# ME425 Syllabus
# Fall 2023

## Class meetings

TH 9 - 10:45 am

PHO 201

## Textbooks

1) J. Anderson, *Modern Compressible Flow*, 4th ed --McGraw-Hill
2) Flack, *Fundamentals of Jet Propulsion with Applications* – Cambridge University

## Other Reference Texts

-- Sutton and Biblarz, *Rocket Propulsion Elements*, 7th ed. – Wiley  (and other older editions by Sutton)
-- Kuethe and Chow, *Foundations of Aerodynamics*, 4th Ed. McGraw-Hill, 1986
-- Mattingly, *Elements of Gas Turbine Propulsion*
-- Hill and Peterson, *Mechanics and Thermodynamics of Propulsion* - 2nd Ed. , Addison Wesley
-- Archer and Saarlas, *An Introduction to Aerospace Propulsion* – Prentice Hall

## 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)
- Diffferential Conservation Equations, Substantial (Material) Derivative,  Chap 6 (JA)
- Transonic flows, numerical methods. Chap. 14 (JA) + notes
- Thermodynamic cycles, thrust. Chap 1 (RF)
- 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)

## Projects and labs

There are several computational projects in the course:
Other computational assignments may be included if resources permit.
1) Students will develop a matlab code for computing the lift around a supersonic double wedge airfoil.
2) Students will develop a matlab code for computing the profiles for viscous internal flow, using finite difference approximations to the differential equations of motion.
3) Students will develop a suite of matlab codes for performing cycle analysis for various engines.

# General course information

<u>Exams</u> The plan is to have two exams (one midterm and one final - during the finals period). It is encouraged that you develop a note sheets with helpful formulae etc.

<u>Homework</u>, which will be assigned in class and noted on the course web page is due at the beginning of the designated class period (unless otherwise noted.) All homework will be graded and returned. The top of the first page of the homework should have: your name and the course number. Every page should have the problem number on the top right corner. There should be no frayed edges and multiple pages must be stapled. You should briefly restate the problem ( some even make a photo copy and tape the problem statement to the page ). Give a sketch if helpful. List the basic assumptions. Give all necessary analysis. If asked to plot something, you must create a computer generated graph with appropriate axis labels and legend. Place a box around the final answer. Correct units should accompany all numerical answers. **Any answer that is not of the correct order of magnitude, with no accompanying explanation, will be given no points, even if the method used to do the problem is correct.** Homework solutions will be accessible after the assignment is due.

<u>Honesty policy:</u> 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 counter-example, 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 a 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 the 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.

<u>Inclusion:</u> 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.

<u>Accommodations for Students with Documented Disabilities:</u> 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/*