MAE 434 / MAE 434L – Experimental Aerodynamics Lecture and Laboratory
Mechanical and Aerospace Engineering Department
Fall 2024

Lecture Info	MAE 434 Section 001 MW, 12:00 – 12:50 PM, G83 ESB
Lab Info	*Every other Friday by section*
	MAE 434L Section 001: 12:30 PM – 1:20 PM, WVU Hangar
	MAE 434L Section 002: 1:30 PM – 2:20 PM, WVU Hangar
	MAE 434L Section 003: 2:30 PM – 3:20 PM, WVU Hangar
Instructor Info	Dr. Christopher Griffin, Teaching Associate Professor
	Office Hours: M, 1:00 – 2:00 PM; Th, 10:00 AM – 11:00 AM; open door policy
	Contact Info: 939 ESB, 304.293.3386, cgriffin@mail.wvu.edu
Prerequisites	MAE 336
Recommended Text(s)	Barlow, Jewel B., Rae, William H., Pope, Alan. *Low-speed Wind Tunnel Testing,* 3^{rd}*ed.* John Wiley & Sons, 1999.
	Montgomery, Douglas C. *Design and Analysis of Experiments,* 9^{th}*ed.* John Wiley & Sons, 2017.

Grading Scheme

Lecture (2 credit hours)

Assignment	Weight	ABET Outcome(s)
Homework	15%	6
Quizzes	15%	5, 6
Midterm Exam 1	20%	N/A
Midterm Exam 2	20%	N/A
Final Exam	30%	N/A

Lab (1 credit hour)

Assignment	Weight	ABET Outcome(s)
Lab Reports	80%	5, 6
Peer Review	10%	N/A
Attendance	10%	N/A

Final course grade will be submitted as: A($\geq 89.5\%$), B($\geq 79.5\%$), C($\geq 69.5\%$), D($\geq 59.5\%$), F($< 59.5\%$)

Option to Submit Mid-term Exam Corrections

It is my belief that reviewing your work, particularly exams, will benefit your overall performance in this course. Therefore, all students have the option to submit corrections to their mid-term exams **within one week** of them being graded and returned. Corrections must be done on separate pieces of paper, with new questions starting on a new piece of paper (all conceptual question corrections may be written on one piece of paper). The original exam must be submitted with corrections, in correct order, stapled on top of the original exam. The following is the schedule for percentage points added to the original exam score.

Original Exam Score	**Potential Missed Points Returned**
$90\% - 100\%$	60%
$80\% - 89\%$	50%
$70\% - 79\%$	40%
$< 70\%$	30%

Course Objectives

The objective of this course is to provide students with the knowledge of the fundamentals of practices in experimental aerodynamics. Specifically, the objectives are:

1. Learn how to design and conduct a wide variety of wind tunnel experiments
2. Learn key concepts related to acquisition, post-processing, statistical analysis, and interpretation of experimentally collected data
3. Learn organizational and communicative methods for effective engineering technical writing

Course Learning Outcomes

Through satisfactory completion of homework, quiz and exam problems, lab assignments, as well as through classroom discussion, successful students will demonstrate the ability to

1. Design and conduct experiments in aerodynamics (ABET outcomes 5 and 6)
2. Analyze and interpret experimentally collected data (ABET outcomes 5 and 6)
3. Infer and quantify statistical correlations of experimental variables (ABET outcome 6)
4. Outline, measure, organize, and communicate experimental results in concise technical reports (ABET outcome 5)

Prescribed ABET Student Outcomes for MAE 434 / MAE 434L

ABET Outcome 5	Upon graduation, all Bachelor of Science Students in mechanical or aerospace engineering will have an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
ABET Outcome 6	Upon graduation, all Bachelor of Science Students in mechanical or aerospace engineering will have an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Engagement Policy

Regular attendance is necessary for students who wish to master the topics covered in this course. Attendance will be taken during lecture and lab periods. For MAE 434 (Lecture), up to four (4) bonus percentage points are available to be added to your final course average. The breakdown of the awarded points is located in the table below.

