# MECH 480A8: Propulsion

10:50 pm – 12:05 pm Monday/Wednesday
Location: CENT 191

Dr. Bret Windom (He | Him | His | They)
bret.windom@colostate.edu
Phone: 970-491-7794
Office Location: ENG A103T
Office Hours: Monday and Thursday: 3-4 pm (or by appointment)

**Teaching Assistant**
TBA
Office Location: TBA
Office Hours: TBA

**Course Objectives**

- Aerospace Concentration: MECH 480A8 – Propulsion is one of the core required courses for the newly established Aerospace Concentration in the CSU Mechanical Engineering Department.
- Following completion of this course students will:
    - Learn principles of thermodynamics and fluid dynamics required to characterize propulsion systems including foundational concepts of thrust, compressible flow, and boundary layer theory.
    - Apply propulsion principles to understand characteristics of operation and analysis of common air breathing propulsion systems (turboprop, turbofan, turbojet, and hypersonic systems) and their respective components
    - Apply propulsion principles to understand characteristics of operation and analysis of chemical rocket systems.

**Prerequisites**

- MECH 342 (Fluid Dynamics)

**Course Text**

- P. Hill & C. Peterson, Mechanics and Thermodynamics of Propulsion, 2nd Edition, Addison-Wesley, 1992.

**Additional Resources**

- Mechanical Engineering Student Ambassadors (MESA) tutors are available for additional help. For MESA hours and other tutoring resources please visit: https://www.engr.colostate.edu/me/tutoring/

**Grade Breakdown**

| | |
|---|---|
| Homework/quizzes: | 25% |
| Exam 1 (in class): | 25% |
| Exam 2 (in class): | 25% |
| Final Exam: | 25% |

# Course Outline

| Week | Topic | Reading |
|---|---|---|
| 1 | Course Introduction / Principles of Propulsion | Ch. 1 |
| 2 | Thermodynamics of flow | Ch. 2 |
| 3 | Thermodynamics / Steady 1-D flow | Ch. 2 and Ch. 3 |
| 4 | Compressible flow / Shocks | Ch. 3 |
| 5 | Shocks / Boundary layer / Heat transfer | Ch. 3 and Ch. 4 |
| 6 | Review / **Midterm Exam #** | |
| 7 | Jet Engines: Thrust, Efficiency, Performance | Ch. 5 |
| 8 | Jet Engines / Inlets, Combustors and Nozzles | Ch. 5 and Ch. 6 |
| 9 | Inlets, Combustors and Nozzles / Compressors and Turbines | Ch. 6, Ch. 7, and Ch. 8 |
| 10 | **Spring Break – No Class** | |
| 11 | Compressor and Turbines / Hypersonic Propulsion | Ch. 6, 7, 8 |
| 12 | Review / **Midterm Exam #2 (Apr. 8)** | |
| 13 | Introduction to Rockets | Ch. 10 |
| 14 | Chemical Rockets | Ch. 11/12 |
| 15 | Chemical Rockets / Advanced Concepts | Ch. 14 |
| 16 | Advanced Concepts / Review | |
| 17 | **Final Exam** | |

- Material coverage is tentative and subject to change.
- The Exam dates are final. There will be no makeup exams except for University approved absences.

# Course Policies

**Online Course Updates**

In response to COVID19 the class will operate in a hybrid mode to accommodate students completing course via the online section and those who wish not to be present at live lectures.

Though most of the course remains the same, the following changes have been made to accommodate an online offering:

- 50-minute lectures will be streamed live through MS Teams and alos recorded and uploaded to Canvas for later viewing. It is up to the students to view these recordings ahead of assignments and exams, just as it was the student's responsibility to attend lectures.
- The assignments will remain unchanged except that all handwritten portions must be submitted online through Canvas. Please ensure uploads are legible and easy to follow, else points will be taken off.
- Office hours and the Learning Sessions will be held virtually through MS Teams. The times of the help sessions will remain the same as noted above.
- Midterms and Final Exams will be assigned through Canvas at the originally scheduled days and times (1p for Midterms). The dates are provided to you on the first day of class and have remained unchanged.
- Midterms will be 50-minute exams with an additional 10 minutes to allow for uploading of the solutions to Canvas. I reserve the right to refuse to grade any exam submitted after the allotted time has expired. I will provide an emergency contact for you to immediately reach out to if there is any trouble uploading your exam solutions, but it will be up to you to judge your time accordingly.
- The 2-hour final exam will be held at the same time as originally scheduled and will also be administered through Canvas.
- The same academic integrity standards are in place as before and will be upheld. Everyone is here to learn, and I expect everyone to put in the same required effort to learn and prepare for a professional engineering career.
- Lastly, changes to add/drop periods are being implemented school wide. Please reach out to your academic advisors to learn more about your options when it comes to dropping the course and the associated deadlines.

