

ME 200 – THERMODYNAMICS

SUMMER 2024

SYLLABUS

Course Description: Introduction to classical thermodynamics through first and second law; system and control volume analyses of thermodynamic processes; irreversibility and availability; relations for ideal gas mixtures

Prerequisites: MATH 241

Instructor and TA: Jiajun He (Instructor) Email: jiajunhe@illinois.edu
Sadman Sakib (TA) Email: ssakib2@illinois.edu

Class Meetings: Mon, Wed, and Fri 8:00 am – 9:50 am via Zoom. The class sessions will be held synchronously unless otherwise noticed. Recordings will be provided after each class session. Attendance will not be taken, but you are expected to attend every class session or watch every recorded video.

Zoom link to the lectures:

<https://illinois.zoom.us/j/82163234903?pwd=eG9ib2FkTjZpek1iZ3RaS3h3YzVSUT09>

Office Hours: Office hours will be held via Zoom.

Jiajun He: Mon 2:00 pm – 3:00 pm,

<https://illinois.zoom.us/j/84355796893?pwd=NzExeTBaN3ZPTU54dkFZbmFvWm9lQT09>

Sadman Sakib: TBD
TBD

Additional office hours by appointment.

Course Website: Canvas (<https://canvas.illinois.edu/>)

Homework assignments and solutions, supplementary handouts, and other relevant information will be made available through the Illinois Canvas site.

Textbook: Fundamentals of Engineering Thermodynamics, 9th Ed., 2018
Moran, Shapiro, Boettner, and Bailey, ISBN: 9781119456285

Important notes:

- Homework will be assigned from this textbook.
- Textbook will be used on **the midterm and final exams**.
- Either a hard copy or electronic copy is fine.
- An earlier version of the textbook can be used, but please pay attention to the potentially different numbering of the homework problems in different versions.

Homework: Homework assignments will be posted each week through the Illinois Canvas site. Assigned problems will be from the textbook listed at the end of each chapter under “PROBLEMS: DEVELOPING ENGINEERING SKILLS” (make sure you work on the correct problems). **Homework must be turned in through Compass by the deadline.** Late assignments may be emailed to me or the TA within 24 hours from the deadline for a 20% penalty. No further assignments will be accepted after the 2nd deadline. One low homework grade will be dropped when computing the final grades. **Approximately 7 or 8 problems will be**

assigned each week, and you are responsible for the content of all assigned problems. However, **only the first five (5) will be graded** for credit. Grading is effort based. You would need to show your steps to receive full credits regardless of whether you show the correct answers. There will be 7 homework assignments throughout the semester. The lowest grade will be dropped when the final grade is calculated.

Solutions to all assigned problems will be posted on the class website after the late homework deadline. Collaboration on homework is encouraged, but every student needs to submit his or her own homework.

Extra credits: If you complete ALL the optional problems showing steps, you will receive 5 extra points. That means you will receive a total score of 105 for that specific homework assignment. This score will be used to calculate your final grade of the course.

If you need help on the homework, use the following resources:

- Get help from a classmate, but do not copy their solution. Discussion among students to understand homework problems or to prepare for quizzes/exams is encouraged. Working in a group on the homework can be an excellent way to learn the material; however, do not get in the habit of letting others do the thinking for you. Do not divide up the problems, but help each other when you get stuck. Remember that every student will be individually accountable for the material on the quizzes and the final exam.
- Get help from the instructor and/or TA (in class or during office hours)

Exams:

There will be a **2-hour midterm** to be held during the semester, and a **comprehensive 3-hour final exam** to be held at the end of the semester. Dates will be announced later. Makeup exams will only be permitted by prior arrangement and only for reasons described in the U of I Student Code. The exams will be conducted remotely with synchronous proctoring. A web camera is required to facilitate the proctoring process.

The midterm and final exams will be open books and notes. The use of lecture recordings, slides, and homework assignments is allowed. However, you may not communicate with any other person by any means about the exam until the exam scores are released. You may use a calculator or Excel for calculation. No other program is allowed. Use of the internet by any means is not allowed.

Students missing the exam without a valid excuse, and those who neither notify the instructor of their absence before the exam begins nor are exempt based on incapacitation (see below) will receive a grade of zero on the final exam. Students with a valid excuse for missing the final exam, and who either notify the instructor before the beginning of the exam or present documentation of incapacitation, might be eligible to receive a grade of "Incomplete." (Note that this grade is not awarded by the instructor, but rather by the College of Engineering upon recommendation by the instructor and department.)

