

ENG ME425 - Compressible Flow and Propulsion

Fall 2024 Course Syllabus

Instructor:

Prof. Anthony Linn
ENG 408
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Graduate Student Teacher:

TBD

Class Meeting times:

TR 09:00-10:45,
PHO 201

Catalog Course Description:

Fluid mechanics and thermodynamics of compressible fluid flow with application to external and internal flows as found in propulsion systems. Fluid/thermal related topics include normal and oblique shocks, Prandtl-Meyer expansion waves, variable area duct flow, and wave drag. Propulsion applications include rocket nozzles, supersonic inlets, and exhaust nozzles for airbreathing propulsion systems. Parametric cycle analysis for ramjet, turbojet, and turbofan

Prerequisites:

ENG ME303 & ENG ME304

Course Materials & Resources:

J. Anderson, *Modern Compressible Flow*, 4th edition
Flack, *Fundamentals of Jet Propulsion with Applications*, 2nd edition

Blackboard: <https://learn.bu.edu>

Course Topics:

- Governing Equations of fluid motion. Chaps. 2&6 (JA)
- 1-D flow, definitions, Normal shocks. Chaps 3 (JA)
- 1-D flows with heat and friction. Chap 3 (JA)
- Oblique shocks and expansion waves. Chaps. 4 (JA)
- Quazi 1-D flows, nozzles, rockets, supersonic inlets, wind tunnels. Chap. 5 (JA)
- Differential Conservation Equations, Substantial (Material) Derivative, Chap 6 (JA)
- Transonic flows, numerical methods. Chap. 14 (JA) + notes
- Thermodynamic cycles, thrust. Chap 1 (RF)

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- Ideal cycle analysis, Non-ideal cycle analysis. Chaps 2,3 (RF)
 - Ramjet: diffuser, burner, nozzle.
 - Turbojet: compressors, turbines, afterburner.
 - Turbofan: fan, bypass.
- Off design air-breathing. Chap 11 (RF)

Coursework:

Homework: Homework will be assigned approximately weekly. Homework will be due at the beginning of class on the designated due date.

Computational Projects: There will be several computational projects. Students are free to use the programming language of their choice. Graphing of results will be required.

Exams: There will be two exams. Midterm and final exams. Exam scheduling is TBD

General Course Information:

Honesty policy: Adherence to the Student Academic Code of Conduct is expected. I encourage you to freely discuss the homework amongst one another as you formulate your solutions individually. *Your* written work should represent *your* understanding of the problem.

In practice this means that copying (in whole or in part) another student's homework, exam, computer program, or paper is not permitted. If you choose to discuss your work with a colleague, it should be a discussion in which one teaches another or both work to a mutual understanding. As a counterexample, it is not acceptable to give a friend your homework five minutes before class so that your friend can copy your work. I also consider it unacceptable to copy work from a student who was in the class the previous year. In your written reports, be careful to correctly use quotation marks for words that did not originate with you. Also, be sure to properly cite all sources you used. As is done in scientific literature, you should *briefly* acknowledge in writing any significant discussion or interactions you had regarding the work you submit. As a general principle, I do not accept the justification that you were not sure of my intentions. If you feel you may be in an ethical gray area, then you should consult with me *before* acting.

Inclusion: I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Accommodations for Students with Documented Disabilities: If you are a student with a disability or believe you might have a disability that requires accommodations, requests for accommodations must be made in a timely fashion to Disability & Access Services, 25 Buick St, Suite 300, Boston, MA 02215; 617-353-3658 (Voice/TTY). Students seeking academic accommodations must submit appropriate medical documentation and comply with the established policies and procedures <http://www.bu.edu/disability/accommodations/>