

# AEE427: Aircraft Performance and Dynamics

## Syllabus – Fall 2026

M/W 8:00-9:20 Link 369 | F 12:45-1:40 Eggers 032

### Catalog Description

Wing aerodynamics, thrust and drag. Performance analysis of aircraft: take-off, landing, climbing, gliding, turns, range and load factors. Control surfaces. Longitudinal and lateral static stability. Dynamic stability. Introduction to autopilot.

### Prerequisites

MAE 341, Fluid Mechanics

### Instructor

Prof. Kasey M. Laurent  
241 Link Hall  
klaurent@syr.edu  
Office hours: W/Th 10:45--12:15

### Teaching Assistant

Adhip Gupta  
2-128 CST  
agupta46@syr.edu  
Office hours: M/T 11:15 – 12:15

### Course Web Information

From time to time, course resources will be posted on Blackboard. The syllabus posted there is the latest for the course and will supersede any previous versions.

### Course Materials

- Anderson, *Introduction to Flight* (required, any edition)
- Nelson, *Flight Stability and Automatic Control* (recommended)

### Course Goals

By the end of this course, you will be able to:

- explain and apply fundamental principles governing aircraft performance, such as take-off, landing, and climbing
- analyze and evaluate the static stability and control characteristics of an aircraft
- describe and interpret the dynamic stability modes of an aircraft and the role of automatic control systems in maintaining stability

## Course Learning Objective Measurement and Assessment

In-class exams	20% (each)
Final exam	25%
Labs	25%
In-class activities (lowest 2 dropped)	5%
Homework (lowest dropped)	5%

Numeric scores will be translated into letter grades with the following table:

	B+	87.0 – 89.9	C+	77.0 – 79.9	D	60.0 – 69.9	
A	93.0 – 100	B	83.0 – 86.9	C	73.0 – 76.9	F	below 60
A-	90.0 – 92.9	B-	80.0 – 82.9	C-	70.0 – 72.9		

## In-Class & Final Exams

You will have three exams in total, including two in-class exams and a final exam, with the specific timing and locations listed in the course schedule. To recognize your hard work and mastery of the material, your lowest in-class exam grade may be replaced by your final exam grade. To qualify for this grade replacement, you must demonstrate consistent engagement by submitting at least 80% of your homework assignments and participating in at least 80% of our in-class activities (including the lowest dropped).

To help you focus on applying concepts rather than memorizing formulas, you may prepare and use your own handwritten note sheet during each exam. For Exam 1 and Exam 2, your note sheet is limited to one side of an 8.5”x11” piece of paper, while the final exam allows for two sides. Your note sheet should include your name, formulas, and key concepts in your own writing, but please ensure it does not include worked-out example problems. These sheets will be collected at the end of the exam, and following these guidelines is essential to ensure your exam is graded. If these guidelines are not followed (e.g. extra pages, including example problems, not turned in etc.) you may receive a zero on the exam. If you are ever unsure whether your note sheet meets these requirements, I encourage you to email me for confirmation at least 24 hours before the exam begins.

## Labs

Our lab sessions are designed to bring the theoretical concepts of aircraft performance to life through hands-on experience and flight simulation. Lab lectures and lab sessions will generally alternate each week, beginning with lab lecture during the second week of class (Lab 1a). During the first week, the TA will schedule everyone into groups of three or four for one-hour lab sessions.

To ensure everyone has a consistent and fair schedule, any reoccurring conflicts with your assigned time must be finalized with me before the start of Lab 1b. If a new time is not finalized by this deadline, you will be required to attend your originally assigned lab session for the remainder of the semester. If you have a one-time conflict, please contact the TA at least one week in advance to discuss making up that specific lab.

Preparation is key to a successful flight; therefore, each lab (except Lab 4) includes a pre-lab and a post-lab report. Pre-labs are due on Tuesday at 11:59 PM during lab weeks. To ensure everyone's safety and maximize our time in the flight simulator, completing the pre-lab is a prerequisite for participating in the flight session. Post-lab reports are due one week after your specific lab session ends and are only accepted if you attended lab.

