ASEN 3802: Aerospace Sciences Laboratory II

University of Colorado **Boulder**

Spring Semester 2025

Syllabus

Time: Section 001: Fri. 08:30 AM - 10:20 AM
Section 002: Fri. 10:35 AM - 12:25 PM
Section 003: Fri. 12:40 PM - 2:30 PM

Laboratory Classroom: AERO N100

Instructors: Erik Knudsen
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Teaching Assistants/Facilitators:

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Description: This course provides an intermediate laboratory experience in aerospace sciences, with a focus on aerodynamics, structural mechanics, thermodynamics, and heat transfer. The course emphasizes design and analysis of experiments, processing and analysis of experimental data, and model validation using experimental data.

Last edited on: January 11, 2025

Learning Goals: A student who successfully completes this course will:

1. Have an operational understanding of experimental measurement techniques used in aerodynamics, structural mechanics, thermodynamics, and heat transfer,
2. Be capable of designing and analyzing experiments to study physical phenomena, measure physical properties, and assess performance of aerospace designs,
3. Be capable of processing and critically analyzing experimental data, including characterizing and propagating uncertainties,
4. Have a basic understanding of the verification and validation process, and
5. Be capable of validating models using experimental data.

The course will also reinforce students' understanding of fundamental concepts covered in ASEN 3711 (Aerodynamics), ASEN 3712 (Structures), and ASEN 3713 (Thermodynamics and Heat Transfer).

Required Text: None.

(While there are no required textbooks for this course, the textbooks associated with ASEN 3711, ASEN 3712, and ASEN 3713 are highly recommended as references for the material covered in the laboratory assignments, please see Supplemental References below.)

Supplemental References:

1. J. D. Anderson, *Fundamentals of Aerodynamics*. McGraw Hill, 5th - 7th ed., 2010-2024.
2. Y. Cengel, R. Turner, and J. Cimbala, *Fundamentals of Thermal-Fluid Sciences*. McGraw Hill, 5th-6th ed., 2016-2022.
3. A. M. Keuthe and C.Y. Chow, *Foundations of Aerodynamics: Bases of Aerodynamic Design*. Wiley, 5th ed., 1997.

Class Format: The class meets in-person once a week for one hour and fifty minutes of active laboratory instruction. Note that the activities vary week by week with some weeks focused on formal lecture or laboratory introductions, while others may be focused on carrying out hands-on laboratory measurements, programming analysis or post-processing code, carrying out simulations or writing laboratory discussions and completing other laboratory deliverables. Three primary laboratory activities will be assigned over the semester, with one laboratory activity focused specifically on each of the three course disciplines of structural mechanics, thermodynamics and heat transfer, and aerodynamics. As a result, each activity will nominally take five weeks of the 15 week semester. Note the specific calendar weeks for each of the three laboratory activities are identified below in the "Schedule of Lab Activities."

All of the labs will be carried out in small groups, assigned by the instructional team, which will be sized appropriately to match the amount of work expected and shuffled each week. If students do not participate in the group (i.e. attending lab periods, group meetings, online discussions, etc.) and do not contribute sufficiently to the group work, the team will be re-arranged, and the non-participating students might have to complete the report on their

own. Teams can work together to discuss the means and methods for formulating and solving problems and even compare answers, but you are not free to copy work from other groups.

Copying material from any resource (including code from another student, online, or from Generative AI) and submitting it as one's own is considered plagiarism and is an Honor Code violation. Students who are caught copying material will receive a zero grade for the assignment and will be reported for an "Honor Code Violation" for additional punitive action.

To complete these assignments, students must have access to a computer, basic programming skills, and familiarity with some programming languages and/or environments similar to what is covered in introductory computing courses. The minimum requirement is some proficiency with MATLAB. In addition to writing a detailed report for each assignment, students may also be required to submit their post-processing or analysis code. When requested your code should be must be submitted in a single zip file, including a "driver" or "main" MATLAB script producing all requested figures. Code may be written as a group, but each individual within the group is responsible for understanding exactly how all of the code works. Each part of each lab assignment will be due on the day of the lab indicated in the schedule (below) at 11:59 PM.

Lab reports and code should be submitted to the appropriate location via the course canvas site by the due date, **no late assignments will be accepted**.

Further guidelines for each laboratory activity will be addressed in the respective lab assignment documents.

The course instructors will be available in-person during the full laboratory periods. If students wish to seek help on the laboratory assignments outside of class time, they should attend the consolidated Aerospace Study Hall Periods on Tuesday evening (only) which will be supported by the teaching assistants and facilitators.

Attendance Policy: While attendance is not technically mandatory, this course is designed so that you and your group can finish the course within the designated laboratory periods. Ideally, there should not be much work outside of class. Therefore, attendance is expected at all scheduled laboratory periods, and students should expect new material to be presented. Students are expected to be working on this class during class time. None of the laboratory introductions or lectures will be recorded or posted for asynchronous consumption. Thus students who miss important information during laboratory periods should coordinate with their assigned lab groups and catch-up independently on the material they may have missed.

