San José State University
Mechanical Engineering Department
ME 113 Thermodynamics, Section 1, Spring 2020

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Office Hours:	Mon/Wed 9-10, Tues/Thurs 1:30-2:30. Feel very free to make an appointment for another time if these hours don't work for you
Class Days/Time:	Mon 11-12, Wed 1-2, Thurs 10:30-11:30 (revised 2/5/20)
Classroom:	ENG 329
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 syllabus, assignments, exam review material, Powerpoint presentations, etc. may be found on the Canvas site for the class. This system will also show you your grades, and it allows you to have discussions or chat with the class. This feature may be especially helpful if you need assistance on a homework problem. Homework assignments and electronic classroom materials (such as Powerpoint slides) are posted on this site.

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.
    ~~) Use EES to model and optimize thermodynamic cycles.~~

~~6)~~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. Earlier editions are also OK, and ebooks are acceptable. You will be automatically charged for an ebook combined with online learning resources as part of an "inclusive access" program. You may opt out, but access to the homework system is needed. The cost is about $80.

Other technology requirements

We will be using McGraw-Hill's homework system, called Connect, in this class. Connect is available via inclusive access. If you purchase your own text, you'll need to purchase Connect access separately. You can get a two-week free trial and convert it at the end of the trail period if you wish.

You can access Connect assignments via Canvas.

Classroom Protocol

Do not use cell phones in class.

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		

Essay	5%
Quizzes	66%
Project	5% or 0% ~~10%~~
Homework	9%
Final Exam	15% or 20% ~~10%~~

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

This class will run under an unusual setup. In most classes, you are graded on how well you know many different topics. In this class, you will be largely graded on how many topics you know well. There will be 10 quizzes offered in class. You cannot move on to a quiz in the next topic section until you have passed all the quizzes in the previous section with a score of 9/10 or better. For example, you can take the "Ideal Gas Law" quiz before passing the "Property Tables"

quiz, but you can't take any "Required Quiz Topics" until you pass both the property tables and ideal gas law quizzes. You may take quizzes as many times as needed to pass, but no more than one per class session starting Feb. 5. You will be able to sign up to retake a quiz via the Canvas site (signing up in advance is required so that your instructor knows what quizzes to prepare and bring to class). Quiz retakes can be taken during another scheduled quiz time or else during a scheduled problem session in class.

Preliminary Quiz Topics
- Property Tables
- Ideal Gas Law (may include pressure calculations)

Required Quiz Topics
- 1st Law for Closed Systems
- 1st Law for Steady State Steady Flow Devices
- 1st Law for Uniform State, Uniform Flow Processes
- Isentropic Efficiency

Supplementary Topics
- Gas Power Cycles – Otto, Diesel, Brayton
- Rankine and Vapor-Compression Cycles
- Gas Mixtures
- Air Conditioning Processes

Your quiz grade will be determined by how many quizzes you pass with a 9/10 or greater: 10=A 100, 9=A- 93, 8=B 86, 7=B- 82, 6=C 75, 5=C- 72, 4=D 65, 3=D- 60, 2= F 30, 1=F 10.

Videos

To give more time in class for problem-solving, videos will be assigned throughout the semester. Watch them before the class period for which they are assigned in order to understand what's going on in class. The videos are available via Canvas.

Final Exam

The final exam will be based on theory (including topics like ozone depletion and global warming, which are covered in the required videos) and both preliminary and required quiz topics. Supplementary topics covered include the Otto, Diesel, Brayton, and Rankine cycles, Other supplementary topics are only covered on quizzes.

The final exam will be shorter than the full exam period. In the remaining time, you may take one last quiz. The final exam will be offered via ProctorU, which requires the use of a webcam. Computers will likely be available on campus if you do not have a webcam. Contact your instructor if this arrangement will cause a problem.

Homework

Homework is assigned for every chapter and will be graded automatically by Connect. The purpose of the homework is to get you ready for the quizzes. As a result, the grading scale is looser than the regular course grading scale. You will have 20 points added to your average homework score at the end of the semester, with a maximum of 100%. It is recommended that

you work hard to get full credit on all early assignments since it is expected that some students may not reach the assignments on the latest supplementary topics.

LearnSmart Assignments are optional and are not worth course credit. They can help you get a good understanding of thermodynamics theory.

