

AEM 414/514
Experimental Aerodynamics

Instructor: Dr. James P. Hubner
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Location: SERC 1014

Lecture Hours: MWF 1:00 – 1:50 pm

Office Hours: TR 10:00 – 11:30 am or by appt

Prerequisites: AEM 250, AEM 313

Required Text: Tavoularis, S (2005) *Measurement in Fluid Mechanics*, Cambridge

Other Resources: Barlow, JB, WH Rae, and A Pope, *Low-Speed Wind Tunnel Testing*, Wiley
Goldstein, RJ, *Fluid Mechanics Measurements*, Taylor and Francis
Montgomery, DC, *Design and Analysis of Experiments*, Wiley
Colman, HW, and WG Steele, *Experimentation and Uncertainty Analysis for Engineers*, Wiley
Bendat, JS, and AG Peirsol, *Random Data Analysis and Measurement Procedures*, Wiley
Figliola, RS, and DE Beasley (2006) *Theory and Design of Mechanical Measurements*, 5th ed., Wiley

Web Page: Blackboard will be used as the class web portal. **For technical questions regarding Blackboard Learn, contact the Office of Information Technology at 348-3532.**

Catalog

Description: This course provides a laboratory counterpart to concepts discussed in aerodynamics and fluid mechanics. Course topics include statistical and uncertainty analysis techniques, design of experiments, computer-based data-acquisition, sensors for fluid mechanic measurements, and aerodynamic measurement techniques and facilities.

Learning Goals:

- To develop a working knowledge of experimental test facilities, techniques and equipment commonly used in the field of experimental aerodynamics.
- To develop a basic proficiency in digital data acquisition and analysis techniques.
- To apply statistical, regression and uncertainty analysis techniques to reduce, assess, quantify and validate data sets from experiments.
- To refine technical communication skills.

Class Policies:

Attendance: Attendance and on-time arrival is expected. Students are responsible for all scheduling and policy announcements made in class.

Lecture: **Reading assignments are to be completed prior to class.** Please power off or silence cell phones, pagers or other electronic items before the start of lecture.

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Assignments: Assignments include homework and lab reports. Homework is designed to further assist in the understanding of concepts discussed in the text book and lecture as well as prepare the student for class demonstrations and student laboratories. Assignments must be neat and orderly.

Quizzes: Quizzes will be given routinely throughout the semester.

Lab Sessions Lab sessions will be scheduled for time-blocks outside the normal class period. Each lab requires lab report. Further information regarding lab reports is in AEM514 Laboratory Reports.pdf posted on Blackboard.

Presentation Each graduate student will present a 20-25 minute lecture on an experimental technique not covered in the course but used in the field aerodynamics or fluid mechanics. One week prior to the presentation, an electronic version (draft) of the presentation is due to the instructor for feedback. A final printed version must be distributed to the instructor and students the day of the presentation. Topic options as well as presentation requirements will be discussed early in the semester.

Final: A final project (theoretical design analysis or experimental design and implementation) will be assigned mid-semester. A detailed report regarding the project will count as the final exam and is due Wednesday of finals week.

Undergraduates: Students enrolled for undergraduate credit (AEM 414) will be assigned less comprehensive homework, will be allowed to work in larger groups on labs, will not be required to present a lecture, and will have a final project of lesser scope.

Make-ups: Make-up for missed assignments is permitted on a case-by-case basis and requires proper documentation. Scheduled events conflicting with lectures, laboratories and assignment due dates must be addressed prior to the event and will be handled case-by-case. For unforeseen events, contact the instructor as soon as possible.

Grading Policy:	HW/Quizzes/Presentation	25%
	Lab Reports	50%
	Final Report	25%

Regrade requests **must be submitted in writing** (with a thorough and clear explanation of the disputed problem) **within one week** of the returned and graded assignment.

Services: If you are registered with the Office of Disability Services (<http://ods.ua.edu>), please make an appointment with me as soon as possible to discuss any course accommodations that may be necessary. If you have a disability but have not contacted the Office of Disability Services, please call (205) 348-4285 (Voice) or (205) 348-3081 (TTY) or visit 1000 Houser Hall to register for services. Students with disabilities must be registered with the Office of Disability Services before receiving accommodations.

