

# ASEN 5151: FUNDAMENTALS OF GAS DYNAMICS

Spring 2023

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<b>Time:</b>	Mon./Wed./Fri. 10:40 – 11:30 AM	<b>Location:</b>	AERO 111
<b>Instructor:</b>	Professor Robyn Macdonald	<b>Email:</b>	<a href="mailto:robyn.macdonald@colorado.edu">robyn.macdonald@colorado.edu</a>
<b>Teaching Assistant:</b>	Tanner Stockwell	<b>Email:</b>	<a href="mailto:tanner.stockwell@colorado.edu">tanner.stockwell@colorado.edu</a>

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**Course Page:** <https://canvas.colorado.edu/>

**Course Slack Channel:**

**Office Hours:** TBD

**Lecture Zoom Link:**

**Text:** There is no required textbook for this course. Notes will be posted on the course website for each section of the course. Some useful references are listed below which are available digitally or in the course reserves at the Gemmill Library. At the beginning of the notes for each section is a list of sources from which the notes were compiled.

- Anderson, J. D., Jr., *Modern Compressible Flow with Historical Perspective*, Second Edition, McGraw-Hill, 1990. Available in course reserves.
- Liepmann, H. W. and Roshko, A., *Elements of Gasdynamics*, Dover Publications, 2001. Available online: <https://tinyurl.com/yb5pux98>
- Pletcher, R. H., Tannehill, J. C., and Anderson, D. A., *Computational Fluid Mechanics and Heat Transfer*, Third Edition, CRC Press, 2013. Available online: <https://tinyurl.com/y2hjeflc>
- Rathakrishnan, E., *Theoretical Aerodynamics*, Wiley, 2013. Available online: <https://tinyurl.com/y6tt3sv6>
- Shapiro, A. H., *The Dynamics and Thermodynamics of Compressible Fluid Flow*, Vol. I, Ronald Press, 1953. Available online: <https://tinyurl.com/yxergkvo>
- Zucrow, M. J. and Hoffman, J. D., *Gas Dynamics*, Vol. I, Wiley, 1976. Available in course reserves.
- Zucrow, M. J. and Hoffman, J. D., *Gas Dynamics*, Vol. II, Wiley, 1977. Pending purchase at the library.

**Prerequisites:** A first course in fluid mechanics or aerodynamics, including ASEN 3111. I will assume that you are familiar with typical topics from an introductory compressible flow course, including isentropic flow with area change, normal shock waves, oblique shock waves, Prandtl-Meyer flow, associated applications such as converging and converging-diverging nozzles, etc. I expect students to be proficient with programming which will be used for some assignments.

**Grading Policy:** Homework (50%), Exam 1 (20%), Exam 2 (30%).

**Homework:** Homework will be assigned periodically as the appropriate material is covered, and will include both handwritten problem sets and programming assignments (most assignments will include some of both). There will be approximately 6 homework assignments. The due date for each assignment will be announced when the assignment is made. All students will submit assignments through the course Gradescope website. The late penalty for homework will be 10% per day, for up to 5 days. Beyond 5 days late, the assignment is worth 0%. You may receive help from a classmate or the instructor/TA on homework assignments, but

the submitted assignment must be your own work. This includes both handwritten solutions, as well as programming assignments.

**Exams:** There will be two exams in this course. The first will cover material from the first half of the class (to be specified later) and the second will be cumulative, but focusing on material in the second half of the course. Students registered for the asynchronous remote section will have the option to take the exam remotely with a proctor. Professor Macdonald will reach out to you 2 weeks before the exam date to coordinate the remote proctoring of the exam. The exam dates are as follows:

	Day	Time	Location
Exam 1	Monday, March 13	6:00 - 8:00 PM	TBD
Exam 2	Saturday, May 6	4:30 - 7:00 PM	AERO 111

**Class format:** This class operates in two modalities: in-person and asynchronous remote. All lectures will be recorded via Classroom Capture and will be made available to all students. In addition, a Zoom link is provided for the lecture for those who wish to attend lecture remotely.

**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 [classroom behavior](#) policy, the [Student Code of Conduct](#), and the [Office of Institutional Equity and Compliance](#).

**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. CU Boulder currently requires COVID-19 vaccination and boosters for all faculty, staff and students. Students, faculty and staff must upload proof of vaccination and boosters or file for an exemption based on medical, ethical or moral grounds through the MyCUHealth portal.

The CU Boulder campus is currently mask-optional. However, if public health conditions change and masks are again required in classrooms, students who fail to adhere to masking 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.

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](mailto: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](mailto:contacttracing@colorado.edu)).

If you are sick or quarantined and must miss an in-person assessment, please alert me of your absence via email but do not include specific information about your illness due to privacy laws. Because attendance is not required in this class, if you miss a class you do not need to inform me but can watch the lecture asynchronously on Canvas.

**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 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 Student Conduct & Conflict Resolution ([honor@colorado.edu](mailto: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. 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. 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. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email [cureport@colorado.edu](mailto:cureport@colorado.edu). Information about university policies, [reporting options](#), and 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 any issues related to these policies regardless of when or where they occurred to ensure that individuals impacted receive information about their rights, support resources, and resolution 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.

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