Excused Absences from Exams:

The only valid reasons for missing an examination are:

- a) student illness or accidental injury;
- b) serious illness, serious injury, or death in the student's family;
- c) birth of a child for which the student is identified as a parent on the birth certificate;
- d) cancellation of transportation by a scheduled carrier, for which the student had a confirmed reservation, provided that no alternate ground or air transportation (scheduled carrier, rental, or chartered, regardless of cost) would have returned the student in time for the exam;
- e) required duty in the U.S. military (active-duty, reserve, or in a National Guard unit activated by the President or a governor), required service in a foreign military organization acting in concert with the United States, or service under provisions of the Volunteer Emergency Worker Job Protection Act;

- f) participation in, or travel to, an obligatory AFROTC, NROTC, or ROTC event;
- g) participation in, or travel to, varsity or DRES-sanctioned athletic events (excludes fencing, bowling, and other club sports);
- h) participation in, or travel to, an organized extracurricular activity sanctioned by the College of Engineering or one of its departments, for which a full-time or emeritus faculty member of the College of Engineering attests that the student's participation is essential; and
- i) observance of a religious holiday.

With only the exception identified in the following sentence, all exam absences will be classified as unexcused unless the student notifies the instructor (at jjjunhe@illinois.edu) of the absence prior to the scheduled beginning of the examination. If the student was so seriously ill or injured as to be unable to communicate his or her absence to the instructor prior to the beginning of the exam, the advance notification requirement will be waived if the student subsequently provides satisfactory documentation of such incapacitation.

In those cases where advance notification of absence has been provided, or where such notice has been waived according to the provisions of the second sentence of the above paragraph, exam absences will be classified as unexcused unless the student provides satisfactory after-the-fact documentation, as indicated below.

For illness or injury of the student, a satisfactory letter stating that the student was medically unfit to take the examination at the prescribed time must be provided by an appropriate medical practitioner (C.N.P., D.D.S., D.M.D., D.O., D.P.M., M.D., O.D., or P.A.) after the missed examination. Medical bills, prescriptions, e-mail or letters from friends or relatives, letters from naturopaths, chiropractors, psychologists, and mental health counselors, "visit slips" from McKinley Health Center, and records of calls to McKinley Health Center's Dial-a-Nurse program (with or without endorsement by an "emergency dean" in the Office of the Dean of Students) are among the types of documentation that will not be accepted.

For serious illness, serious injury, or death in the student's family, the student's relationship to the ill, injured, or deceased party must be established, along with documentation of the illness, injury, or death.

For birth of a student's child, a photocopy of an original birth certificate, showing the student as a parent, is required.

For cancellation of service by a scheduled carrier, the student must present documentation showing that (s)he had purchased a return ticket prior to the cancellation.

For military duty, copies of valid orders are required.

For participation in or travel to varsity or DRES-sanctioned athletic events or AFROTC / NROTC / ROTC events, a satisfactory letter from the Division of Intercollegiate Athletics, DRES, or the commanding officer of the detachment is required.

For participation in, or travel to, an organized extracurricular activity sanctioned by the College of Engineering or one of its departments, a satisfactory letter from the faculty sponsor is required.

Grading Policy:

Final course grades will be calculated based on the following scheme:

- Homework 40%
- Midterm exam 30%
- Final exam 30%

Final letter grades will be assigned based on the scale below.

<i>Letter Grade</i>	<i>Final Course Average</i>
A+	97 – 100
A	94 – 96
A-	90 – 93
B+	87 – 89
B	84 – 86
B-	80 – 83

C+	77 – 79
C	74 – 76
C-	70 – 73
D+	67 – 69
D	64 – 66
D-	60 – 63
F	0 – 59

For final grades that are very close to the cutoff lines (**less than 0.5 below the cutoff**, e.g., 96.5, 93.5, ...), the upper letter grade will be given. The instructor has no predetermined ‘target’ grade distribution, and the distribution can vary significantly from semester to semester.

Academic Integrity:

The highest academic integrity is expected. Academic violations will however be dealt with according to the UIUC Student Code, Article 1, Part 4. Violations will be reported to the College of Engineering. The recommended penalty will be either failure of ME 200, or failure of ME 200 and separation from the College of Engineering or UIUC.