In addition to pre- and post-lab reports, you must submit one analyst report during the semester, which will be assigned by the TA at the end of your lab. Members of the same lab group may not select the same lab for this report, and analyst reports will not be accepted if you did not attend your assigned lab session. While late submissions for all reports are accepted, they are subject to a 1% deduction of the full assignment grade per hour late.

All reports must be your own original work. You may use AI models (like ChatGPT) to assist with brainstorming, clarification, or to support your own learning. You may not use it as a shortcut to produce written reports. Use of AI-generated materials must be cited properly, listing the tool you used as the author and indicating how it was used. Improper use and failure to cite AI models will be reported to the Academic Integrity Office.

To maintain academic integrity, you are required to work in a platform like Google Docs or OneDrive that tracks document history. If you are suspected of using AI to write your reports and cannot provide this document history upon request, you will receive a zero for the entire lab and associated assignments. Furthermore, to avoid future issues, any student unable to provide document history will be required to handwrite all future reports. Please note that copy-pasting an assignment from another source into your document also results in a zero.

This class will use the plagiarism detection and prevention system Turnitin. You will have the option to submit your papers to Turnitin to check that all sources have been properly acknowledged and cited before submitting reports. Turnitin compares submitted documents against documents on the Internet and against student papers submitted to Turnitin at Syracuse University and at other colleges and universities. Keep in mind that all reports submitted for this class will become part of the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers.

**Pre-labs, lab reports, and analyst reports will be turned in on Blackboard.**

## **In-class Activities**

In-class activities will occur in class approximately once a week. These sessions are designed to help you apply new concepts and practice problem-solving in a collaborative environment. Each activity takes place during the first 10 minutes of class, so arriving on time is essential to ensure you can participate. These exercises are graded based on completion and a good-faith effort rather than correctness; if you are unable to reach a final answer, you will still receive full credit by explaining your reasoning or identifying what prevented you from solving the problem.

While you are encouraged to use your notes and textbooks and to discuss the problems with your classmates, the use of the internet or other external sources is not permitted. These activities must be turned in during the class period and cannot be made up. However, to provide flexibility for unexpected conflicts or illnesses, your lowest two in-class activity grades will be dropped at the end of the semester. If you have an officially excused absence, you will be excused from that day's activity with no penalty to your grade.

**In-class activities will be turned in in class.**

## **Homework**

Homework is assigned nearly every week to provide consistent practice with the principles of aircraft performance. These assignments are submitted through Blackboard and often include recommended textbook readings to support your understanding. When a problem requires figures, you should generate them using MATLAB and attach both the plots and the corresponding code. To demonstrate your underlying technical proficiency, any problem solved with MATLAB must also include a hand-calculated process for at least one representative data point. Please ensure your work is organized and clearly explained, as disorganized submissions may not receive full credit.

The grading for each assignment is divided into two parts: your initial completion of homework problems and a subsequent self-grading reflection. For the reflection portion, you will use an instructor-provided solution video to review your work and complete a form explaining your mistakes and what you learned. Your new homework problems and the reflections from the previous assignment must be submitted together by 11:59 PM on the due date to receive full credit. While late submissions are accepted, they are subject to a deduction of 1% of the total assignment grade per hour late. To provide flexibility for unexpected personal circumstances, your lowest homework grade will be dropped at the end of the semester.

As with all engineering work, your submissions must be your own original effort. You are welcome to use AI models for brainstorming or clarifying difficult concepts, but any AI-generated material must be cited properly, listing the tool as the author and describing how it was utilized. Failure to cite AI use or any other form of improper use will be reported to the Academic Integrity Office and will result in a grade of zero for the assignment.