Days Missed	Points Awarded
0	4
$1, 2$ (5%)	3
$3, 4$ (10%)	2
5 (15%)	1
> 5	0

For MAE 434L (Lab) attendance is mandatory. You can not be expected to contribute to the preparation of the Lab Report if you did not attend the lab session. It is expected there will be five (5) lab sessions. Therefore, attendance at each lab session will be worth two (2) percent of your course average, as noted in the Grading Scheme. I am willing to work with anyone to make up lab sessions.

Fall 2024 General Academic Calendar Key Dates

AUG 21	First Day of Classes	NOV 05	General Election Day (No Classes)
AUG 27	Last Day to Modify Courses	NOV 22	Last Day to Drop/Withdraw
SEP 02	Labor Day (No Classes)	NOV 23 - DEC 01	Fall Recess (No Classes)
OCT 09	Mid-Check Grades Due	DEC 12	Last Day of Classes
OCT 11	Fall Break (No Classes)	DEC 13	Prep Day for Finals
		DEC 18	Final Exam (2:00 PM)

***If a student has more than three final examinations in one day, the student may make arrangements to reschedule the last examination of the day on a different day.**

Assignment Policy

Make-up exams, quizzes, late homework, or late reports will **NOT** be accepted without **prior approval granted at least 2 days before the due date** from the instructor, consistent with WVU policies. Neat work is expected on all material submitted for grading (i.e. have to be able to read it to grade it). **All written assignments will be scanned and submitted via eCampus**.

Lab Safety

All students in laboratory courses MAE 211, MAE 244, MAE 322, and MAE 434 are required to complete MMAE safety training. Students are required to read the lab manual, review and understand a PowerPoint presentation, and complete the safety quiz by **September 4, 2024**.

Students are required to answer every quiz question correctly and have an unlimited number of chances to get a 100%.

MAE policy states that a failure to take the MAE safety training and obtain 100% on the quiz will result in a failing grade for the course. Any questions or issues (technical and content) concerning the safety training material or quiz should be directed to Kathy Sabolsky (kathy.sabolsky@mail.wvu.edu).

It is paramount that all participants of this course (including instructors and non-student members) know and adhere to all established laboratory safety protocols. Additionally, all participants must demonstrate safe and appropriate behavior in the laboratory at all times. Failure to successfully complete the lab safety examination(s) or to comply with accepted safe practices in the laboratory will result in removal from the course.

Teaching Philosophy

As the instructor, I will do everything possible to help you learn and understand the material, but you must do your part. The student is ultimately responsible for learning the material. It is not a trivial matter to earn an "A" in my course, but in the same respect, it is also difficult to receive an "F". It is my opinion that discussion in the classroom helps reinforce concepts. Please participate in our discussions and never hesitate to ask a question.

If you have a question on material, homework, how I graded, or life in general, please come and see me as soon as possible. The earlier we can address a deficiency, the better. I am always open to meeting to discuss any questions and concerns.

Finally, I cannot stress enough the importance of doing all assigned work yourself. This includes reading, homework, projects, and self-study. I believe this approach is the only way to learn to address the following questions when solving a problem: a) what is the problem asking, b) what relevant theory do I need to apply, c) what is a representative system drawing for this problem, d) what assumptions and simplifications can I make, e) what local, initial or boundary condition information do I need, and f) what are the steps to solve this problem? **In other words, do not confuse copying solutions with asking your peers for help**.

Directions to WVU Hangar

Location: 39.639968 $^\circ N$, -79.922513 $^\circ E$ $\leftarrow$ use these lat/lon values to find the hangar with GPS. Address is approximately 461 Hartman Run Road, Morgantown, WV. **WARNING: During periods of high traffic congestion it may take 30+ minutes to reach the hangar from ESB, so plan accordingly.**

From Evansdale Campus: Leave campus by going down the hill past the Rec Center, then take a right onto Patteson Drive. From Patteson Drive, continue onto Van Voorhis Rd. Turn right onto WV-705/Chestnut Ridge Rd. Take 2^{nd} exit at traffic circle onto US-119/Mileground Rd. Turn right onto Co Rd 857 at the first traffic light, then turn slightly to the right as the road becomes Hartman Run Rd. Turn left onto Hart Field Rd, then turn immediately right and take the small paved drive up around the hill until you reach the end of the drive where you will find a paved parking area.

