

San José State University
Mechanical Engineering Department
ME 113 Thermodynamics, Section 05, Fall 2022

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Office Hours:	Fridays 9:10 – 10:00 AM (Classroom) and 4:00 – 5:45 PM (ENG 348)
Class Days/Time:	Wednesdays and Fridays 7:30 – 9:10 AM
Classroom:	ENG 401
Prerequisites:	Phys 52 and Math 32, with a C- or better in each

Canvas and Course Messaging

Copies of the course materials such as the assignments, course notes, green sheet, etc. may be found on the Canvas site for the class. This system will also allow you to have discussions or chat with the class. This feature may be especially helpful if you need assistance on a homework problem.

To log in, go to the Canvas URL <http://sjsu.instructure.com>. Log in with your 9-digit digit SJSU ID and password you use for your SJSUOne account. For questions on the use of Canvas, please check out

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

You are responsible for regularly checking with the messaging system through Canvas. You can set up your Canvas account to forward all email sent to your Canvas account to any other email address you wish.

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 Goals and Student Learning Objectives

Upon completion of this course, 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 physical aspects of the first and second law of thermodynamics, and apply them in solving 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 using technical terms.
 - c) Analyze different air-conditioning and cooling processes involving air-water vapor mixtures.

Required Texts/Readings

Textbook

Thermodynamics: An Engineering Approach, by Cengel and Boles, 9th ed., McGraw-Hill, 2019.

Your course materials are being delivered digitally via Canvas through the Inclusive Access program. Please access the material through Canvas on the first day of classes to make sure there are no issues in the delivery, and if you are having a problem or question, they can be addressed quickly.

You automatically have access to the course materials on day one without entering a code or being charged upfront. After the add drop period, your bursar account will be billed at a discounted rate for the required course materials representing significant savings for you as the student. If you choose to not have your account be billed, you must opt out before the required deadline. If you do not opt out, you will be charged. The last date for student to opt out is September 2nd. We highly recommend you do not opt out if you are going to continue in this course because this is the lowest cost available for this product.

After you have paid for the product, you will have access for the remainder of the term.

Classroom Protocol

Please do not use cell phones in class. Exams and most quizzes will be given at the beginning of class, so plan to be on time.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's [Catalog Policies](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the [current academic calendar](http://www.sjsu.edu/academic_programs/calendars/academic_calendar/) web page located at http://www.sjsu.edu/academic_programs/calendars/academic_calendar/. The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

Assignments and Grading Policy

Grade Distribution

		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 Assignments	10%
SmartBook Assignments	5%
Essay	4% or 100%
Quizzes (4@ 4% each)	16%
Midterms (2@20% each)	40%
Final Exam	25%

Expected Time Commitment

According to university rules: “Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.”

Many students who do poorly in ME 113 appear to do so because they do not devote enough time to learning and practicing the subject material. You should plan to spend 2-3 hours outside of class for every hour in class, for a total of **8-12 hours outside of class minimum**. This time should be spent reviewing notes, reading the book, doing homework problems, and studying for exams. Some student may need to spend more time than this.

Quizzes

Four quizzes will be given in class. Some of them may be open book, so remember to bring your textbooks to class! The best way to study for these quizzes is to do the assigned homework and make sure that you understand it completely, including all physical concepts and definitions.

Homework

Homework will be assigned every week, and it will be due the Friday of the following week at 5:00 pm unless otherwise announced. Homework is turned in via the Connect software. Some assignments will require you to scan and upload a solution done by hand, so make sure that you find a place to do this. These uploads must be uploaded as doc (Word) or pdf files. Camera phones typically will not provide enough resolution. If you find it difficult to scan and upload these files, you may turn them in in class Thursday night instead of submitting them to Connect.

The amount of homework assigned is the **minimum** necessary to understand the material. Many of you will need to complete more problems!

For problems done by hand, include your name, date, and homework assignment number at the top of your assignment.

- Begin each problem by summarizing the problem statement. Give enough information that someone could understand the problem without looking up the problem in the book/handout. A figure is often helpful, particularly as problems become more complicated later in the semester.

- List all assumptions, where appropriate.
- Write down all equations in symbolic form first, before putting in numbers.
- Keep units with all equations. This step is very important.

No late homework is accepted without a university-authorized excuse.

There are additional assignments on Connect called “SmartBook” assignments. These are assignments to help you learn theory. If you get questions wrong on these assignments, you are able to do them again, so scores should be very high on these assignments. **Note the due dates for the SmartBook assignments.** You can’t finish these assignment after the due dates.

EES modeling

Some assignments can be completed using the software EES. This software will be made available to all students free of charge and can also be used in the department’s computer labs (E213/215). This software is a simultaneous equation-solver with thermophysical properties built in and can be used for solution of complicated thermodynamics problems as well as system optimization. I personally do not recommend using EES for homework problems until students feel comfortable with how to set up problems and find properties from thermodynamics property tables themselves.

Essay

One short essay related to a contemporary environmental issue will also be assigned. This essay is a “Gateway Assignment” which must be passed with a C or better to pass the class. If you don’t pass the first time, you will be allowed to revise and resubmit. However, the best grade you can get after resubmission is a C.

Any student caught plagiarizing on their essay or copying another student’s EES model, or allowing another student to copy their model, will receive a “0” for this entire assignment.

Exams

Two exams will be given in addition to the final exam. They must be taken on the scheduled dates except for documented emergencies (for example, you’re ill and have a note from a doctor or the SJSU health center, were in a car accident on the way to class, or had a death in the family). If you have an un-avoidable scheduling conflict (such as travel for work or for a sports competition), arrangements must be made in advance. All work must be shown clearly on exams. The two mid-terms will be closed book except for the property tables and one page of notes (8.5"x11", one side only) for the first exam and two pages for the second. The final exam will be open book with no notes allowed. Bring your textbook to all exams. You are not allowed to share a textbook.

