

San José State University
Mechanical Engineering
Department
ME 113: Thermodynamics – Section 2, Fall 2022

Course and Contact Information

Instructor:	Prof. Abdie Tabrizi
Office Location:	Engr 348
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Office Hours:	Tuesday/Thursday 8:00 – 8:30 AM (Also by appointment)
Class Days/Time:	Tuesdays/Thursdays 8:30-10:10 AM
Classroom:	Engr 303
Prerequisites:	Phys 52, and Math 32, with a C- or better in each
Course Website:	To access lecture material/homework/exams, click on the McGraw Hill Connect link from the canvas website.
Course Format	Weekly, TTR (on-campus lectures)

Canvas and Connect

All lectures will be delivered through in-person classroom meetings (unless required to go online due to COVID) using board work, written notes, discussion, PowerPoint, and the assigned textbook material. Communications will be done via my office hours, in-class information, email, and appointments, if possible. You are responsible for keeping up-to-date with the latest information about the course. Homework will be available through a link to the textbook publisher at the course canvas site. Announcements and discussion topics will be through the canvas site. To use Canvas, go to <http://mysjsu.edu> click “Canvas,” and log in with your 9-digit SJSU ID and password. If you have any questions about using Canvas, please see me or visit the following link:

http://www.sjsu.edu/at/ec/canvas/student_resources/index.html

All homework will be posted, submitted, and graded via a separate online system called McGraw-Hill Connect. You are required to purchase access to the Connect site to access the ebook, homework, and other instructional material. You will receive an email (and an announcement posting) regarding your textbook. To complete homework, you will need regular access to a computer (tablet, laptop, or desktop) with access to the internet. If you require special accommodation(s), please contact me ASAP at the start of the semester. The McGraw-Hill Connect system has been integrated into the Canvas so you do not need to access two different

websites. Of course, you still need to purchase access to the Publisher material through the Connect link within Canvas.

Course Description

This class covers properties of simple compressible substances, ideal gas and other equations of state, and the first and second laws of thermodynamics. Power cycles, refrigeration cycles, gas mixtures, and gas-vapor mixtures are also included.

Course Learning Outcomes (CLO)

Upon completion of this course, the student should be able to

1. Discuss the causes of ozone depletion and global warming and the uncertainty involved in making long-term environmental predictions.
2. Discuss basic thermodynamic terms, such as enthalpy, entropy, specific and relative humidity, dew point, and adiabatic saturation, and wet-bulb temperatures, in simple enough terms that someone outside the field of thermodynamics could understand what they are.
3. Understand how energy transfer processes (heat and work) affect the thermodynamic state of pure substances. This involves the ability to
 - a. Use tabulated data, equations of state, and the computer program EES to determine the phase and properties (temperature, pressure, specific volume, internal energy, enthalpy, and entropy) of a pure substance.
 - b. Analyze the thermodynamic performance (i.e., calculate work or heat input or output, mass flow rates, and first and second law efficiencies) of common steady-flow engineering devices such as pumps, compressors, turbines, nozzles and diffusers, expansion valves, heat exchangers, and mixing chambers using the first and second laws of thermodynamics and the conservation of mass.
 - c. Apply the first law of thermodynamics to simple unsteady-flow problems.
 - d. Explain the physical aspects of the first and second law of thermodynamics, and apply them to solve real engineering problems
4. Understand the operation of basic energy conversion devices and be able to analyze their performance, including calculation of work, heat input or output, mass flow rates, and first law efficiencies. This involves the ability to
 - a. Analyze the performance of a simple Otto cycle and Diesel cycles
 - b. Analyze the performance of a simple Brayton cycle and one with regeneration.
 - c. Analyze the performance of a simple Rankine cycle and one with reheating and regeneration.
 - d. Analyze the performance of a simple vapor compression cycle.
 - e. Use EES to model and optimize thermodynamic cycles.
5. Understand engineering systems involving non-reacting mixtures and be able to analyze their thermodynamic performance. This involves the ability to
 - a. Calculate properties of ideal and real gas mixtures.
 - b. Explain why condensation forms use technical terms.
 - c. Analyze different air-conditioning and cooling processes involving air-water vapor mixtures.

Required Texts/Readings

Textbook

The textbook for this course is the 9th edition of *Thermodynamics: An Engineering Approach*, by Çengel and Boles. At a minimum, you need access to the Connect site where the course material is located. In addition to the Connect access, you may also purchase a printed copy of the book (an older version will suffice), if you like to have it for offline reading.

Other Materials

You will use Canvas and McGraw-Hill Connect regularly; see details above.

Course Requirements and Assignments

Prerequisites

To enroll in this course, you must have completed Phys 52 and Math 32, with a C- or better in each. You must turn in an unofficial transcript with the prerequisites highlighted by **the second lecture of the semester**, or you will be dropped from the class.