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.

University Policies

Per University Policy S16-9 *(http://www.sjsu.edu/senate/docs/S16-9.pdf)*, relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/" Make sure to review these university policies and resources with students.

Tentative Schedule -- may change with fair warning

Date	Lecture Topics	Problem-Solving/Quiz Topics	Text Sections	Videos
23-Jan	Basic Concepts, Pressure	Pressure	Chapter 1	
28-Jan	Forms of Energy, 1st law of Thermodynamics	Unit conversion, 1st Law of Thermo	2.1-2.7	1st Law of Thermo, Forms of Energy
30-Jan	Phase Changes, Property Diagrams, Property Tables	Property Tables	2.8, 3.1-3.5	Ozone Depletion, Greenhouse Effect
4-Feb	Equations of State	Equations of State; PT Quiz 1 Property Tables	3.6-3.8	
6-Feb	Boundary Work, Closed Systems	Closed Systems; PT Quiz 2 Ideal Gas Law	4.1-4.3	Specific Heats
11-Feb	1st law for Closed Systems	1st law for closed systems	4.4-4.5	
13-Feb	1st law for steady state, steady-flow device analysis	conservation of mass, steady flow devices	5.1-5.3	Conservation of Mass
18-Feb	steady-flow device analysis	steady flow devices; RT Quiz 1 1st law - closed sys.	5.4	
20-Feb	Steady-flow device analysis	steady flow devices		
25-Feb	Unsteady-Flow Processes	unsteady processes; RT Quiz 2 1st law -- steady flow	5.5	
27-Feb	1st law problem-solving	1st law		
3-Mar	Carnot Cycle, Entropy, Isentropic Processes	Carnot Cycle, Isentropic Proc.; RT Quiz 3 Unsteady Flow	Ch. 6, 7.1-7.4	2nd Law of Thermo
5-Mar	T dS relations	T dS relations	7.5-7.9	
10-Mar	Reversible Work, isentropic efficiencies	isentropic efficiencies; RT Quiz 4 Isentropic processes	7.10-7.12	
12-Mar	Isentropic Efficiencies, ~~Entropy Balance~~	isentropic efficiencies	~~7.13~~	
17-Mar	Otto Cycle	Otto cycle; RT Quiz 5 Isentropic Efficiencies	9.1-9.5	Gas Power Cycle Intro
19-Mar	Increasing Engine Power, Diesel Cycle	Diesel cycle	9.6	The Challenge…. Envr. Decisions
~~24 Mar~~April 7	Brayton Cycle	Brayton Cycle; ST Quiz 1 Otto and Diesel Cycles	9.8-9.9	
~~26 Mar~~April 9	Brayton Cycle	Brayton Cycle	9.1	
31-Mar	SPRING BREAK			
2-Apr	SPRING BREAK			

~~7~~14-Apr	Carnot Vapor and Rankine Cycles	Rankine cycle; ST Quiz 2 Brayton Cycle	10.1-10.4	
~~9~~16-Apr	Rankine Cycle	Rankine cycle	10.5-10.9	Cogeneration
~~14~~21-Apr	Vapor-compression cycle	vapor-compression cycle; ST Quiz 3 Rankine cycle	11.1-11.7	
~~16~~23-Apr	~~environmental essay review,~~ gas mixtures	mole/mass fraction	13.1-13.2	
~~21~~28-Apr	gas mixture~~s~~ properties	gas mixtures ST Quiz 4 Vapor-compression cycle	13.3	
~~23 Apr~~	~~gas mixture properties~~	~~gas mixtures; ST Quiz 4 Vapor compression cycle~~	~~13.3~~	
~~28~~30-Apr	humidity, psychrometric chart, heating	Humidity, ST Quiz 5 gas mixtures	14.1-14.5	
~~30 Apr~~May 5	~~heating,~~ heating with humidification, cooling with dehumificiation	heating and humidification processes; ~~ST Quiz 5 gas mixtures~~	14.6-14.7	
~~5 May~~May 7	~~cooling with dehumificiation~~air conditioning problem-solving	~~dehumidification~~ST 6 AC Processes		
~~7 May~~	~~prototype testing~~	~~ST Quiz 6 air conditioning processes~~		
19-May	final exam and last quiz makeup opportunity 7:15-9:30 am	-		

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