Course Website and Course Communications: There will be a class website on Canvas. All relevant documents, lab assignments, schedules, and supplemental documents will be posted to this site throughout the semester. Please check back to see what has been posted. All course announcements outside of the laboratory periods will be sent as Canvas announcements, so it is the student's responsibility to make sure their Canvas settings are appropriately configured to receive these announcements.

Students should e-mail the course instructors and teaching assistants/facilitators if they have a pressing logistical or health issue, or to request a private meeting to discuss personal matters. All questions related to laboratory assignments and course content should be asked in person during the laboratory period. The teaching team will not address technical challenges with the laboratory material (e.g. correctness of solutions, debugging code, etc.) over email, instead these questions and challenges should be resolved either during the in-person laboratory periods or at the consolidated Aerospace Study Hall period.

Schedule of Lab Activities: The following presents a nominal schedule for the semester:

Week	**Date**	**Activity**	Due
Lab 1: Structural Mechanics			
Week 1	Jan 17	Intro & Equivalent Beam Bending	
Week 2	Jan 24	Truss Experiment	
Week 3	Jan 31	Finite Element Method	
Week 4	Feb 7	Run Simulations	Lab 1 Part 1 Monday
Week 5	Feb 14	Work Session	Lab 1 Part 2 Monday
Lab 2: Thermodynamics & Heat Transfer			
Week 6	Feb 21	Heat Transfer Demo/Introduction	Lab 1 Part 3 Monday
Week 7	Feb 28	Model & Data Analysis	
Week 8	Mar 7	Model & Data Analysis	Lab 2 Part 1 Monday
Week 9	Mar 14	Work Session	
Week 10	Mar 21	Work Session	Lab 2 Part 2 Monday
Lab 3: Aerodynamics			
Week 11	Mar 28	No Class - Spring Break	
Week 12	Apr 4	2D Airfoils	Lab 2 Part 3 Monday
Week 13	Apr 11	Vortex Panel Method	
Week 14	Apr 18	Prandtl Lifting Line Theory	Lab 3 Part 1 Monday
Week 15	Apr 25	Analysis of Finite Wing	Lab 3 Part 2 Thursday
Week 16	May 2	No Class - Reading Day	Lab 3 Part 3 Thursday

Grading: The following presents the planned grading structure for the course. Be aware, that this is subject to change, however the class will be thoroughly notified and polled for agreement.

33.3% Structural Mechanics Laboratory Assignment
33.3% Thermodynamics and Heat Transfer Laboratory Assignment
33.3% Aerodynamics Laboratory Assignment
- Note that each lab has been broken up into smaller parts with varying weights, please see the individual lab assignments for details
- Grades are posted to the class website (Canvas).
- There will not be a final exam for this course.

Deliverables: There are no longer long-form lab reports due for each lab. Instead, each part of the lab will require some combination of **derivation/calculations, plots, discussions, and codes**. The marking rubrics for each type of turnin are included in the individual lab

assignments. This distills the content into the important parts and reduces the focus on writing.

In addition, each lab has been broken into smaller parts that are due at various intervals throughout each lab. This is done for several reasons:

1. To break up each lab into small manageable parts
2. To ensure that teams keep up with the material and do not leave things until the end
3. To allow teams to get feedback during the lab before it ends

Regrading: All regrade requests must be made within two weeks of receiving the grade for an assignment. These requests must be made in writing (i.e. via email) to the appropriate course teaching assistant/facilitator with the appropriate course instructor copied. Regrade requests received verbally or without the instructor copied will not be considered.

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	60.00 - 69.99	1.00
F	Below 60.00	0.00

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.

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. Visit Honor Code for more information on the academic integrity policy.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation: Disability Services determines accommodations based on documented disabilities in the academic environment. If you qualify for accommodations because of a disability, submit your accommodation letter from Disability Services to your faculty member in a timely manner so your needs can be addressed. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance.

If you have a temporary medical condition or required medical isolation for which you require accommodation, please notify the instructor as soon as possible so that appropriate accommodations can be made. If you are sick or require isolation please notify the instructor of your absence from in-person activities and continue in a completely remote mode, as you are able, until you are allowed or able to return to campus. Please note that for health privacy reasons you are not required to disclose to the instructor the nature of your illness or condition, however you are welcome to share information you feel necessary to protect the health and safety of others within the course. Also see Temporary Medical Conditions on the Disability Services website.

Accommodation for Religious Obligations: 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, you must let the instructor know of any such conflicts within the first two weeks of the semester so that they can work with you to make reasonable arrangements. See the campus policy regarding religious observances for full details.

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.

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, 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.

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.

Visit OIEC for or more information about university policies, reporting options, and support resources. If you believe you may have been subjected to misconduct, email OIEC or call 303-492-2127.

Faculty and graduate instructors are required to inform OIEC when they learn of any issues related to these policies regardless of when or where they occurred. This ensures that individuals impacted receive information about their rights, support resources, and resolution options. Visit the Don't Ignore It page to learn more about reporting and support options.

Mental Health and Wellness: The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS) located in C4C or call (303) 492-2277, 24/7.

Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.