Expected Time Commitment

SJSU classes are designed such that to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

Effort and course performance are strongly correlated. I don't give A's for effort, but putting the time and energy into this class will give you a much better chance of performing well. You should plan to spend 2-3 hours outside of class for every lecture hour of class; for a 4-credit class such as this one, you should expect to spend 8-12 hours outside of class every week. Some students may spend more or less time than this, but this is a good guideline. How you spend this time is dependent on how you best learn, but I would suggest reviewing your notes, reading pertinent sections of the book, doing or redoing homework problems, and completing LearnSmart activities (discussed subsequently).

Class Attendance

NOTE that **University policy F69-24** (<http://www.sjsu.edu/senate/docs/F69-24.pdf>) states that “Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to ensure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading.” However, class participation earns recognition. Extra credit opportunities, if any, are **only available to those without absences**.

Make-up for any missed activity in class, such as a quiz, will only be given for a substantiated medical excuse.

Homework

There will be chapter assignments throughout the semester. Homework will be assigned for every chapter, and it will be due Thursday of the following week at 11:00 PM unless otherwise announced. All homework is done via the McGraw-Hill Connect website. Some assignments will require you to scan and upload a solution done by hand. These uploads must be *.doc, *.docx, or *.pdf files. It is **your responsibility** to make sure that the scanned document is legible; many cellphones can take a legible photo, but please double-check before submitting it. If you are unable to scan and upload these files, please ask me for help.

For problems done by hand, please include the following:

- List your name, date, and homework assignment number at the top of your assignment.
- Summarize the problem statement before beginning each problem. Give enough information that you could return to this problem a month or a year from now and understand what it is asking without looking up the problem in the book.
- Drawing a figure may be helpful as well, particularly on more complex problems.
- List all assumptions.

- Write down all equations in the symbolic form first, before plugging in numbers.
- Write units next to all equations! This will keep you from making mistakes. If you learn nothing else from this class, please learn to keep track of your units.

No late homework will be accepted without a university-authorized excuse; however, **one lowest homework score will be dropped.**

LearnSmart Exercises

There will be LearnSmart assignments per chapter throughout the semester. These are guided readings with theory-based questions, and they reinforce the course material. They are structured so that if you get a question wrong, it will ask you more questions on the same topic until you achieve 100% completion. These due dates coincide with our completion of the corresponding material in class.

Gateway Essay

One short essay related to a contemporary environmental issue will also be assigned. This essay is a “Gateway Assignment”, **and it must be passed with a 70% or better to pass the class.** If you don't pass the first time, you will be allowed to revise and resubmit within four days after notification. However, the best grade you can get after resubmission is 70%.

Copying any portion of your essay from another student or a book or website without appropriate citations **constitutes plagiarism and will result in a grade of 0 for the assignment.** As this is a Gateway Assignment, this will result in you failing the course. This assignment will be submitted via Canvas and checked using the plagiarism-detection software.

Quizzes

Four quizzes will be given during the semester. The best way to study for these quizzes is to understand the lecture and textbook examples and do the assigned homework and make sure that you have mastery of the subject including all physical concepts and definitions.

Grading Information

General (Quizzes, Midterms, Final Exam)

In engineering, getting the right answer is important, however, while mastering the material, it is important to learn the process of solving problems and paying closer attention to the details of things. To that end, in grading your work, I will look at the following:

- Getting the correct answer
- Using the correct units
- Using the correct equations in the correct way

If you attempt a problem, I will try my best to give you partial credit. The more clearly you write your solution, the easier it is for me to do this. The required contents for each solution are:

- A figure depicting the system, with boundaries indicated where appropriate
- A list of assumptions
- All equations are written in the symbolic form first, before plugging in numbers

- Units included whenever applicable
- The final answer indicated clearly

McGraw-Hill Connect Assignments

The Connect system gives all homework problems an “all-or-nothing” score based on your answer (within 5% of the correct answer). However, there are cases in which a small error in an otherwise correct solution prevents you from getting the right answer, and Connect would assign you a 0, which doesn’t seem fair. If you cannot get Connect to accept your answer, please discuss this with me in my office.

Grading Policy

		A	93.0-100	A-	90.0-92.9
B+	87.0-89.9	B	84.0-86.9	B-	80.0-83.9
C+	77.0-79.9	C	74.0-76.9	C-	70.0-73.9
		D	60.0-69.9		

Homework	10%
LearnSmart Assignments	5%
Essay	5% (or 100%*)
Discussion Topics	5%
Quizzes (4)	15%
Midterms (2)	30%
Final Exam	30%

*As discussed, you must pass the essay with a grade of 70% or higher to pass this course. The inability to do so will result in a failing grade in the class.

