

**AE433  
Aerospace Propulsion  
Fall 2024**

**SUMMARY of Important E-Platforms for this Course**

- Gradescope - <https://www.gradescope.com/> - for downloading and uploading homework and exams, post-class quizzes, and tracking your grades and performance in the course. Entry Code: 3RDP32
- CANVAS - <https://canvas.illinois.edu/> - for announcements and course handouts
- Media Space – <https://mediaspace.illinois.edu/channel/channelid/350018042> - lecture videos

**Pre-Requisite:** AE 312 and Phys 212

**Credit:** 3 undergraduate hours. 4 graduate hours

**Instructor:** J.L. Rovey, 317 Talbot Lab, Phone: 217-300-7092, email: [rovey@illinois.edu](mailto:rovey@illinois.edu)

**Class Time and Location:** MWF, 2:00-2:50 p.m., 1320 Digital Computer Laboratory (DCL)

**Office hours:** Weds 3-4pm in my office and on ZOOM, and by appointment

Meeting URL: <https://illinois.zoom.us/j/81647897142?pwd=axwaESoRNXUuACrCppUccgNXMkqtKe.1>

Meeting ID: 816 4789 7142

Password: 519980

**Teaching Assistants (all office hours on zoom and in-person):**

Justin Shell [jkshell2@illinois.edu](mailto:jkshell2@illinois.edu) OH TBD - lead for grading

Sandeep Murthy [smurth2@illinois.edu](mailto:smurth2@illinois.edu) OH TBD - lead for CANVAS discussion boards

Meeting URL: <https://illinois.zoom.us/j/81647897142?pwd=axwaESoRNXUuACrCppUccgNXMkqtKe.1>

Meeting ID: 816 4789 7142

Password: 519980

**Course Assistant:** TBD - grading assistance

**Course Description:** Fundamentals of airbreathing jet propulsion devices; prediction of thrust, combustion reactions, specific fuel consumption, and operating performance; ramjets; turbojets; turbofans; turboprops; aerothermodynamics of inlets, combustors, and nozzles; compressors, turbines; component matching.

**Course Objectives:**

The purpose of this course is to develop a mastery of the fundamental concepts of the mechanics and thermodynamics of propulsion devices including the analysis of air-breathing and rocket engines.

***This is a Note-Intensive Class!***

***All Lecture Notes are provided as a PDF in CANVAS on the first day of class.***

***Much of the material is given only in lecture notes.***

***YOU are responsible for attending class and taking notes.***

***The text is important but only supplementary to the notes.***

**Recommended Text:** Mechanics and Thermodynamics of Propulsion, Philip Hill & Carl Peterson

**Other Useful References:** Mattingly, Elements of Propulsion: Gas Turbines and Rockets, AIAA Education Series, Modern Compressible Flow, 3<sup>rd</sup> Edition, John D. Anderson, Rocket Propulsion Elements, George P. Sutton & Oscar Biblarz, Aerothermodynamics of Gas Turbine and Rocket Propulsion, 3<sup>rd</sup> Edition, Gordon Oates.

**Grading:**

Letter Grade	Score
A	93 and above
A-	90-93
B+	87-90
B	83-87
B-	80-83
C+	77-80
C	73-77
C-	70-73
D	60-70
F	<60

**Weighting:**

Exam 1	20%
Exam 2	20%
Homework (~11 assignments+GasTurb project)	25%
Final Exam	35%

There are **NO** make-up exams. The final exam is cumulative (it covers everything). Homework will be due at the beginning of class. Late Homework will **NOT** be accepted. If I cannot read it, I will not grade it. This applies to both homework & exams. Homework is available on and turned in through Gradescope.