## Course Website and Online Content

- The class Canvas site will provide access to the Wiley Plus material. Wiley Plus will be used to administer homework assignments, solutions, and reading assignments. Announcements and grades will be posted on Canvas. I recommend visiting the site often to stay up to date.

**Anything posted on Canvas is the student's responsibility!!!**

- It is the student's responsibility to verify grades versus returned assignments. If an error has occurred, either in grading or in inputting to Canvas, please bring it to the instructor's attention. No grades, except the final exam, will be updated after the start of the final exam.

## Academic Integrity

- The instructor reserves all right and judgment regarding incidents involving academic integrity.

- The following website contains information from Colorado State University regarding Student Codes of Conduct and Academic Dishonesty. As a student in this course, you are held to the Student Codes of Conduct and the Academic Dishonesty clauses. You should become familiar with the information contained on the CSU website regarding these issues.
    - http://resolutioncenter.colostate.edu/conduct-code/
    - http://www.ssw.chhs.colostate.edu/field/files/Field%20Manuals/Policies/CSU%20Policy%20on%20Academic%20Dishonesty.pdf.

## Coursework

- A portion of the assignments will be completed through Wiley Plus, and there will be one or two problems which you will complete by hand and turn in at the beginning of the class period they are due. It is considered late and will not be accepted, resulting in a **zero** for the assignment, if submitted after the due date corresponding to the beginning of class.
- Homework solutions must be legible and easy to follow. Problem solutions which are illegible or difficult to read will not be graded and will be given a zero.
- All assignments are posted on ***Canvas***. The homework assignment and due date will be posted under the "Assignments" tab.
- You are allowed to discuss **qualitatively** with other students the concepts required to solve homework problems.

**However, copying or in any way using the written work of another person as well as relaying or receiving solutions via any means (including solutions manuals) is strictly prohibited and considered cheating.**

- The intent of this policy is to allow you to share ideas, discuss concepts, and clarify processes when needed. This policy requires you to **independently** prepare the detailed solution to homework problems.
- Quizzes, Projects, and Exams are to be **INDIVIDUAL EFFORT** and **NO COLLABORATION** is acceptable.
- **In general, no late homework or Exams will be accepted**.
    - The exam dates are set and given in the course outline. If you expect to miss an exam, you must notify me **As Soon As Possible.** If you do not notify me before the exam and we have not developed an alternative plan, you will receive a zero on the exam.
    - If you will be absent the day an assignment is due it is your responsibility to notify me and make arrangements to turn in the assignment before class.
    - I will accept electronic submissions for assignments as long as the email or Canvas posting timestamp is received before the start of class.

## Cheating Policy

- Students caught using other students' material, or using material not their own (this includes, but not limited to, the use of solutions manuals, copying from your peers on exams or homework assignments, using prohibited materials on exams, and plagiarism on written assignments) will receive an **"F"** for **failing the course due to academic integrity**. **This is your only warning.**

## Disability Services

- If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact and register with the Disability Services Office, and provide them with documentation of your disability, so they can determine what accommodations are appropriate for your situation. To avoid any delay in the receipt of accommodations, you should contact the Disability Services Office as soon as possible. Please note that accommodations are not retroactive, and that disability accommodations cannot provided until an accommodation letter has been given to me. Please contact Disability Services for more information about receiving accommodations at the General Services Building room 100, 970-491-6385 or Rose.Kreston@colostate.edu.

## Dropping the Course

- Last day to withdraw from course is March 23, 2020 (https://registrar.colostate.edu/faculty-staff/important-dates/)

## Classroom Etiquette

- Students may not listen to any electronic device or answer their cell phone in class. If you need to answer an important call or text, please leave the room. Disruptive students will be asked to leave for the remainder of class, will not be able to make up missed material, and will be required to meet with the Dept. Head.