COURSE SYLLABUS

AE 311

Incompressible Flow

Spring 2025

Time: 1:00 – 1:50 pm MWF

Main website: **Canvas** (you should be automatically enrolled – let me know if you add late and need help accessing Canvas)

From this website, access lectures, office hours, announcements, syllabus, course discussions, etc.

Assignment website: **Gradescope.com** (should be linked to Canvas)

Instructor: Prof. Theresa Saxton-Fox

Preferred contact method: Canvas message

Email: tsaxtonf@illinois.edu

Office Hours: TBD, See Canvas

Teaching assistant: Aman Agrawal

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Office Hours: See Canvas

Yogi Patel

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Course goal: Enable you to solve problems that involve incompressible flow

Key take-aways: Improved problem-solving skills

- Approaching complex or novel problems
- Iterative solving strategies
- Using self-reflection to get unstuck

"Fluent" in incompressible flow

- Vocabulary
  - E.g. pressure, viscosity, Reynolds Transport Theorem, etc.
- Concepts
  - Understanding the context and implications of the vocabulary
- Equations, when to use them, and how to approach them
  - E.g. Bernoulli equation, Navier-Stokes equations, etc.

Content outline:

Lectures	Textbook chapters
Introduction	1.1 – 1.4, 1.9 – 1.11, 2.2
Governing equations	2.3 – 2.6, 2.9 – 2.12, 3.2 – 3.5
Potential flow theory	2.13 – 2.16, 3.8 – 3.18, 1.5 – 1.6
Inviscid flow over airfoils	4.1 – 4.10
Inviscid flow over finite wings	5.1 – 5.3
Viscous flow	15.2 – 15.4, 16.2 – 16.3, 17.1 – 17.4, 18.2, 19.1 – 19.3

Textbook: (Recommended but not required)

Fundamentals of Aerodynamics, 5th or 6th Edition. John D. Anderson, Jr. McGraw-Hill, 2011/2016.

Other resources:

Video Channels:

1. NSF Fluid Mechanics Series https://www.youtube.com/playlist?list=PL0EC6527BE871ABA3
2. F Yeah Fluid Mechanics https://www.youtube.com/user/fyfluiddynamics
3. Physics Girl https://www.youtube.com/user/physicswoman/playlists
4. Gallery of Fluid Motion https://gfm.aps.org/

Textbooks (also on Reserve at Grainger):

1. Foundations of Aerodynamics, 5th edition, A.M. Kuethe and C.-Y. Chow, Wiley, 1998.
2. Aerodynamics, Aeronautics and Flight Mechanics, 2nd edition, B.W. McCormick, Wiley, 1995.
3. Aerodynamics for Engineers, 6th edition, J.J. Bertin and R.M. Cummings, Pearson, 2014.
4. Theoretical Aerodynamics, E. Rathakrishnan, Wiley, 2013.
5. Introduction to Fluid Mechanics, 8th edition, R.W. Fox, P.J. Pritchard, and A.T. McDonald, Wiley, 2011.
6. Viscous Fluid Flow, 3rd edition, F.M. White, McGraw Hill, 2006.
7. Boundary Layer Theory, 8th edition, H. Schlichting and K. Gersten, Springer, 2000.
8. An Album of Fluid Motion, M. Van Dyke, Parabolic Press, 1982.

Pre- / co-requisites: AE 202, MATH 241

Grading:	Homework + Quizzes	40%
	Project 1	20%
	Project 2	20%
	Project 3	20%

Homework:

Due: **Wednesdays** by end of day (midnight) on gradescope.com

Assigned: Weekly

Late policy: 5% is dropped per late day up to a reduction of 40%. Homework will be accepted until the last day of class for up to 60% of the credit.

Projects:

There will be a project in this course with 3 deadlines throughout the term. The goal of the project is to connect the content of the course to real-world problems efforts in the fields of fluid dynamics and aerodynamics.

Late policy: 10% is dropped per late day.

Reasoning: Projects provide opportunities to connect course content to problems that students are interested in.

Accommodations:

We want everyone to be able to succeed in this class. Students who require disability-related academic adjustments and / or auxiliary aids should contact Professor Saxton-Fox and the Disability Resources and Educational Services (DRES) to ensure that proper accommodations are made. To contact DRES, you can visit them at 1207 S. Oak St., Champaign, call them at 333-4603, email them at disability@illinois.edu, or go to their website at disability.illinois.edu. Please do this as early in the class as you can so that we can be set up to succeed from the start.

Belonging Statement:

The effectiveness of our course is dependent upon each of us to create a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. Inappropriate or offensive behavior towards people based on race, ethnicity, gender, sexual orientation, age, religion, or other personal aspects of identity is not acceptable in a classroom or professional environment. University is a time of learning and growing for all of us, and we ask everyone to be ready to learn and grow in your respect and understanding of others, in addition to your understanding of the course material.

A feeling of belonging and inclusion is critical to the success and health of our community. The Aerospace Engineering department has a committee called Aero's Space to Belong. They offer office hours, one-on-one discussion, and a

reporting process. If you experience conflict that undermines your or someone else's feelings of belonging, please consider using these resources: https://aerospace.illinois.edu/diversity/reporting.

Academic integrity:

Each homework assignment turned in must be your work. Working with classmates to understand the problem and identify solution strategies is encouraged, as is getting help and guidance from the instructor, but any work you write down on your homework must be your own. You must understand and be able to independently replicate anything on your homework, and you must have contributed to the solution you show. You may not copy another person's work under any circumstance. Evidence of copying or other academic integrity infractions on homework will be punished according to the severity of the infraction.

Projects should reflect team work, but you should be primarily responsible for your part of the assignment (to be explained in more detail in project-specific documentation). Evidence that one member of the team did not substantially contribute to the project or did not fulfill their project role may result in significant reductions in the project grade of that team member. Evidence of copying, plagiarism, or other academic integrity infractions on a project will result in a serious academic penalty depending on the severity of the infraction.

Learning from published sources (books, papers, or websites) is encouraged for both homework and projects. Be sure to cite the source of information that you learn if you include it in your homework and / or project. Please make sure not to directly copy information from another source without putting that information in quotation marks in addition to citing it.

If you use AI as a source, please cite it as a source and explain how it was used. You should not directly copy language from AI that does not reflect your own writing and ideas, just as you should not directly copy information from a textbook or article without quotation marks. If you use AI to help generate ideas for your project, check your thinking, or improve your writing, please explain the manner in which it was used in your submission in an appendix. Appropriate use of AI will not be penalized. Appropriate use of AI includes using it as a tool that improves your work and increases your overall learning, and not a way of avoiding learning. Appropriate use of AI must include acknowledgement of use of AI.

Getting help:

For technical help on the course, please contact us over Canvas or attend one of our weekly office hours. Other useful resources for assistance include:

- Student Assistance Center
- CARE
- Campus Counseling Center
- Aero's Space to Belong