2025 Fall Semester

Undergraduate Aerodynamics and Propulsion Laboratory (AerE 344)

COURSE SYLLABUS

Course Instructors: Dr. Hui Hu and Dr. Jincheng Wang
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Teaching Assistants:

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Class notes: Available at the AerE3440 website of https://www.aere.iastate.edu/~huhui/teaching/2025-08F/AerE344/2025F-AerE3440.html

If a student has a disability that qualifies under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act and requires accommodations, he/she should contact the Disability Resources (DR) office for information on appropriate policies and procedures. DR is located on the main floor of the Student Services Building, Room 1076; their phone is 515-294-6624.

The contents of the syllabus may be altered by the instructor during the semester.

Course Objectives:

By completion of the course, students will:

- Understand the applications of the fundamental principles taught in aerodynamics courses
- Know basic knowledge related to experimental aerodynamics and measurements techniques
- Become proficient in using basic equipment representative of aerospace engineering practice
- Know how to design conduct experiments
- Know how to analyze and evaluate experimental data
- Know how to write good lab reports
- Gain more lab experiences to get "hands-on" lab training
- Gain experiences to promote the spirit of teamwork among engineers

Topics Covered:

- Similitude and Dimensional Analysis
- Pressure measurement methods and instrumentation: manometers and pressure transducers
- Pitot-static probes, hotwire anemometry, and Particle Image Velocimetry (PIV)
- Flow visualization techniques: Schlieren and shadowgraph photography
- Wind tunnel calibration
- Pressure distribution around a circular cylinder
- Determination of aerodynamic performance of airfoils by wing tunnel testing
- Pressure distribution around a low-speed airfoil at difference angles of attack
- Flow characteristics in the wake of a low-speed airfoil at different angles of attack
- Wind turbine aerodynamics and wake interferences in turbulence boundary layer flows
- Aircraft icing physics and anti-/de-icing technology
- Supersonic flows and shock waves in a de Laval nozzle

Course Policy:

- **Required attendance for lab exercises:** In this course, you will conduct lab experiments for a range of different applications. These experiments will involve computer data acquisition systems, pressure and velocity measurement techniques, uncertainty analysis, and report writing. ***Unexcused absences from lab exercises will result in an "F" in the grade for the entire course!***
- **Enter and leave classroom:** You need to arrive at the lab room ~5 minutes before the class starts. Please do not congregate outside the classroom while waiting to enter; maintain social distance with previous and current class; quickly exit the room when your class is over (i.e. not hang around in the classroom to discuss things)...
- **Lab experiments:** While conduct lab experiments, please follow the faculty member and/or TA's guidance with respect to lab safety protocols. Please make sure adhering to the workspace markings, cleaning spaces, any rotation or structures in the lab used to maintain distancing, etc.
- **Lab Reports:** Please make sure to turn in your lab reports on time. If lab reports are turned in after 5 pm on the due date, the score will be reduced by 25%. If work is turned in 2 days after the due date, scores will be reduced by 50%. No credit will be given to late report submission more than 2 days after the due date. To be granted an extension on a missed homework or project assignment requires a written signed memo delivered to the course instructor in advance of the due date explaining in detail the reason for the request.
- **Other Excusable Absence:** It is required for you to attend lab exercises and the final exam. Providing doctor's note to state the sickness is an example to justify the excusable lab or exam absence. You can also provide other reasonable evidence to justify your lab or exam absence.

- **Make up the Excusable Absence:** Pease contact the course instructor as soon as possible to discuss about the plan to make up the excusable absence when you have an excusable absence from lab exercise and final exam.

Grading:

The final grade of the course will be calculated with the following weights:

• Labs reports (including pre-lab homework for 10%)	65%
• Class/lab participation; in-class quizzes	10%
• Final exam	25%

Other Important Statements:

Free Expression

Iowa State University supports and upholds the First Amendment protection of **freedom of speech** and the principle of **academic freedom** in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

No employee, student, applicant, or campus visitor is compelled to disclose their pronouns. Anyone may voluntarily disclose their own pronouns.

Academic Dishonesty

The class will follow Iowa State University's policy on academic misconduct (**5.1 in the Student Code of Conduct**). Students are responsible for adhering to university policy and the expectations in the course syllabus and on coursework and exams and for following directions given by faculty, instructors, and ISU Test Center regulations related to coursework, assessments, and exams. Anyone suspected of academic misconduct will be reported to the **Office of Student Conduct in the Dean of Students Office**. Information about academic integrity and the value of completing academic work honestly can be found in the **Iowa State University Academic Integrity Tutorial**.