**Homework will be turned in on Blackboard.**

## **Participation & Professional Conduct**

Active participation is essential for a successful learning experience in this course, which includes arriving prepared, listening respectfully to others, sharing ideas, and remaining attentive throughout our sessions. You are encouraged to ask questions and support your peers as you work through the course material together. Because consistent engagement is a core component of mastering aircraft dynamics, attendance is mandatory, and your grade will be affected by any unexcused absences.

If you encounter circumstances that make participation difficult, please reach out to me early so that we can work together to find a reasonable solution. For absences due to illness or other personal reasons, you should obtain an official excuse from the Student Records office. If you must miss a class or lab for a sanctioned event, such as a sporting event or field trip, you must submit an absence request signed by your coach or advisor before the absence occurs. In these instances, homework is expected to be submitted early, with the only exceptions made for documented medical emergencies.

## **Late Policy, Make-Up Work, & Grade Disputes**

To provide flexibility for unexpected personal circumstances while maintaining a steady pace through the material, you may submit pre-labs, post-labs, analyst reports, and homework after the deadline. Late submissions are subject to a deduction of 1% of the total assignment grade per hour late. At the end of the semester, I will drop the late penalty from your single most affected assignment to account for a one-time emergency. Please note that while late pre-labs are accepted for credit, they must be completed before your assigned lab session; if they are not, you will not be permitted to operate the flight simulator. In-class activities are designed for real-time engagement and cannot be made up. However, your two lowest activity grades are dropped to allow for unexpected absences or conflicts. Exceptions to these late policies are only granted in the case of a documented medical emergency.

All grade disputes must be initiated within one week after the graded items have been returned or posted. This does not mean that the dispute must be resolved in one week, but the process must start. Grade disputes raised after one week will not be considered.

## **Attendance Policy**

- The University policy on classroom attendance states that “Attendance is expected in all courses at Syracuse University.” It is essential that you attend all classes and recitations.
- If you miss classes for illness or other personal reasons, see the Student Records office for an official excused absence.

- The expectation is that you submit an excused absence ahead of the absence. Homework will be expected to be handed in early. The only exception will be made in the case of a medical emergency.
- If you must miss a class or lab for a sporting event, field trip, etc., you MUST submit an absence request that is signed by your coach, advisor, etc. before you miss the class.

## Academic Integrity

As a pre-eminent and inclusive student-focused research institution, Syracuse University considers academic integrity at the forefront of learning, serving as a core value and guiding pillar of education. Syracuse University's Academic Integrity Policy provides students with the necessary guidelines to complete academic work with integrity throughout their studies. Students are required to uphold both course-specific and university-wide academic integrity expectations such as crediting your sources, doing your own work, communicating honestly, and supporting academic integrity. The full Syracuse University Academic Integrity Policy can be found by visiting [class.syr.edu](http://class.syr.edu), selecting, "Academic Integrity," and "Expectations and Policy."

Upholding Academic Integrity includes the protection of faculty's intellectual property. Students should not upload, distribute, or share instructors' course materials, including presentations, assignments, exams, or other evaluative materials without permission. Using websites that charge fees or require uploading of course material (e.g., Chegg, Course Hero) to obtain exam solutions or assignments completed by others, which are then presented as your own violates academic integrity expectations in this course and may be classified as a Level 3 violation. All academic integrity expectations that apply to in-person assignments, quizzes, and exams also apply online.

Students found in violation of the policy are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered. Students may not drop or withdraw from courses in which they face a suspected violation. Any established violation in this course may result in course failure regardless of violation level.

Specifically for this course:

- There is to be no collaboration on exams. Students who either give or get help will receive a grade of zero for the exam and will be reported to the Academic Integrity Office.
- The homework assignments and pre-lab reports are to be done separately by each student. While it is permissible to "discuss" problems with other students, copying solutions, MATLAB code, calculations, or write-ups will result in a grade of zero for all copied solutions and will be reported to the Academic Integrity Office.
- In written work, text that has been copied from another source must appear in quotes and must include a citation at the end of the sentence. This includes any use of AI models. Failure to do so will result in a grade of zero on the assignment and will be reported to the Academic Integrity Office.

