AE 4453 Syllabus

Advanced Aircraft Propulsion, Section A, and 3 Credits

Fall 2026

Instructor Information

Instructor: Benjamin Emerson

Contact Information and Office Hours: Detailed on Canvas

General Course Information

Description

This course details the analysis and design of compressors, turbines and combustors for aircraft propulsion. It includes an overview of sizing these components, as well as analysis approaches for their internal components. The course includes compressor-turbine matching and off-design engine performance. This course also provides an introduction to advanced propulsion architectures including scramjets, pressure gain combustion, and electric/hybrid electric.

Course Learning Outcomes

A student successfully completing this course will be able to:

1. Define preliminary design parameters for compressors and turbines and characterize their performance based on a mean (pitch) line approach.
2. Evaluate the operation and performance of a jet engine based on compressor and turbine maps for different operating conditions.
3. Provide preliminary design parameters and define key design issues and constraints for main combustors in jet engines.
4. Describe the advantages, drawbacks and challenges of various advanced propulsion architectures.

Required Course Materials

This course will not have required text/materials. Recommended materials for self learning are the following:

- Mechanics and Thermodynamics of Propulsion, 2nd Edition, Philip Hill and Carl Peterson, Addison-Wesley, 1992.
- Aircraft Propulsion, S. Farokhi, Wiley, 2009.

- An alternative and excellent resource is the course notes from Professor Seitzman, which are included on Canvas. My lectures will largely follow those notes.

Schedule

See Canvas for an up-to-date course schedule.

Grading Policy

We will nominally have weekly homework assignments. We will have two midterm exams and one final project. There will also be an attendance grade. I will weight grades as follows:

25% Homework

20% Final project

25% Midterm 1

25% Midterm 2

5% Attendance

Description of Graded Components

The objective of the homework assignments will be to facilitate learning by practicing the lectured material, and to prepare for midterm/final exams. We will have two midterm exams. The first will mostly focus on turbomachinery, and the second will mostly focus on turbomachinery matching, off-design operation, and combustors. A final project will used to assess and practice the cumulative course material. There will not be a final exam. The homework cadence will be relaxed around the timing of tests to prevent excessive workload. Five percent of the grade will given for class attendance, but may be lost if I notice significant absence from class; this is my discretion.

Other Grading Policies

In cases where the class as a whole under-performs on an exam or assignment, I may apply a curve to increase the class average; this is my discretion. While I generally curve generously, I do NOT round up final grades. Imagine for example that the 90% required to earn an A is a "finish line in the sand" that must be crossed; there is no rounding across the finish line.

Late Assignments and Missed Exams

Timeliness is important in an engineering career, and likewise it is an important element of this course. However, I understand that life happens. I will allow each student one skipped homework. No questions asked. To redeem your skipped homework, you must message me via email or canvas **before** the deadline. If you will use the skipped assignment option, I encourage you to still attempt the homework to benefit from the learning- but you may do so on your own timeline and need not turn it in.

Late homework submissions will lose one letter grade (10 percentage points) for every day they are late, and will continue to lose at 10% per calendar day until the homework is submitted or its score is zero, whichever comes first.

Missed exams will follow a similar policy. If you must miss an exam, please let me know beforehand. We will re-schedule you at no cost to your grade. If you miss an exam and do not contact me beforehand, I will deduct 10% per day of late notification.

Course Policies

Attendance and/or Participation

I expect attendance in class. The final grade includes a 5% attendance component. These points are yours to lose. In cases where I notice a significant level of absence of an individual I will remove these points. I understand occasionally missing classes. If you know you will be absent, please just send me a quick message. In cases of repeated widespread absences, I will implement graded pop-quizzes to be factored into the homework score.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

Core IMPACTS is the University System of Georgia's General Education curriculum. If you are teaching a course that counts towards Core IMPACTS, you should include a syllabus statement about the Core area and associated career competencies. This resource developed by the Center for Excellence in Teaching and Learning and Online Education at Georgia State University includes template syllabus statements for each of the Core IMPACTS areas that you may adapt for your course.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Pre- &/or Co-Requisites

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Collaboration, Group Work, and Use of Generative AI

Your interaction with AI should be the same as with your classmates. I encourage the use of AI as a learning aid, just as you would converse with a classmate about class topics. This means searching for literature or other resources, or discussion of course topics. Note that just like classmates, AI does not always bring correct or well explained information in complex subject matter like this. I do not permit the use of AI on assignments. This means AI must not be used to make calculations, to write code, or to manipulate equations. If in doubt, please ask.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Timeliness is important in an engineering career, and likewise it is an important element of this course. However, I understand that life happens. I will allow each student one skipped homework. No questions asked. To redeem your skipped homework, you must message me via email or canvas **before** the deadline. If you will use the skipped assignment option, I encourage you to still attempt the homework to benefit from the learning- but you may do so on your own timeline and need not turn it in.

Late homework submissions will lose one letter grade (10 percentage points) for every day they are late, and will continue to lose at 10% per calendar day until the homework is submitted or its score is zero, whichever comes first.

Missed exams will follow a similar policy. If you must miss an exam, please let me know beforehand. We will re-schedule you at no cost to your grade. If you miss an exam and do not contact me beforehand, I will deduct 10% per day of late notification.

Inclement Weather and Digital Learning Days

In cases of campus closure for inclement weather, I will communicate plans via Canvas. I will prioritize holding class remotely in these cases. Otherwise, I will cancel if needed.

On days that I have to be absent for travel, I will prioritize an in person substitute. My next priority will be to teach remotely live via teams. My last priority before cancelling class will be to provide a recorded lecture.

Campus Resources for Students

Undergraduate Student Academic Success Resources:

Academic Support: Academic Success and Advising (a unit in the Office of Undergraduate Education & Student Success) provides free support for your courses. Students can attend scheduled supplemental review (PLUS) sessions, stop by Drop-In Tutoring, or schedule a one-

on-one appointment through Knack. To explore what options work best for you, please visit us online at success.gatech.edu/tutoring, email us at tutoring@gatech.edu, or come see us at Clough Undergraduate Learning Commons, Suite 283.

Student Well-Being:

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive list of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being student-resource-guide (gatech.edu)