Accessibility Statement

Iowa State University is committed to supporting students with disabilities. Promoting these values entails providing reasonable accommodations where barriers exist to students' full participation in higher education. Students in need of accommodations or who experience accessibility-related barriers to learning should work with Student Accessibility Services (SAS) to identify resources and support available to them. Staff at SAS collaborate with students and campus partners to coordinate accommodations and to further the academic excellence of students with disabilities. Information about SAS is available online at **www.sas.dso.iastate.edu**, by email at **accessibility@iastate.edu**, or by phone at 515-294-7220.

Non-Discrimination Statement

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 2680 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. **515-294-7612**, email **eooffice@iastate.edu**.

Mental Health and Wellbeing Resources
We're committed to your success and wellbeing at Iowa State. As a Cyclone, you can access 24/7 resources, services, and people dedicated to helping you achieve your goals and be your best in and out of the classroom. Whether you need academic support or just someone to talk to, we're here for you at Cyclone Support (**cyclonesupport.iastate.edu**). If you are struggling emotionally and need support, there's confidential help available 24/7/365. You can call or text 988 or use the chat at **988lifeline.org**.

Statement on Prep Week
This class follows the Iowa State University Prep Week policy, as noted in the ISU Policy Library and the Senior Vice President and Provost's website.

Religious Accommodation
Iowa State University welcomes a broad spectrum of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request the reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the **Dean of Students Office** at 515-294-1020 or the **Office of Equal Opportunity** at 515-294-7612.

Contact Information for Academic Issues: If you are experiencing, or have experienced, a problem with any of the above statements, email academicissues@iastate.edu

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COURSE SYLLABUS

Week No.	Date	Lecture Topics (HOOVER 1227) (Tuesdays: 9:55am-10:45am)	Lab Activities (1311 TIEB - Therkildsen IE Bld - lecture) (1380 Howe Hall - lab experiments)	Reports Due on Fridays
1	08/26	Course introduction and policy	No lab	
2	09/02	Similitude and measurement uncertainty analysis	Lab #1: Flow visualization by using smoke wind tunnel	
3	09/09	Fluid mechanical apparatus: wind tunnel and water tunnels	Lab #2: Wind tunnel calibration	*Lab report #1 due on Friday*
4	09/16	Pressure measurement techniques and instrumentations	Lab #3: Pressure sensor calibration and measurement uncertainty analysis	*Lab report #2 due on Friday*
5	09/23	Introduction of velocimetry techniques and instrumentation	Lab #4: Pressure distributions around a circular cylinder	*Lab report #3 due on Friday*
6	09/30	Hotwire anemometry: Fundamentals and instrumentation	Lab #5: Airfoil aerodynamic performance based on pressure measurements	*Lab report #4 due on Friday*
7	10/07	Laminar and turbulence flows	Lab #6: Airfoil wake measurements and hotwire anemometer calibration	*Lab report #5 due on Friday*
8	10/14	Technical basis for optical instrumentation	Lab #7: Hotwire anemometry and measurements in airfoil wake flows.	*Lab report #6 due on Friday*
9	10/21	Shadowgraph and Schlieren techniques and instrumentation	Lab #8: Characterizing the development of boundary layer flows over a flat plate.	*Lab report #7 due on Friday*
10	10/28	Shock waves and De Laval nozzle	Lab #9: Shadowgraph and Schlieren systems to visualize thermal plume flows.	*Lab report #8 due on Friday*
11	11/04	Particle Image Velocimetry(PIV): fundamentals and instrumentation	Lab #10: Shockwave visualization & pressure measurements in a de Laval nozzle	*Lab report #9 due on Friday*
12	11/11	Bio-inspired aerodynamics & designs for UAV applications	Lab#11: PIV measurements of unsteady vortices in the wake of an airfoil	*Lab report #10 due on Friday*
13	11/18	Wind turbine aeromechanics & wind farm aerodynamics	Lab#12: Wind tunnel testing of wind turbine aeromechanics and wake interference in ABL winds	*Lab report #11 due on Friday*
14	**11/26**	**Thanksgiving break; No class**		
15	12/02	Aircraft icing physics & anti-/de-icing technology	Lab#13: Wind tunnel testing of dynamic ice accreting process over an airfoil.	*Lab report #12 due on Friday*
16	12/09	Course review	Prepare for final exam	*Lab report #13 due on Friday*
17	12/16	Final Exam will be held **from 9:45am ~ 11:45am on Tuesday, 12/16/2025**	https://www.registrar.iastate.edu/students/exams/fallexams	