### *Artificial Intelligence*

Based on the specific learning outcomes and assignments in this course, artificial intelligence is permitted on the following: homework and lab reports. See each assignment, quiz, or exam instructions for more information about what artificial intelligence tools are permitted and to what extent, as well as citation requirements. If no instructions are provided for a specific assignment, then no use of any artificial intelligence tool is permitted. Any AI use beyond that which is detailed in course assignments is explicitly prohibited except when documented permission is granted.

## Tentative Schedule

Week starting	Monday <i>Link Hall 369</i>	Tuesday	Wednesday <i>Link Hall 369</i>	Friday <i>Eggers 032/Link 213</i>
8/24	Review of Aero 1 (basic concepts)		Review of Aero 2 (standard atmosphere)	Review of Aero 3 (airspeed)
8/31	Review of Aero 4 (finite wings & aircraft aero)	<b>Due: HW1</b>	Aircraft performance 1 (SLUF, thrust curves)	Lab 1a SLUF
9/7	<i>No class Labor day</i>	<b>Due: Prelab 1, HW2</b>	Aircraft performance 2 (power curves, rate of climb)	Lab 1b
9/14	Aircraft performance 3 (range, endurance)	<b>Due: HW3, Post- lab 1*</b>	Aircraft performance 4 (take-off, landing)	Lab 2a Take-off/Landing
9/21	Collaborative Exercise 1 (Exam 1 review)	<b>Due: HW4</b>	Aircraft performance 5 (turns, pull-up, V-n)	<b><u>Exam 1</u></b>
9/28	Aircraft stability 1 (longitudinal static stability)	<b>Due: Prelab 2, HW5</b>	Aircraft stability 2 (pitching moments, trim)	Lab 2b
10/5	Aircraft stability 3 (SFNP, longitudinal control)	<b>Due: HW6, Post- lab 2*</b>	Aircraft stability 4 (directional & roll stability)	Lab 3a Turn/climb
10/12	<i>No class Fall break</i>	<b>Due: Prelab 3 Procedure</b>	Equations of motion 1 (Euler angles & ang rates) <b>Due: Prelab 3</b>	Lab 3b
10/19	Equations of motion 2 (rigid body dynamics)	<b>Due: HW7, Post- lab 3*</b>	Equations of Motion 3 (small perturbations)	Lab 4a/4b Weight/balance
10/26	Collaborative Exercise 2 (Exam 2 review)		Equations of Motion 4 (2 <sup>nd</sup> order ODEs)	<b><u>Exam 2</u></b>
11/2	Equations of Motion 5 (matrix method)	<b>Due: Post-lab 4, HW8</b>	Dynamic stability 1 (dynamic response)	Lab 5a Long. Stability
11/9	Dynamic stability 2 (longitudinal equations)	<b>Due: Prelab 5</b>	Dynamic stability 3 (longitudinal approx.)	Lab 5b Long. Stability
11/16	Collaborative Exercise 3 (weight & balance)	<b>Due: Post-lab 5*, HW9</b>	Dynamic stability 4 (lateral equations)	<i>No class</i>
11/23	<i>No class Thanksgiving break</i>		<i>No class Thanksgiving break</i>	<i>No class Thanksgiving break</i>

11/30	Dynamic stability 5 (lateral approx.)	<b>Due: HW10</b>	Collaborative Exercise 4 (Final review)	Review
12/7	Review		<i>No class</i> <i>Reading day</i>	<i>No class</i> <i>Reading day</i>

\* Post-lab reports are due 1 week after your lab ends. For example, if your lab is 11 Sept from 12pm-1pm, your lab report is due 18 Sept at 1pm.

**Final exam**

Thursday December 10<sup>th</sup> 8:00am-10:00am Link Hall 369