University counseling services are available at <http://sa.ua.edu/counseling>.

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The University of Alabama is committed to an ethical, inclusive community defined by respect and civility. The UAct website (www.ua.edu/uact) provides a list of reporting channels that can be used to report incidences of illegal discrimination, harassment, sexual assault, sexual violence, retaliation, threat assessment or fraud.

Weather: The guiding principle at The University of Alabama is to promote the personal safety of students, faculty and staff during severe weather events. Please be familiar with UA's severe weather guidelines (<http://uanews.ua.edu/weather/>) and be prepared to quickly move to safety if severe weather occurs. In general, classes will remain in session until the National Weather Service issues tornado warnings for the Tuscaloosa metro area.

**Academic
Misconduct:**

All students in attendance at The University of Alabama are expected to be honorable and to observe standards of conduct appropriate to a community of scholars. The University of Alabama expects from its students a higher standard of conduct than the minimum required to avoid discipline.

Honor Pledge: "I promise or affirm that I will not at any time be involved with cheating, plagiarism, fabrication, or misrepresentation while enrolled as a student at The University of Alabama. I have read the Academic Honor Code, which explains disciplinary procedures that will result from the aforementioned. I understand that violation of this code will result in penalties as severe as indefinite suspension from the University."

UAct: The University of Alabama is committed to an ethical, inclusive community defined by respect and civility. The UAct website (www.ua.edu/uact) provides extensive information on how to report or obtain assistance with a variety of issues, including issues related to dating violence, domestic violence, stalking, sexual assault, sexual violence or other Title IX violations, illegal discrimination, harassment, child abuse or neglect, hazing, threat assessment, retaliation, and ethical violations or fraud.

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Schedule

Week	Topic	Ref Matl	Overview	Due	M	W	F
1	8/17	Course Policies; Measurement Systems	Chp 1, 4, 7			L: Intro	L: Meas Sys & Signals
2	8/22	System Behavior	Chp 2	1	L: System Behavior	Examples	Lab Overview
3	8/29	Data Acquisition	Chp 4		L: DDAQ	Examples	Quiz
4	9/7	Report Writing; Wind Tunnels	Chp 6	1	Holiday	L: Report Writing	L: Wind Tunnels
5	9/12	Pressure Measurements	Chp 8	2	L: Pressure	Examples	Lab Overview
6	9/19	Measurement Uncertainty	Chp 3		L: Uncertainty I	Examples	Quiz
7	9/26	Measurement Uncertainty; LabVIEW	Notes	FP&P	2	L: Uncertainty II	L: Project and Pres Overview
8	10/3	Hot Wire Anemometry	Chp 11	3	L: Hot Wire	Lab Report Discussion	Lab Overview
9	10/10	Turbulence and Correlations; Flow Visualization	Chp 5, 10	FP-Prop	L: Turbulence	L: Flow Visualization	Quiz
10	10/17	Laser Diagnostics	Chp 5, 11	3	L: Laser Diagnostics	L: LabVIEW	Demo: PIV
11	10/24	Aerodynamic Forces	Notes	4	L: Aerodynamic Forces	Lab Overview	Holiday
12	10/31	High Speed Flows	Chp 10		L: High Speed Flows	Demo: Schlieren	Quiz
13	11/7	Final Project Status, Work Week		4	FP Status	Work Day	Work Day
14	11/14	Presentations		Pres	Presentations	Presentations	Presentations
X		Work Week, Holiday			Work Day	Holiday	Holiday
15	11/28	Final Project Demo			FP Demo	FP Demo	FP Demo
16	12/5	Final Report due by 12/7 (5 pm)		FP		Final Report	

Schedule subject to change due to availability of facilities and equipment. If changes are necessary, then an announcement will be made in class.

Labs/Demos	
Digital Data Acquisition and Analysis	Finnel-Bryan Tunnel
Surface Pressure Measurements	Finnel-Bryan Tunnel
Wake Profile Measurements	Finnel-Bryan Tunnel
Lift, Force and Pitching Moment Measurements	Finnel-Bryan Tunnel
PIV	Water Tunnel
Schleiren	Supersonic Tunnel
Final Project	TBD