ENAE311H – Aerodynamics I
Fall 2024

Instructor: Christoph Brehm
3184 Glenn L. Martin Hall
Office Number: 3135
cbrehm1@umd.edu

Grader: TBD

Class Schedule: Tues./Thurs., 9:30 – 10:45, Martin Hall 2116

Office hours: Tues. 11:00-12:00 or schedule by email

Textbooks: Fundamentals of Aerodynamics, John D. Anderson (Required)
Introduction to Fluid Mechanics, Fox & McDonald (FM Supplemental)
Elements of Gasdynamics, Liepmann & Roshko (LR Supplemental)
Modern Compressible Flow with Historical Perspective,
John D. Anderson (A2 Supplemental)

Additionally, I will post typeset course notes on the class website for your reference.

Objective: To introduce students to the governing equations describing generalized fluid flow, then to specialize to the case of an inviscid, compressible flow; in particular, to study the simplifications in the governing equations that enable estimates of important quantities to aerospace engineers such as lift, drag and moment on an airfoil.

Learning outcomes: After taking this class, students will be able to:

1. Write down generalized conservation equations for mass, momentum and energy
    a. Integral form
    b. Differential form
2. Compute the lift, drag and moment acting on an airfoil.
3. Compute an aircraft's velocity based on pressure measurements from a Pitot tube.
4. Compute the change in pressure, density, and temperature across shock waves and expansion waves.
5. Design a nozzle and test section of a supersonic wind tunnel.
6. Estimate the effects of friction and heat addition on a constant-area flow.
7. Design an experiment to measure pressure, temperature, velocity and lift in a wind tunnel.

Lecture format: All lectures will be available for viewing before the scheduled lecture times. Lecture time will be spent in knowledge assimilationactivities such as quizzes, tests, worked problems, and further discussion, so it is important that you are familiar with the material before the lecture. A short quiz will be given at the beginning of some lectures to ensure that this is the case (results from these quizzes will contribute a small amount to your final grade). The mandatory lecture time will be shortened accordingly, but I will be available for the entire 75 minutes of each class to answer questions.

Grading: Option I:
Quizzes (5%), Homework (15%), Midterm I (30%), Midterm II (30%), Project (20%)
Option II (with final exam):
Quizzes (5%), Homework (15%), Midterm I (20%), Midterm II (20%), Final Exam (20%), Project (20%)

Homework: Each homework assignment will consist of a set of problems from the material covered in lectures. The problems from Anderson as indicated on the course schedule may be useful as additional practice problems but are in general less challenging. Homework assignments will be due approximately every 1½ weeks and should be uploaded on Canvas. Late assignments will receive 10% penalty per day; homework more than 3 days late will receive no credit. Please do the homeworks – there is no other way to learn the material.

Exams: These will cover lecture material, as well as problems from the homework assignments and Anderson.

Project: The class project will take place during the latter part of the term and will involve the use of computational fluid dynamics (CFD) software.

Policies: Discussing the homework problems and their solution strategies with classmates is allowed and encouraged, but when it comes to writing up the problems, it must be your own work. Copying anything from another student or material from a previous year is a breach of academic integrity and will not be tolerated. If you have any questions, please review the university's policy on academic integrity:
http://www.usmh.usmd.edu/regents/bylaws/SectionIII/III100.html
Students are expected to attend class. If you need to miss a class, please talk to me in advance.
There will be NO make-up exams given. If you miss an exam with an acceptable reason, the weight of the final exam will increase proportionally.
Illegible homework assignments will not be accepted – one of the main tasks of an engineer is to communicate his/her findings clearly and concisely, and I will expect this of your assignments (and exams).

Course website: https://umd.instructure.com

Land Acknowledgement
Every community owes its existence and strength to the generations before them, around the world, who contributed their hopes, dreams, and energy into making the history that led to this moment. Some were brought here against their will, some were drawn to migrate from their homes in hope of a better life, and some have lived on this land for more generations than can be counted. Truth and acknowledgement are critical in building mutual respect and connections across all barriers of heritage and difference.