Specific comments about academic integrity

- All students are responsible to refrain from infractions of academic integrity, conduct that may lead to suspicion of such infractions, and conduct that aids others in such infractions. “I did not know” is not an excuse.
- The following are academic integrity infractions (<http://www.provost.illinois.edu/academicintegrity/students>):
 - Cheating: using or attempting to use unauthorized materials.
 - Plagiarism: representing the words, work, or ideas of another as your own.
 - Fabrication: falsification or invention of information, including citations.
 - Facilitating infractions of academic integrity, helping or attempting to help another commit infraction.
 - Bribes, favors, and threats: actions intended to affect a grade or evaluation.
 - Academic interference: tampering, altering, or destroying educational material or depriving someone else of access to that material.
 - Note: All infractions are documented in the campus-wide FAIR database.
- If you have difficulty completing your homework or quizzes, you should consult the instructor by showing him evidence of your attempts to solve the specific problem/s. However, most in-class time has been set aside exactly for this type of activity; use it to your full advantage.
- You are encouraged to freely discuss the homework among one another as you formulate your solutions individually. In practice, this means that copying (in whole or in part) another student’s homework, quiz, exam, or assignment is not permitted. Copying homework from web-based answer keys is also considered to be an honor code violation. If you choose to discuss your work with a fellow student, it should be a discussion in which one teaches the other, or where both work to a mutual understanding.
- It is not acceptable to give a fellow student your completed homework or quiz or other assignment so that (s)he can copy it. In such a case, both you and your fellow student will have committed an academic violation.
- It is unacceptable to copy work from a student who completed the course previously.
- You should properly cite references and sources in your written reports. Cases of cheating or plagiarism will be handled severely. Also, be weary to correctly use quotation marks for sentences or important data that did not originate ^[SEP]with you. Further, paraphrasing should be kept to a minimum. When used, the paraphrased section should be specifically identified by citing the original source. It is not sufficient to simply provide a list of references but not indicate where a specific quotation or paraphrase was employed. In addition, all sources should be fully cited. As is done in scientific and engineering literature, you should briefly acknowledge in writing any significant discussions or interactions you had regarding the work you are reporting on.

Ignorance of academic integrity or uncertainty regarding the instructor’s wishes are not

justifiable reasons for academic violations. If you are uncertain of the instructor's wishes or intentions, you should consult with him before acting.

Course Schedule:

Course Calendar: ME 200 – Summer 2024

Lecture		Week	Date	HW Due	Topic	Reading
1	M	1	Jun 10		Course intro, introductory concepts: system, boundaries, properties, state, process, equilibrium, temperature, pressure, phase change, specific heats, P-v-T property relations, thermodynamic tables and diagrams, table interpolation.	1.1-1.9
2	W		Jun 12			3.1-3.11
3	F		Jun 14			
4	M	2	Jun 17		Ideal gas law, using ideal gas for properties, polytropic processes, First Law, energy, work and heat, closed system energy balance, thermodynamic cycles	3.12-3.15
5	W		Jun 19 (no class)	HW1		2.1-2.6
6	F		Jun 21			3.8
7	M	3	Jun 24		Control volume analysis, open system energy balance, components of thermal systems and analysis, Second Law, irreversibility, cycle efficiencies	4.1-4.12
8	W		Jun 26	HW2		5.1-5.7
9	F		Jun 28			
10	M	4	Jul 1		Carnot cycle and efficiency, entropy, isentropic process Entropy balance: open and closed systems	5.8-5.11
11	W		Jul 3	HW3		6.1-6.11
	F		Jul 5	Midterm		
12	M	5	Jul 8		Isentropic efficiency: compressors and turbine, power generation Vapor power systems: Rankine cycle, power plants, comparison to Carnot, Rankine cycle improvements	6.12
13	W		Jul 10	HW4		8.1-8.5
14	F		Jul 12			
15	M	6	Jul 15		Gas power systems: Brayton / gas turbine cycle Otto and Diesel cycles	9.5-9.11
16	W		Jul 17	HW5		9.1-9.4
17	F		Jul 19			
18	M	7	Jul 22		Refrigeration and heat pump cycles: vapor compression Ideal gas mixtures, psychrometrics	10.1-10.7
19	W		Jul 24	HW6		12.1-12.9
20	F		Jul 26			
21	M	8	Jul 29		Additional topics, review, course evaluation	
22	W		Jul 31	HW7		
			TBD	Final		