University Policies

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The [University's Academic Integrity policy](http://www.sjsu.edu/senate/S07-2.htm), located at <http://www.sjsu.edu/senate/S07-2.htm>, requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://www.sa.sjsu.edu/judicial_affairs/index.html) is available at http://www.sa.sjsu.edu/judicial_affairs/index.html.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Policy S07-2 requires approval of instructors.

A major problem in ME 113 is that many students copy homework from one another or else rely very heavily on assistance from friends in completion of homework. This may improve your homework grade, but it will result in poor or even failing exam grades. The best way to handle homework is to struggle through it in your own first. Use your book and notes to help you. Then if you're stuck, ask your instructor or friends from class for hints. You are welcome to compare homework answers or solution methods with your friends after you have completed your problems.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the [Disability Resource Center](http://www.drc.sjsu.edu/) (DRC) at <http://www.drc.sjsu.edu/> to establish a record of their disability.

Student Technology Resources

Computer labs for student use are available in the Academic Success Center located on the 1st floor of Clark Hall and on the 2nd floor of the Student Union. Additional computer labs are available in ENG 213/215. Computers are also available in the Martin Luther King Library. The computer program EES, which is used in this class, is available for download from the instructor's [ME 115 website](http://www.engr.sjsu.edu/ndejong/me_115.htm) located at http://www.engr.sjsu.edu/ndejong/me_115.htm. The password is your instructor's last name, all in lowercase. Do not pass on this password to any student outside the MAE Department, since our site license only allows students in our department to download a free copy. This copy will work until 9/1/2010. Your textbook may also include a copy of EES, but it is a very limited copy that does not allow you to copy or print.

Learning Assistance Resource Center

The Learning Assistance Resource Center (LARC) is located in Room 600 in the Student Services Center. It is designed to assist students in the development of their full academic potential and to motivate them to become self-directed learners. The center provides support services, such as skills assessment, individual or group tutorials, subject advising, learning assistance, summer academic preparation and basic skills development. The [LARC website](http://www.sjsu.edu/larc/) is located at <http://www.sjsu.edu/larc/>.

Additional tutoring may be available through the engineering honor societies. An announcement will be made in class when this becomes available.

Peer Mentor Center

The Peer Mentor Center is located on the 1st floor of Clark Hall in the Academic Success Center. The Peer Mentor Center is staffed with Peer Mentors who excel in helping students manage university life, tackling problems that range from academic challenges to interpersonal struggles. On the road to graduation, Peer Mentors are navigators, offering “roadside assistance” to peers who feel a bit lost or simply need help mapping out the locations of campus resources. Peer Mentor services are free and available on a drop –in basis, no reservation required. The [Peer Mentor Center website](http://www.sjsu.edu/muse/peermentor/) is located at <http://www.sjsu.edu/muse/peermentor/>

Tentative ME 113 Schedule

Week	Date	Topic	Textbook Reading
1	August 19	Basic Concepts, Pressure	Chapter 1
2	August 24 August 26	Forms of Energy, 1st law of Thermodynamics Ozone Depletion, The Greenhouse Effect, Phase Changes, Property Diagrams	2.1-2.7 2.8, 11-6, 3.1-3.4
3	August 31 September 2	Property Tables	3.5
4	September 7 September 9	Ideal-Gas Equations of State, Boundary Work Quiz 1 Property Tables , Closed Systems, Specific Heat	3.6, 4.1 4.2-4.5
5	September 14 September 16	Closed Systems Problem Solving Conservation of Mass, Flow Work, 1st Law for Steady Flow	4.2-4.5 5.1-5.3
6	September 21 September 23	Steady Flow Processes and Devices Steady Flow Problem-Solving	5.4
7	September 28 September 30	Quiz 2 Steady-Flow Processes and Devices Unsteady-Flow Processes	5.5
8	October 5 October 7	Second Law of Thermodynamics, Entropy Exam 1 Ch 1-5	Ch. 6, 7.1-7.3, 7.6
9	October 12 October 14	Isentropic Processes, Property Diagrams, T-dS Relation More Entropy Changes, Reversible Work, Isentropic Efficiencies	7.4, 7.5, 7.7 7.8-7.12
10	October 19 October 21	Isentropic Efficiencies cont., Entropy Balance Ch 7 Problem-Solving Session	7.13
11	October 26 October 28	Quiz 3 Entropy , Gas Power Cycle Intro, Otto Cycle Diesel Cycle, Brayton Cycle, Cycles Problem-Solving	9.1-9.5 9.6, 9.8-9.10
12	November 2 November 4	Carnot Vapor and Rankine Cycles, Improving Efficiencies, Reheat and Regenerative Cycles, Cogeneration, Refrigeration Cycles, Vapor-Compression Cycle	10.1-10.4 10.5-10.6, 10.8 11.1-4, 11.7
13	November 9 November 11	Exam 2 Ch 6, 7, 9 Veteran's Day, Campus Closed	
14	November 16 November 18	Mole and Mass Fraction, Properties of Gas Mixtures Mixture Problem-Solving, Humidity, Psychrometric Chart	13.1-13.3 14.1-14.2, 14.5
15	November 23 November 25	Thanksgiving Holiday	
16	November 30 December 2	Quiz 4 Power Cycles Air Conditioning Processes Air Conditioning Process Problem Solving	14.6-14.7
17	December 9	Final Exam 7:15 – 9:30 AM	