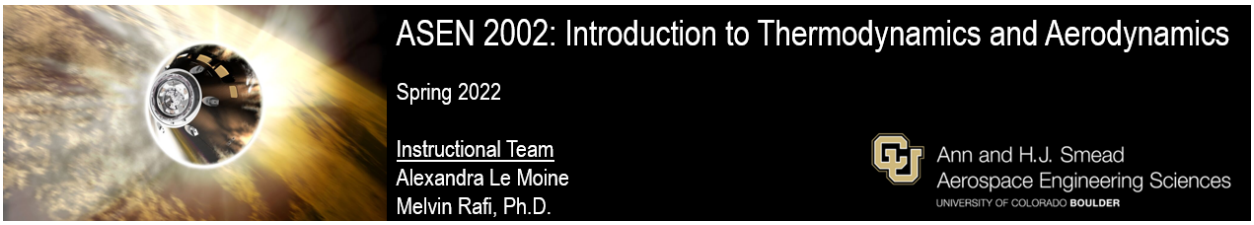

Lecture: T/Th 8:30 – 9:45 AM, Aero 114 (zoom until Jan 24th)
Lab: F 8:30-10:20 AM, Aero 114 (zoom until Jan 24th)

Thermodynamics Instructor	Alexandra Le Moine (she/her/hers), *Alexandra.Lemoine@colorado.edu* Office: Aero N209 **Office Hours**: Friday 11–12 PM **Zoom Link**:
Aerodynamics Instructor	Dr. Melvin Rafi, *Melvin.Rafi@colorado.edu* Office: Aero 213 **Office Hours**: TBD
Teaching Fellows	Hayden Fuller Email: *Hayden.Fuller@colorado.edu* Bartlomeij Kubiak Email: *Bartlomiej.Kubiak@colorado.edu* **Office Hours:** see Canvas **Zoom Link:**

COURSE TEXTBOOKS (Loose-leaf or eBook of both texts is required):

1. Cengel, Y., Cimbala, J., & Ghajar, A. (2021). *Fundamentals of thermal-fluid science*s (6th ed.). McGraw-Hill Education.
2. Anderson, J., & Bowden, M. (2021). *Introduction to Flight* (9th ed.). McGraw-Hill Education.

LAB EQUIPMENT - Safety glasses/goggles (if in-person lab participation). Laboratory notebooks (physical or electronic) 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 WEBSITE – Canvas Course Link

COURSE PREREQUISITES - APPM 1350/1360, PHYS 1110 or equivalent

COURSE COREQUISITES - APPM 2350 or equivalent, ASEN 2012

COURSE PURPOSE - 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.

COURSE OBJECTIVES - By the end of this course, you should be able to:

- State the 1st Law of Thermodynamics and to define heat, work, and the difference between various forms of energy [Thermodynamics]
- Identify and describe energy exchanges processes (in terms of various forms of energy, heat, and work) in engineering systems [Thermodynamics]
- Apply the 1st Law of Thermodynamics to a closed system to estimate the required balances of heat and work. [Thermodynamics]
- Apply the 1st Law of Thermodynamics to an open system to estimate the required balances of heat, work, and flow energy. [Thermodynamics]
- Understand the basic concepts of aerodynamics. [Aerodynamics]
- Understand one-dimensional incompressible and compressible flows. [Aerodynamics]
- Understand two-dimensional flows: lift and drag. [Aerodynamics]
- Understand viscous flows. [Aerodynamics]

POLICIES AND PROCEDURES

I. STUDENT EXPECTATIONS

- Students are expected to attend all class sessions (lecture and lab) in addition to completing all assignments.

- For most students striving for B grades or higher, **we recommend that you schedule at least 3-5 hours per week for engaging with this course**. Your background knowledge/experience and other variables may require you to spend additional time. Please plan accordingly by scheduling time on your calendar now. Several factors influence student academic performance and long-term learning. Active engagement in all course activities (e.g., class participation, readings, homework, assignments, projects, studying, etc.) will contribute to your learning and to success in this course. According to research, a metacognitive learning approach combined with practice testing and distribution of practice over time is most effective. The instructional team is available if you are seeking more information on how to be successful in this course. Your academic advisor is another helpful resource to assist you in meeting the requirements of this course.

II. INSTRUCTOR EXPECTATIONS

- You can expect your instructors to be courteous, punctual, well-organized, and prepared for lecture and other class activities; to answer questions clearly; to be available during office hours or to notify you beforehand if they are unable to keep them; to provide a suitable guest lecturer when they are traveling; and to grade uniformly and consistently according to the posted guidelines.

III. COMMUNICATION

- 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.

- **Email** – Emails will not be a primary communication method used in course correspondence. Emails sent to instructors or TFs may go unanswered.

- **Slack –** General questions about homework assignments, syllabus & class policy, lab assignments, and assessments should be posted to the Official Course Slack channel. Any private student questions or coordination should be handled via a direct Slack message to the instructors.

- **Canvas –** Canvas is the official webpage for this course. All general announcements, assignments, course materials, and grades will be available via Canvas. Direct Canvas messages to instructor will not be a primary communication method. Any Canvas DM sent to the instructor may go unanswered.

- **Hours of Operation –** All correspondence to instructors and TFs will be handled during regular business hours: M-F 9-5 PM. Any messages sent to the instructional team on off - hours, or the weekend will go unanswered.

