

**ASEN 2002**  
**Introduction to Thermodynamics and Aerodynamics**  
**Fall 2020**

**Lecture: Remote via Zoom Link**

**T/Th 11:40 am – 12:55 pm (Section 100)**

**T/Th 01:15 pm – 02:30 pm (Section 200)**

**Lab: Hybrid In-Person/Remote**

Date/Time	Section	Room
W 8:30-10:20 am	301	Aero 141
	305	Aero N100
	309	Aero 120
W 10:40-12:30 am	302	Aero 141
	306	Aero N100
	310	Aero 120
W 12:50-2:40 pm	303	Aero 141
	307	Aero N100
	311	Aero 120
W 03:00-4:50 pm	304	Aero 141
	308	Aero N100
	312	Aero 120

Instructors

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Teaching Assistants

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**Class Canvas Portal:** <https://canvas.colorado.edu/courses/62826>

**Texts:** Cengel, Fundamentals of Thermal-Fluid Sciences, 5th Edition.  
Anderson, Introduction to Flight, 8<sup>th</sup> Ed. 2016 (hardcopy or electronic version)

**Prerequisites:** APPM 1350/1360, PHYS 1110 or equivalent

**Corequisite:** APPM 2350 or equivalent, ASEN 2012

**Required Equipment:** Safety glasses/goggles (if in-person lab participation). Laboratory notebooks are expected for tracking assignments and documenting lab progress, and may be spot checked periodically (note that lab notebooks will be required for Sr. Projects and promote good professional practice, so use this opportunity to establish good engineering habits, whether in person or remote).

**Course Objective:** Introduce the fundamental concepts and principles of thermodynamic and fluid dynamic systems. The focus is in areas of general importance to the aerospace engineering discipline. The primary goal is the synthesis of basic science (physics), mathematics, experimental methods for quantitative analyses, and design of general aerospace technology systems.

**Topical Outline:**

1. Basic concepts of thermodynamics
2. Conservation of energy: the First Law of Thermodynamics
3. Properties of pure substances
4. Control Volume Analysis
5. Introduction to basic concepts of aerodynamics
6. One-dimensional incompressible flows
7. One-dimensional compressible flows
8. Two-dimensional flows: lift and drag
9. Introduction to viscous flows

**Grading**

Evaluated Outcomes

The Department of Aerospace Engineering Sciences has adopted a policy of assigning grades according to “evaluated outcomes” in each course:

- O1** Professional context and expectations (ethics, economics, business environment, etc.)
- O2** Current and historical perspective
- O3** Multidisciplinary, systems perspective
- O4** Written, oral, graphical communication ability
- O5** Knowledge of key scientific/engineering concepts
- O6** Ability to define and conduct experiments, use instrumentation
- O7** Ability to learn independently, find information
- O8** Ability to work in teams
- O9** Ability to design

**O10** Ability to formulate and solve problems

**O11** Ability to use and program computers

Evaluation of these outcomes allows an assessment of your performance and provides a major portion of the process we use for continuous assessment and improvement of the entire AES undergraduate curriculum. The model for these outcomes derives from several sources including the “*Desired Attributes of an Engineer*” as defined by The Boeing Company, and “curriculum reviews” from major aerospace corporations including The Boeing Co., Lockheed Martin Corp. and Ball Aerospace Corp. These inputs were combined with the AES faculty vision of the desired attributes of an aerospace engineer and the requirements of the Accreditation Board for Engineering and Technology (ABET) to produce this list of evaluated outcomes. Each assignment is designed and graded to assess some portion of these outcomes.

*Grade Breakdown:* The two principal lecture / lab elements of the course, *thermodynamics and aerodynamics*, are equally weighted. Your final grade is determined according to the following percentage breakdown.

Type	Description	Percentage
<b>Individual</b>	Quizzes (Lab and Lecture)	20%
	3 x Exams	40%
	<i>Thermo Mid-term</i>	10%
	<i>Aero Mid-term</i>	10%
	<i>Comprehensive Final</i>	20%
<b>Group</b>	Experimental Lab**	20% (1 aero)
	Design Lab**	20% (1 thermo)
<b>Total</b>		<b>100%</b>

**\* Homework assignments will not be graded, but are critical in doing well on exams.**

\*\* Lab & Design reports and/or presentation scores may be adjusted by instructors for individuals based on team peer evaluations.

*Grading Philosophy:* Assignments and evaluations are graded to an absolute standard designed to assess your level of competency in the course material. This is known as criterion-based grading where students are evaluated against an absolute scale (90=A, 80=B...). The criteria will be a set number of points or a percentage of the total. Because the standard is absolute, it is possible that all students could get As or all students could get Ds. Minor adjustments may be made in the determination of final letter grades and with grade cut lines, but there is no “curving” in this course. The final grade indicates your readiness to continue to the next level in the curriculum, which requires a C or better to meet AES pre-req standards. The faculty have set these standards and expectations based on our education, experience, interactions with industry, government laboratories, others in academe, and according to criteria established by the ABET accreditation board.