At the University of Maryland, we believe it is important to create dialogue to honor those that have been historically and systematically disenfranchised. So, we acknowledge the truth that is often buried: We are on the ancestral lands of the Piscataway People, who are among the first in the Western Hemisphere. We are on indigenous land that was stolen from the Piscataway People by European colonists. We pay respects to Piscataway elders and ancestors. Please take a momentto consider the many legacies of violence, displacement, migration, and settlement that bring us together here today.

The land acknowledgment we use was organized by Ghonva Ghauri from MICA and approved by Piscataway elders.

University Policies and Resources
Students should familiarize themselves with the university's Course Related Policies site: http://www.ugst.umd.edu/courserelatedpolicies.html. It is your responsibility to understand your rights and responsibilities as expressed in these policies. Topics that are addressed in these various policies include academic integrity, student and instructor conduct, accessibility and accommodations, attendance and excused absences, grades and appeals, copyright and intellectual property.

Attendance and in-class participation are an integral part of this course. Therefore, attendance and in-class participation is mandatory and expected.

Students may be excused from a single discussion for a medically necessitated reason. Students must make a reasonable attempt to inform the instructor of their illness prior to the class, and present a self-signed note or email attesting to the date of the illness. This note or email must include an acknowledgement: (a) that the information provided is true and correct, and (b) that the student understands that providing false information to University officials is a violation of Part 9(h) of the Code of Student Conduct. If students need to miss more than one discussion for a medically necessitated reason, they must provide documentation from their medical doctor or health care professional confirming the dates the student was unable to meet academic responsibilities. The instructor will work with the student to determine an appropriate method of making up missed work.

Spiritual/Religious and/or Cultural Observances:
The instructor is willing to work with any student who needs to miss class meetings if they conflict with religious practices. However, students must provide **advance notification in writing (email)** if this is the case. In cases of religious observation, the student must notify the instructor via email as soon as possible and no later than the end of the schedule adjustment period.

Electronic Devices
Electronic devices such as laptops, cellphones/smartphones, and headphones, are **not** a necessary component of this course. It is expected that students will devote their full attention to the

instructors and their classmates throughout the semester. Unless previously approved for use, students will be asked to put away any electronic devices during discussions

Academic Integrity
The University of Maryland, College Park has a nationally recognized Code of Academic Integrity. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. All students are expected to be familiar with the University of Maryland's policy on academic dishonesty and the Code of Academic Integrity administered by the Student Honor Council: http://www.president.umd.edu/policies/iii100a.html.

Accommodations for Persons with Disabilities:
Students who have a documented disability and wish to discuss academic accommodations, please contact the instructor as soon as possible. More information on academic accommodations for students with disabilities can be found at: https://www.counseling.umd.edu/ads/

Values/Diversity/Inclusion Statement
The instructor is fully committed to creating an inclusive learning environment and supports UMD's efforts to advocate for positive change specifically related to diversity and inclusion. This course strives to establish a classroom climate that values diverse perspectives and experiences while working toward shared academically rigorous goals. https:/diversity.umd.edu/. To view UMD's Anti-Racism Teach-In Series, visit https://diversity.umd.edu/training-education/anti-racism-series/.

Basic Needs Security
Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in this course, is encouraged to speak to the instructor and/or use the following resources for support. UMD Campus Pantry which distributes emergency food to terps in need, also counseling and mental health services, the Student Crisis Fund and Fostering Terp Success, a program supporting students who are homeless, at risk of homelessness, currently in foster care or lacking a supportive family system, are all available resources for students. Information can also be found at: http://go.umd.edu/basic-needs

Pronouns
The Clark School of Engineering values diversity, equity, and inclusion and aligns with the University of Maryland Non-Discrimination Policy and Procedures. https://president.umd.edu/administration/policies/section-vi-general-administration/vi-100b.

In this course, the facilitators recognize that not all students use their legal names or sex/gender assigned at birth. There will be opportunities in class to inform everyone of your name and pronouns. We are happy to use the name and/or pronouns you use. (Adapted from Z Nicolazzo, 2018).

You are also encouraged to use the ELMS-Canvas tool to list your pronouns and use the name coach tool. This will update your profile for all of your ELMS-Canvas courses and organizations. To do this, follow these steps:

- Sign in to myelms.umd.edu
- Update pronouns at: Account --> Settings --> Edit Settings --> Pronouns
- To update name pronunciation: Account --> Namecoach