**Course Schedule:**

WEEK	TOPIC	READING: *
<b>FUNDAMENTALS</b>		
26-Aug	Introduction, Thermodynamics Review	N Ch 1&2, O Ch. 1&2, M Ch. 1&2, A 1.4
2-Sep	Conservation Equations	N Ch 3, O Ch. 2, M Ch. 2, A Ch. 2
9-Sep	Compressible Flow Review – <i>YIKES!</i>	N Ch 4, O Ch. 2, M Ch. 2, A Ch. 3, 4, 5, HP Ch. 3
16-Sep	Compressible Flow, Combustion	N Ch 4&5, M Ch. 2.11, HP Ch. 2.4
23-Sep	Combustion – CEA	N Ch 5, M Ch. 2.11, HP Ch. 2.4
<b>EXAM 1 – Fundamentals Fri. 10/4</b>		HW 1-5
<b>AIRBREATHING</b>		
30-Sep	Thrust, Efficiency, Brayton Cycle	N Ch 10, O Ch. 5, M Ch. 4, HP Ch. 5.2
7-Oct	Direct Computation, Ideal Cycle Analysis	N Ch 10&11, O Ch. 5, M Ch. 5, HP Ch. 5.3, 5.4, 5.5
14-Oct	Ideal Cycle Analysis	N Ch 11, O Ch. 5, M Ch. 5, HP Ch. 5.3, 5.4, 5.5
21-Oct	Inlet, Burner, Nozzle	N Ch 12, O Ch. 6, M Ch 6, HP Ch 6, 7, & 8
28-Oct	Compressor	N Ch 12, O Ch. 6, M Ch 6, HP Ch 6, 7, & 8
4-Nov	Turbine	N Ch 12, O Ch. 5, M Ch. 5, HP Ch. 5.3, 5.4, 5.5
<b>EXAM 2 – Airbreathing Fri. 11/15</b>		HW 6-11
<b>GASTURB SOFTWARE</b>		
11-Nov	GasTurb Software	
18-Nov	GasTurb Software	
25-Nov	FALL BREAK WEEK	REVIEW FOR THE UPCOMING FINAL EXAM
<b>ROCKETS</b>		
2-Dec	Rocket Analysis, Rocket Equation	N Ch 6, O Ch. 3, M Ch. 3, HP Ch. 10
9-Dec	Thrust Chamber Analysis	N Ch 8, O Ch. 3, M Ch 3.4, A Ch. 5.4, S Ch. 3.3
<b>FINAL EXAM Tuesday 12/17 1:30-4:30PM</b>		

**Exams:**

Exams will be in-person on the dates given in the course outline. The exam location may not be the same as the course lecture location (exact location(s) TBD). Exams 1&2 are 50 minutes each and the final exam is max 3 hours. Exams are typically structured with a closed-book, closed-notes section first (multiple choice), followed by an open-book, open-notes section. There is no lecture class on exam days. Final Exam is cumulative, covers the entire course.

\* N = Notes, O = Oates, M = Mattingly, A = Anderson, HP = Hill & Peterson, S = Sutton, Ch = chapter

**Post-class Quizzes:**

The post-class quiz is designed to help you raise your grade. After each lecture, I will post a short (usually 1 question) quiz on GradeScope. Each quiz will be worth 2 points. Each quiz becomes available to you immediately after class and must be completed within 24hrs. Since there are roughly 40 lectures (43 class days – 3 exam days = 40 lectures), you can obtain a maximum of 80 pts with the quizzes. At the end of the semester, I add these points to your earned homework points (numerator) without adjusting the total possible points (denominator). It is possible to have >100% on homework. What does this mean in terms of your final grade? Let's assume you have a 75% on every assignment and exam throughout the semester. If you got all 80 pts from the quizzes, your final course grade is not 75% = C, it's 82% = B-.

**4 Credit Hour Students:**

Some of you may be enrolled for 4 credit hours. Students enrolled in 4 credit hours will complete 2 additional homework assignments (in addition to the ~11 assignments + GasTurb project a 3 credit hour student will complete). Your score on these additional homeworks is added to your overall earned homework points (numerator). The total possible points for these additional homeworks is also added to your total possible homework points (denominator). Therefore 4-credit and 3-credit hour students have different total possible homework points available.

**Communication:**

Please check your email daily. I also plan to use CANVAS to post HW, handouts, announcements, etc. <https://canvas.illinois.edu/>

**Academic Dishonesty:** Violations of academic integrity are unacceptable. Review the University of Illinois student code section on Academic Integrity and Procedure for more information.

<https://studentcode.illinois.edu/>

**Emergency Response:**

Emergency response recommendations are provided by the University of Illinois Police Department. Review those procedures at: <http://police.illinois.edu/safe>

- <http://police.illinois.edu/safe> for more information on how to prepare for emergencies, including how to run, hide or fight and building floor plans that can show you safe areas.
- <http://emergency.illinois.edu> to sign up for Illini-Alert text messages.
- Follow the University of Illinois Police Department on Twitter and Facebook to get regular updates about campus safety

**COVID:**

Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community. Students are also required to follow the campus COVID-19 protocols. <https://covid19.illinois.edu/> Face coverings are not required in classrooms or any campus spaces.

**Belonging statement:**

A feeling of belonging and inclusion is critical to the success and health of our community. The Aerospace Engineering department has a committee called Aero's Space to Belong. They offer office hours, one-on-one discussion, and a reporting process. If you experience conflict that undermines your or someone else's feelings of belonging, please consider using these resources:

<https://aerospace.illinois.edu/diversity/reporting>