Adverse Weather Statement

In the event of inclement or threatening weather, everyone should use his or her best judgment regarding travel to and from campus. Safety should be the main concern. If you cannot get to class because of adverse weather conditions, you should contact your instructor as soon as possible. Similarly, if your instructor(s) are unable to reach the class location, they will notify you of any cancellation or change as soon as possible, using agreed upon methods to prevent students from embarking on any unnecessary travel. If you cannot get to class because of weather conditions, instructors will make allowances relative to required attendance policies, as well as any scheduled tests, quizzes, or other assessments.

Inclusivity Statement

The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in your classes, please advise your instructors and make appropriate arrangements with the Office of Accessibility Services, `http://accessibilityservices.wvu.edu/`.

More information is available at the Division of Diversity, Equity, and Inclusion website as well, `http://diversity.wvu.edu/`.

Sale of Course Material Statement

All course materials, including lectures, class notes, quizzes, exams, handouts, presentations, and other course materials provided to students for their courses are protected intellectual property. As such, the unauthorized purchase or sale of these materials may result in disciplinary sanctions under the Student Conduct Code, `https://studentconduct.wvu.edu/campus-student-code`.

Academic Integrity Statement

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, instruc-

tors will enforce rigorous standards of academic integrity in all aspects and assignments of their courses. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the West Virginia University Academic Standards Policy, `http://catalog.wvu.edu/undergraduate/coursecreditstermsclassification/`. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see your instructor before the assignment is due to discuss the matter.

Statler College Policy of Academic Integrity

Case	Violation	Penalty
1	Cheating or plagiarism on minor course element (e.g., quiz, weekly lab report, homework as specified in the syllabus)	Report of academic dishonesty Grade of zero on the entire minor course element Possible one-letter reduction in final grade
2	Cheating or plagiarism on a major course element (e.g., exam, project)	Report of academic dishonesty Grade of zero on the entire major course element Possible one-letter reduction in final grade Possible UF† recommendation Possible exclusion from further participation in class
3	Collusion on major course element	Report of academic dishonesty Exclusion from further participation in class Failure in the course Recommendation for UF†
4	Other (document alteration, tampering with records, etc.)	Report of academic dishonesty Grade of zero on the entire major course element Possible additional one-letter reduction in final grade Possible failure in the course Possible exclusion from further participation in class Possible recommendation for UF†

† UF – Unforgivable F Grade; cannot be replaced under D-F repeat policy.

Additional notes:

- Dismissal from Statler College is permanent for Academic Integrity violations. Student conduct violations can be considered in dismissal.
- Seperable sanctions (e.g., dismissal from Statler College, suspension, or expulsion from WVU) will be recommended for aggravated or second AI offenses.
- Warning letters may be issued from the Statler College or the WVU Office of Student Conduct.
- Sanctions will be assessed at the instructor and at the college/university levels. Additional sanctions may be assigned at the level of the instructor, college, and/or university.
- FORBIDDEN on Exams and Quizzes: The use of programmable calculators or smart devices (including smart-phones, smart watches, tablets, cameras, wearable devices, etc.) is prohibited unless specifically indicated by the instructor.

Topics

Technical Report Writing, 2 hours
- Basic formatting in MS Word
- Technical report outlining
- Technical report formatting
- Introduction to LaTeX

Fundamentals of Aerodynamics (Review), 2 hours
- Dimensional analysis
- Review of common dimensionless terms
- Internal and external flows

Wind Tunnels, 4 hours
- Types of tunnels
- Tunnel design

Flow Measurement Techniques, 4 hours
- Flow measurement for internal and external flows
- Intrusive and non-intrusive flow measurement

Force Measurement Techniques, 4 hours
- Basics of force measurement
- Internal balances
- External balances
- Balance calibration

Data Acquisition, 4 hours
- Basics of instrumentation
- DAQ systems

Measurement Uncertainty, 2 hours
- Error, uncertainty, and their sources
- Accuracy and precision
- Calculation of uncertainty

Data Analysis, 3 hours
- Basic post-processing techniques
- Advanced statistical methods and hypothesis testing

Experimental Design, 2 hours
- Fundamentals of Design of Experiment (DOE)
- Factorial experimental designs