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**IMPORTANT: The course grade is primarily dependent on individual measures of competency, i.e. exams and quizzes. The other course assignments are designed to enrich the learning**

*experience and to enhance individual performance, not to substitute for sub-standard individual competency. Accordingly, group assignment grades (i.e., labs) are only incorporated into the final grade when the individual grade (made up of quizzes and exams) is a C or better. In other words, if your individual score average is below a C, then the group-based grade fraction will not be averaged into your final grade, which will now be based solely on your individual score. This policy makes it important to use the group assignments as opportunities to enhance your own learning and not simply rely on your team members to 'divide and conquer'. If the work in the assignment is split up among group members, be sure that the learning is not also split up, but is shared among the whole group (i.e., everyone is accountable for and knowledgeable of all parts of their team's collective product).*

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**Class Policies:** Students are all responsible for knowing and adhering to the following class policies

- Class Communication:** The primary means for general course communication will be via course-wide Canvas announcement. Informal questions and discussions will be handled via the course Slack site: [asen2002fall2020.slack.com](https://asen2002fall2020.slack.com). Instructors, TAs, TFs, and LAs will all monitor Slack for questions on lectures, labs, and assignments. Private student questions or coordination can be handled via direct Slack message to the instructors. Questions regarding grading or regrade requests will all be handled via Gradescope: <https://www.gradescope.com/courses/145684>. Emails will NOT be a primary communication method used in course correspondence. Students are encouraged to attend virtual office hours for questions regarding course content or assignments as it enables better clarity and learning.
  - Request access to course Slack using your Colorado.edu email: [asen2002fall2020.slack.com](https://asen2002fall2020.slack.com)
  - You will receive an invite to the Gradescope course page. You must also use the same email address that is aligned with your Canvas account (the one you received the email invite on).
  - Communication of any medical or studies-related needs of absence that are known (non-emergency) should be communicated as soon as possible, and--when possible--any expected impact to assignments/exams should be coordinated with the instructor prior to, not after the fact, of missing a course deadline. See specific guidelines regarding COVID related illness and reporting are below.
- Homework and Quizzes:** Homework assignments are to provide you practice application problems to prepare you for the exams, but will not be graded. Lab and lecture quizzes will be administered online via Canvas. Quizzes will be offered during a multi-day window and therefore, no makeup quizzes will be provided unless extenuating circumstances result in an inability to complete the quiz within the available window. The lowest two **lecture** quizzes will be dropped from the individual grade assessment.
  - Note that ALL Quizzes are individual effort and you may not collaborate with classmates. External resources that you are permitted to use will be defined by the instructor for each quiz. Anything not explicitly allowed is to be considered unusable during a quiz.
- Exams:** All exams in this course will be conducted in a remote, synchronous format during scheduled lecture-section time periods and the assigned finals time period. Students must look ahead and ensure that they coordinate their schedules to be available to accomplish the exams at the prescribed times.
  - Assignment or Exam Conflicts:** All students are expected to review the entire course schedule at the beginning of the semester and identify any potential conflicts. You must make arrangements with the professor at least two weeks in advance. There will be no make-up assignments or exams "after the fact" if the student misses a graded event when prior coordination was possible.
  - Final Exam Scheduling:** If you have three or more final exams scheduled on the same day, you are entitled to arrange an alternative exam time for the last exam or exams scheduled on that day. To qualify for rescheduling final exam times, you must provide evidence that you have three or

more exams on the same day, and arrangements must be made with your instructor **no later than the end of the sixth week of the semester**

