

Course Information for AerE 411 – Aerospace Vehicle Propulsion I

Note: this document is subject to change by the instructor during the semester.

General Information

Instructor: Alric P. Rothmayer
2235 Howe Hall
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Office hours: MWF 12–1.

Pre–requisites: AerE311 or equivalent (ME 231 and 332).

Course structure:

Textbook: Oates, *Aerothermodynamics of Gas Turbines and Rocket Propulsion* (required, in University and Campus Bookstores)

Other Relevant Textbooks:

Anderson, *Fundamentals of Aerodynamics*

NACA Report 1135, *Equations Tables and Charts for Compressible Flow*

Moran & Shapiro, *Fundamentals of Engineering Thermodynamics*

Grading: midterm exam (30%), final exam (30%), homework (15%), quizzes (25%). There is the possibility of a quiz every Friday. The quiz will be 10min long and will cover all material presented in class prior to the quiz day. Homework will be collected on the days noted in the class schedule at the beginning of class. Grading scales and policies are outlined below.

Please address any special needs or special accommodations with me at the beginning of the semester or as soon as you become aware of your needs. Those seeking accommodations based on disabilities should obtain a Student Academic Accommodation Request (SAAR) form from the Disability Resources (DR) office (515–294–6624). DR is located on the main floor of the Student Services Building, Room 1076.

Course Objectives

1. Review thermodynamics of compressible gases
2. Develop performance analysis for ramjets, turbojets, turbofans, and other engines
3. Overview engine component properties.
4. Develop performance analysis for non–ideal and off–design simulations.

Pet Peeves and Suggestions

1. Please be on time (especially on quiz and test days), coming in late can be very disruptive.
2. Keep up with the material and read the book (this is really important in this course).
3. Do not study and do homework at the last minute. Pace yourselves.
4. If you are having problems, see me early – don't wait until it's too late.
5. You may consult each other as much as you want on the homework, but you will be better off doing it yourself. Remember that many homework questions are taken from old tests.
6. Turn off your cell phone!
7. Put away laptops and newspapers (i.e. no game playing, web browsing, text messaging, etc.)!

Departmental Course Objectives:

1. Identify the components of turbojets and turbofans (with and without afterburning), ramjets and turboprops.
2. Derive the specific thrust and specific fuel consumption equations for an ideal cycle analysis of a turbojet engine. Program and plot the variation of the performance parameters with changing design and flight conditions. Apply ideal cycle analysis to turbojets and turbofans with and without afterburning.
3. Show an understanding of component efficiencies through the use of component figures of merit.
4. Apply the figures of merit to the non-ideal cycle analysis of turbojets and turbofans.
5. Understand engine off-design performance.

Grading Policies

Quizzes: will be graded on a 1–10 scale with 0.5 accuracy. Topics will be taken directly from the lecture. The quizzes will cover definitions, theory and derivations given in the lecture. Quizzes will not include material from the homework. Quizzes will be comprehensive from the start of the semester. It is relatively easy to get a high grade on quizzes if you study regularly. The final quiz grades will be curved by adding the same number of points to the final quiz average (i.e. the average of all quiz grades) so that the highest quiz average is 100%.

Homework: I expect the homework to be neat, readable and complete. Grading is on a 1–10 scale with 0.5 accuracy. Extra consideration will be given for more complete analyses. Points will be deducted for sloppiness, lack of clarity and lack of detail – even if you have the right answer. **Problems which require a solution graph must use computer generated plots (hand-plotted graphs are not allowed). To receive full credit for problems which require plotted solutions, a listing of the source code must be include with the solution.** Problems which require plots are the ones for which the posted solutions have plots. You should feel free to collaborate with your classmates on the homework. Many (but not all) of the final homework solutions will be posted on the course website prior to the due date. The final homework grades will be curved by adding the same number of points to each final homework average (i.e. the average of all homework grades) so that the highest homework average is 100%.

Tests: The midterm examination will be closed book. The final examination will be open book (and you can only use the book, so it is a good idea to read it so that you are familiar with the location of material). No additional material will be allowed. All exams are comprehensive and graded on a 1–100 scale with one point accuracy. The midterm and final examination will each be curved by adding the same number of points to individual test grades so that the highest midterm and final grades are each 100%.

Grading Scale:

final grade = 0.3 x midterm + 0.3 x final + 0.25 x quiz + 0.15 x homework

90–100	= A
85–90	= A–
80–85	= B+
75–80	= B
70–75	= B–
65–70	= C+
50–65	= C
45–50	= C–
40–45	= D+
35–40	= D
30–35	= D–
below 30	= F

Policy for Missed Assignments and Examinations:

Homework is due at the beginning of the class period on the due date assigned in the class schedule. Late homework will not be accepted under any circumstances. If you know that you have to miss a class, or if you are sick on the due date, then it is your responsibility to arrange to have the homework delivered to me on, or before, the due date. There will be no make-up quizzes. **You may miss up to two quizzes due to a legitimate absence or illness. Those absences must be communicated to me by email on or before the date of the quiz.** The scores for the first two missed quizzes will not be counted towards the final quiz grade. Any missed quizzes after the first two will be given a grade of zero, irrespective of the reason for missing the quiz.

To be excused from an exam or homework assignment due date requires written notice and must include substantial justification. Medical excuses for missing exams or homework require a **signed statement** from a physician, including a clearly written or typed name, contact address and phone number. In order for you to be excused from the original exam and be allowed to take a make-up exam, the physician must confirm in writing that you were incapable of taking the original examination on the date in question. It is your responsibility to make sure that the physician understands that he/she will be contacted to verify that the medical excuse is valid. In general, absences from midterm and final examinations will not be allowed except due to extreme mitigating circumstances, which must be documented in writing prior to the exam date. To be excused from a midterm or final exam requires prior approval except for the medical excuse noted above.