IV. HOMEWORK

- **Homework Format** – Homework assignments will be posted on Canvas. Each homework assignment should be completed individually in one person's handwriting. The written work should be uploaded to Gradescope as a PDF. The problems should be submitted in the same order as in the homework assignment (correctly labeled in Gradescope). Your name (last, first) and assignment number should be visible in the upper portion of each page. Each problem must begin on a new page and clearly labeled. Final answers should be boxed in. To qualify for full credit, each problem should follow the problem-solving method presented in class as follows:

  Problem Statement: Paraphrase the problem statement in your own words.
  Sketch: Draw a sketch of the system(s) and state(s) that are being considered.
  Givens: List and organize all the given information.
  Process/Assumptions: List any assumptions given in the problem statement.
  Relevant Equations: Write out the governing principles or equations required to solve the problem.
  Properties: Use property tables to list out required properties needed to perform analysis. Provide references for all tabulated data used.
  Analysis: Provide step-by-step procedure of your analysis. Include numerical values and units. Box in your final answer.
  Conclusion/Comments: Answer short answers for questions. Provide 1-2 sentences which comment on the reasonableness of your answer. Write down any observations you have regarding your final answer(s).

- **Late Homework –** Late assignments will receive a 10%-point reduction per day. Late penalties will be waived if and only if you discuss this with the instructor before the submission deadline.

- **Homework Solutions –** Complete homework solutions will be posted to Canvas after the homework grades have been distributed.

V. QUIZZES

- **Reading quizzes –** There will be 13 (timed) in-class reading quizzes based on the reading assignments which will be administered at the beginning of each Tuesday class.

- **Lab quizzes –** There will be 2 (timed) lab quizzes which will be administered online through Canvas.

- **Missed quizzes –** There will be no make-up reading quizzes. The lowest 3 reading quiz grades will be dropped.

VI. EXAMS

- There will be two 75-minute exams during the semester and one 2.5-hour comprehensive final exam. One 75-minute comprehensive thermodynamics exam and one 75-minute comprehensive aerodynamics exam, and one 2.5-hour comprehensive thermodynamics and aerodynamics final exam. *All exams will be closed-book, closed-notes with an equation sheet and property tables provided. Calculators are allowed on all exams.*

- **Missed exams** - There will be no make-up exams.

- **Comprehensive Final exam –** There will be a mandatory comprehensive final exam in this class. The final examination will assess you on both Thermodynamics and Aerodynamics. *Note: the university provides 2.5 hours for final exam times and as such, the comprehensive final exam may be longer than exams given during the semester*.

VII. LAB REPORTS

- 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.

VIII. **HOMEWORK & EXAM GRADING –** If you believe an error was made in grading your homework or exam, you should make 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.

- The regrade request must include a respectful and short justification of your claim.

- Disagreement on the established rubric allocation of points will not be considered.

- Points can be added OR removed based on correctness. If a mistake was made in grading and too few points were awarded, the regrade request may increase the final score. 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.

IX. ATTENDENCE & PARTICIPATION

- Attendance in both lecture and lab is expected. Some materials covered in lab and lecture will not be in the textbook. Quizzes and exams can cover all materials in the course including lectures, homework, and laboratory work.

- **iClicker -** Lecture will make use of iClicker Polling software (available through OIT) to survey the class and help facilitate discussions. Students are required to create an iClicker Student account and download the iClicker App on their smartphone or device. If you do not have a smartphone, access to iClicker polling questions is available via web browser. If you do not have an iClicker account, please create an account by going to the OIT iClicker page (OIT iClicker Setup)create an account and

i. Download the iClicker App for your smartphone or device.
ii. Register for the course here:

X. CALCULATION OF COURSE GRADE - Course grade depends on 2 measures of competency: individual and group assessments.

Individual assessments make up 65% of your total grade and are comprised of:

i. Lecture & Lab Quizzes = 12%
ii. Thermodynamics Comprehensive Exam = 10%
iii. Aerodynamics Comprehensive Exam = 10%
iv. Thermodynamics & Aerodynamics Comprehensive Exam = 18 %
v. Homework = 15%

Group assessments make up 35% of your total grade and are comprised of:

i. Thermodynamics Lab = 15%
ii. Aerodynamics Lab = 15%
iii. Lab Participation = 5%

Group assessments will only count if the average grade on individual assessments is a C or above—in other words, if you cannot pass the individual assessments, you cannot pass this course.

Note: We do not curve grades in this course. It is theoretically possible for everyone in the class to get an A (or an F). Your performance depends only on how you do, not on how everyone else in the class does. It is therefore in your best interests to help your classmates within the limits of the academic integrity policy.

CU BOULDER POLICIES

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 Conduct & Conflict Resolution policies.

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. 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 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.

CU Boulder currently requires masks in classrooms and laboratories regardless of vaccination status. This requirement is a precaution to supplement CU Boulder's COVID-19 vaccine requirement. Exemptions include individuals who cannot medically tolerate a face covering, as well as those who are hearing-impaired or otherwise disabled or who are communicating with someone who is hearing-impaired or otherwise disabled and where the ability to see the mouth is essential to communication. If you qualify for a mask-related accommodation, please follow the steps in the "Accommodation for Disabilities" statement on this syllabus. In addition, vaccinated instructional faculty who are engaged in an indoor instructional activity and are separated by at least 6 feet from the nearest person are exempt from wearing masks if they so choose.

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). Please email your instructor if you will be missing class due to illness or quarantine.

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.

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 academic integrity policy. 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 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 on the Honor Code website.

SEXUAL MISCONDUCT, DISCRIMINATION, HARASSMENT AND/OR RELATED RETALIATION

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. The university 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 or against 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 email cureport@colorado.edu. Information about university policies, reporting options, and the 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 incidents of sexual misconduct, dating and domestic violence, stalking, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about their rights, support resources, and reporting options. To learn more about reporting and support options for a variety of concerns, visit Don’t Ignore It.

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, email your instructor as soon as possible regarding missing class or assignments due to religious holidays. See the campus policy regarding religious observances for full details.