Classroom Protocol

Please place your cellphones on silent and refrain from using them during class. If you absolutely must take an emergency phone call, please leave the room quietly to do so. Exams and quizzes will be given at the beginning of class, so please be punctual. If the class meets in person, **all cell phones must be put on the instructor's table during each exam and quiz. Only one short restroom break is allowed during the exam. No restroom break is allowed during the quizzes. You are not allowed to take your cell phone with you on restroom breaks.**

Any student that submits work that was not done entirely by him/her will be given a grade of "F" in the course and further disciplinary actions will be taken. There may also be additional penalties such as dismissal from the college.

"SOS!"

Sometimes, life happens. If you are struggling with the course material, and/or if something is going on outside of class that may significantly disrupt your studies (financial concerns, upheaval in your home life, physical or mental health issues, etc.), I will do everything I can to help you succeed. If I am personally unable to help you, I will direct you to the appropriate resource. If you aren't comfortable talking to me about a personal issue, that's fine, too! I will maintain a list on Canvas of all the resources available to you as an SJSU student. The earlier you ask for help with a problem, the easier it is to solve.

ME 113: Thermodynamics Section 2, Fall 2022, Tentative Course Schedule

Date	Topics, Readings, Assignments, Deadlines	Chapter	Assignments Due
Aug-23	Basic Concepts	1	HW_Ch1, LS1, IC1
Aug-25	Pressure, Forms of Energy, 1 st Law of Thermodynamics	2.1-2.7	HW_Ch2, LS2, IC2
Aug-30	Ozone Depletion, The Greenhouse Effect, Phase Changes, Property Diagrams	2.8, 11.6, 3.1-3.4	
Sep-1	Property Tables	3.5	HW_Ch3, LS3, IC3
Sep-6	Equations of State, Boundary Work	3.6-4.1	
Sep-8	Closed Systems, Specific Heat	4.2-4.4	HW_Ch4, LS4, IC4
Sep-13	Application problems & Quiz 1 (Property Tables)		
Sep-15	Conservation of Mass, Flow Work, 1 st Law for Steady Flow	5.1-5.3	HW_Ch5, LS5, IC5
Sep-20	Steady Flow Processes and Devices	5.4	Gateway Essay Due
Sep-22	Steady Flow Processes and Devices	5.4	
Sep-27	Quiz 2 + Unsteady Flow Processes	5.5	
Sep-29	2 nd Law of Thermodynamics, Entropy + Review for Exam 1	6.1 – 6.5	HW_Ch6, LS6, IC6
Oct-4	Exam 1: Chapters 1-5		
Oct-6	2 nd Law of Thermodynamics, Entropy	6.6 – 6.11	
Oct-11	Isentropic Processes, Property Diagrams, T-S Relation, More Entropy Changes	7.1 – 7.7	HW_Ch7, LS7, IC7
Oct-13	Reversible Work, Isentropic Efficiencies	7.8-7.12	
Oct-18	Quiz 3 + Isentropic Efficiencies cont., Entropy Balance	7.12-7.13	
Oct-20	Gas Power Cycle Intro	9.1-9.4	HW_Ch9, LS9, IC9
Oct-25	Otto Cycle, Diesel Cycle, Brayton Cycle	9.5-9.6, 9.8-9.9	
Oct-27	<i>Gas Power Cycles Review and Problem-Solving</i>		
Nov-1	Carnot Vapor and Rankine Cycles,	10.1-10.4	HW_Ch10, LS10, IC10
Nov-3	Reheat and Regenerative Cycles, Cogeneration	10.5-10.6, 10.8	
Nov-8	Exam 2: Chapters 6, 7, 9		
Nov-10	Vapor-Compression Cycle	11.1-4, 11.7	HW_11, LS11, IC11
Nov-15	Vapor-Compression Cycle Review		
Nov-17	Mole and Mass Fraction, Properties of Gas Mixtures	13.1-3	HW_Ch13, LS13, IC13
Nov-22	Quiz 4 Rankine Cycle , Properties of Gas Mixtures	13.3	
Nov-24	Thanksgiving Recess		
Nov-29	Humidity, Psychrometric Chart	14.1-14.5	HW_Ch14, LS14, IC14
Dec-1	Air Conditioning Processes	14.6-14.7	
Dec-6	Air Conditioning Processes	14 (all)	
Dec-14	FINAL EXAM: 7:15-9:30 AM		

IC: In-class group problem solving is done on Thursdays, usually at the beginning of class. This consists of one problem from the corresponding homework assignment.

LS/HW: LearnSmart and homework assignments are due on Thursday at 11:00 PM via Connect, or as posted on Connect. The number denotes the chapter number of the assignment. The Gateway essay will be posted on Canvas with its due date. If for ANY reason you missed the deadline, an extension of four days will be granted, however, the max possible grade will be 70%. This extension will be counted as a resubmission as in the case of those who failed to score 70% or higher. No second chance.

Important Dates

Last day to drop (No W) 8/31

Last day to add 9/8

Thanksgiving Holiday 11/25

Last day of class 12/6

Final exam 12/14

