10% for each dropped midterm.

Notes:

- Lecture quizzes gauge the student's level of preparation of a lecture and the conceptual understanding of course material. The lecture quizzes are taken online via CANVAS and need to be completed within a specified time window. The scores of the two lowest lecture quizzes are dropped. No makeup lecture quizzes are offered.
- Lab quizzes gauge the student's level of understanding of a lab assignment and the underlying theory. The lab quizzes are taken online via CANVAS and need to be completed within a specified time window shortly after the due date for the lab reports. Together with the score for a short lab report, the score of the lab quiz is part of the total score of the specific lab assignment. No makeup lab quizzes are offered. No penalty for zero score for lab quizzes is applied only in

case of a medical emergency or other reasons accepted by the instructors. The lab reports need to be submitted via Gradescope; see information below.

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

- 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 remotely only and need to be taken during lecture. All midterm exams are open-book, i.e. students can use lecture notes and slides, as well as solutions to homework, recitation and practice problems. No makeup exams will be offered. However, the use of the internet for searching for information during exams is disallowed. Exam solutions need to be uploaded to Gradescope; see information below.

- The final exam spans the entire course but with additional emphasis on material covered since the third midterm. The final exam needs to be taken during the time assigned by the registrar's office. Exam solutions need to be uploaded to Gradescope; see information below.

- 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 in email to **both** instructors. The subject line of the email should read:

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

- Graded homework, lab reports, midterm exams, and the final exam 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. If indeed the grading was incorrect, the score on CANVAS will then be updated by the instructors and TA/TFs. No further request and email is needed.

- We reserve the right to make minor changes to this distribution of weights based on variations in assignments.

- 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 instructors 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 |

**Exam Times and Locations**:

- Midterm 1: Wednesday, September 23rd, during lecture time
- Midterm 2: Wednesday, October 21st, during lecture time
- Midterm 3: Wednesday, November 18th, during lecture time
- Final exam: Thursday, December 10, 7:30–10 p.m.

**Course Delivery Modes:**

**Definitions** (in accordance with Department and registrar's office definitions):

- In-Person (Synchronous): activity in person on campus on scheduled days and times.
- Remote (Synchronous): activity via Zoom or other real-time platform on scheduled days and times; students will need to participate in activity or complete assignment at a specified time.
- Online (Asynchronous): activity via lecture capture or Canvas online; students can participate when it is convenient for them within a specified time window.

**Lectures:** Students chose to follow the lectures in a remote or online mode. If the online mode is chosen, Monday lectures should be watched before following Wednesday lecture and Wednesday lectures should be watched before following Monday. Exams will take place during scheduled lectures; **the exams are administered in a remote mode only**.

**Labs:** The lab assignments will be introduced during the scheduled lab sessions (see above). Students can follow the introduction in a remote mode or watch a recording of the introduction in an online mode. After an assignment has been introduced**,** students should watch an online video of the experimental setup and the data taking process. **Students will work in groups on lab assignments in a remote style only**. Students can ask questions about lab assignments in-person, remotely via Zoom during recitations, or remotely via Zoom during office hours.

**Recitations:** Students can choose to work on practice problems either in-person, in a remote mode, or an online mode. Students choosing the in-person mode will have to attend the recitation/lab session for which they are registered; all health guidelines and rules need to be strictly followed (see also item 7 under **Course Policies and Procedures)***. The recitations will be recorded and posted on CANVAS. During recitations, students using an in-person or remote mode can ask questions about practice and homework problems and lab assignments.

* While not required, it is recommended that students bring a laptop, tablet, or a smartphone to recitations such that they can project their solutions to screens in the lecture room, facilitating the discussion with the instructor and teaching assistants (TA). If an in-person mode turns out to be impractical for various reasons (health concerns, hampers group work and interaction with instructors and TAs), the instructors reserve the right to cancel the in-person option.

**Course Policies and Procedures**:

1. The instructors 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 exams or any due dates are not guaranteed to be responded to.
2. The instructors reserve the right to 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 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. All written assignments (homework, midterm exams, lab reports and the final exam) need to be uploaded to Gradescope (https://www.gradescope.com/). Students should create an account on Gradescope using the CU Boulder email address. Lecture and lab quizzes are administered directly via CANVAS.
5. No makeup lecture quizzes, makeup homework, and makeup exams will be offered. A zero-score is recorded for each missed lecture quiz, homework, and exam. Note that the two lecture 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%.
6. 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 policies on classroom behavior and the Student Code of Conduct.

7. As a matter of public health and safety due to the pandemic, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements, and public health orders in place to reduce the risk of spreading infectious disease. Required safety measures at CU Boulder relevant to the classroom setting include:

   - maintain 6-foot distancing when possible,
   - wear a face covering in public indoor spaces and outdoors while on campus consistent with state and county health orders,
   - clean local work area,
   - practice hand hygiene,
   - follow public health orders, and
   - if sick and you live off campus, do not come onto campus (unless instructed by a CU Healthcare professional), or if you live on-campus, please alert CU Boulder Medical Services.

   Students who fail to adhere to these 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 policies on COVID-19 Health and Safety and classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please see the "Accommodation for Disabilities" statement on this syllabus.

   Before returning to campus, all students must complete the COVID-19 Student Health and Expectations Course. Before coming on to campus each day, all students are required to complete a Daily Health Form.

   Students who have tested positive for COVID-19, have symptoms of COVID-19, or have had close contact with someone who has tested positive for or had symptoms of COVID-19 must stay home and complete the Health Questionnaire and Illness Reporting Form remotely. In this class, if you are sick or quarantined, please, alert the instructors about your absence due to illness or quarantine. Please, note there is no need to state the nature of their illness.

8. 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. 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. 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; 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.
11. The University of Colorado Boulder (CU Boulder) is committed to fostering an inclusive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (harassment, exploitation, and assault), intimate partner violence (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. 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, dating and domestic violence, stalking, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

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 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 academe, 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.