- There will be no unexcused exam makeups provided. If you miss an exam, course instructors will evaluate each case on an individual basis based on the context and information available to make a determination if a makeup exam will be provided. Students are encouraged to provide as much documentation as possible to enable an informed decision.
  - Collaboration on quizzes or exams: Using another student's work as your own, or allowing another student to use your work as their own, is considered academic misconduct and will not be tolerated. If you are caught in any of these activities, you may receive a grade of "F" for the course and a report will be made to the Office of Student Conduct & Conflict Resolution.
4. **Submission of Assignments:** All assignments will be submitted electronically (unless otherwise stated) via the Canvas or Gradescope course site. Work must be neat and readable with adequate spacing and margins. You are responsible for legibility - no reevaluation will be granted for illegible submissions.
- You are responsible for ensuring your digital upload contains all your work and properly uploads. Always check your uploaded assignment turn-ins! Noncompliant or unacceptably illegible submittals will be returned ungraded with a score of zero.
  - Your name (last, first), assignment number, and due date should be visible in the upper portion of each page. Final answers must be indicated with a box. Multiple answers (when only one is required) will be counted as incorrect.
5. **Experimental lab reports should be completed using a digital word processing program (Word, LaTeX, PDF, etc).** All group member names with relevant assignment information must appear on the cover page. Bottom line - submit all work with a professional appearance. Neatness, clarity, and completeness really do count in the work world!
- Detailed guidelines for laboratory reports and presentations will be distributed and reviewed separately. Labs are written up and presented in groups, and initially graded as a group effort. Final individual grades for each lab assignment, however, will reflect an anonymous peer evaluation of the group members and professor assessment. The peer assessment is a multiplying factor that can significantly alter your individual grade relative to the group grade. This is done to promote fairness in assigning group grades where individual contributions to the group's work may be unequal, but also to promote equal contribution from all group members.
  - Use of MATLAB is required unless otherwise stated for labs.
6. **Assignment and Exam Regrade Policy:** If you would like to submit a regrade request for any assignments or exams you must submit a regrade request via Gradescope within 2 weeks of the graded assignment return date. All regrade requests will be reviewed and approved by a course instructor and not teaching assistants, teaching fellows, or lab assistants.
- The regrade request must clearly state the reason you are requesting the regrade, and what you believe the correct grade should be. Note that disagreement on the established rubric allocation of points is not a valid reason for regrade and will not be considered.
  - Points can be added OR removed based on correctness. Therefore, if a mistake was made in grading and too few points were awarded, the regrade request may increase the final score, however if the professor finds a mistake was made in grading and too many points were awarded, then the regrade request may lower the final score.
7. **Attendance at all scheduled remote lecture/discussions and laboratory periods is encouraged.** Some of the material covered in class is not in the textbook. Expect new material to be presented in both the lecture/discussion and laboratory periods. Quizzes and exams can cover all material in the course including lectures, quizzes, homework and laboratory work.

8. **Rationale for course assignments and evaluations:**

- Reading assignments are to be completed before the start of the lecture period. The lecture discussions can include reading questions to help evaluate grasp of key concepts. The lectures will help clarify and supplement your reading and to prepare you for homework assignments, quizzes, laboratory work, and exams.
  - Homework reinforces the mental processes that help you to become proficient in a subject. In addition to the assigned homework, we encourage you to work additional problems for practice and make summary notes for yourself. Before beginning any homework assignment, you should read the relevant text sections and work through the examples in the text.
  - Experimental laboratory exercises are more complex than the homework and require special equipment (such as the wind tunnel). You will work in teams to collect and analyze the data, as well as deliver the experimental laboratory assessment.
  - Exams and quizzes provide a gauge to determine what you have learned individually.
  - Design projects help you to learn how to synthesize the basic concepts, methods, and tools presented in the course curriculum by combining theory and practice. The team-oriented lab approach will give you experience in the benefits and challenges of working and cooperating in groups, as is typical in this industry.
9. **Safety is priority #1 in the in-person laboratory.** Anyone violating rules of safe conduct may receive a zero for the laboratory exercise and may be restricted from the lab facilities. Use of lab facilities is a privilege, not a right, and you must conduct yourself according to the lab rules and regulations. Those endangering themselves, others, or laboratory equipment by their unsafe conduct will not maintain their access privileges. Failure to wear appropriate safety gear will result in a 10% grade penalty for the lab for each infraction.
10. **Professional behavior and considerate communication practices are expected at all times.** Any questions, comments or concerns you may have should be respectfully voiced to your peers or the professor either in person or via email. ***Please note that all lectures and Zoom sessions will be recorded to facilitate offline review of material.***
- The Zoom meeting environment is a professional one—this includes expectations for your conduct, attire, and environment. Please refer to the guidelines posted on Canvas ([Team-Group Work Guidelines](#)) for detailed expectations for AES team work in the current hybrid climate.
  - Like any professional environment, you can anticipate some variation in expectations based on the culture of your workplace, the personalities of the meeting participants, and the size and subject of the meeting. We will set expectations for the large class lab meetings, but your lab team will likely develop their own style and expectations for your own meetings. Be sure that the whole group understands and is comfortable with the expectations for Zoom meeting conduct. Err on the side of professional!

### **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 policies on [classroom behavior](#) and the [Student Code of Conduct](#).

### **Requirements for COVID-19**

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 due to COVID, please notify your entire instruction team (Prof Thayer, Mah, and Hodgkinson) as soon as possible. Additional details on course COVID guidelines can be found here: ([Team-Group Work Guidelines](#))

#### **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](mailto:dsinfo@colorado.edu) for further assistance. If you have a temporary medical condition, see [Temporary Medical Conditions](#) on the Disability Services website.

#### **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.

#### **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 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](#).

#### **Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation**

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](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, 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.

### **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. See the [campus policy regarding religious observances](#) for full details.