Syllabus for Chemical and Mechanical Engineering 2300, Thermodynamics I, Fall Semester 2020

Online course with scheduled times

University of Utah

Last revised 2020 August 10

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Tests/quizzes:	See schedule 9:40 – 10:20 am (Canvas)
Study Session:	TBD based on class survey
Prerequisites:	Grade of C or higher in PHYS 2210 and MATH 1220 or 1320.
Text:	J. Richard Elliott and Carl T. Lira, *Introductory Chemical Engineering Thermodynamics*, 2nd Edition, Prentice Hall, 2012.

Suggested Reference

H. C. Van Ness, *Understanding Thermodynamics*, Dover Publications, Inc., New York, 1969.

Course Content and Objectives

Engineering thermodynamics is the study of energy and its transformations. It allows you to (1) calculate the amount of work or flow of heat required to accomplish a desired change of state or (2) calculate the amount of work or heat released upon a specified change of state. Thermodynamics is a fundamental science that is part of the foundation of all engineering disciplines including power generation, heating and cooling, fluid mechanics and hydraulics, heat transfer, process engineering, and environmental engineering. This course will cover the energy balance for closed systems, thermodynamic properties, the energy balance for open systems, the entropy balance for closed and open systems, ideal gas mixtures, minimum and

maximum work, and an introduction to power cycles, and the vapor-compression refrigeration cycle.

By the end of this course you will be able to:

1. Demonstrate effective approaches to solving homework problems and presenting solutions.
2. Convert between the United States Customary, SI, and metric units.
3. Define the concepts of (a) system, (b) surroundings, (c) intensive and extensive properties, (d) equilibrium, (e) heat, (f) work, (g) state (point) functions, and (h) path functions.
4. Apply the rate and accumulation forms of the accounting equation to the extensive properties mass, energy, and entropy, in order to solve practical engineering problems, including those involving chemical reactions.
5. Analyze and solve thermodynamic problems involving ideal gases, ideal gas mixtures, phase change fluids, and incompressible substances.
6. Draw and label processes on standard thermodynamic diagrams.
7. Apply the concept of efficiency to calculate actual work input or output.
8. Define reversible and irreversible processes and state what makes a process irreversible.
9. State the significance of entropy and entropy generation.
10. Calculate the change in entropy of a system and its surroundings as it changes from one state to another.
11. Analyze steady, reversible flow processes using the combined energy and entropy balance.
12. Use the concept of adiabatic efficiency in the specification of process equipment.
13. Apply energy and entropy balances to analyze power and refrigeration cycles.
14. Critically analyze proposed processes to determine whether they are thermodynamically and economically feasible.

Supplementary videos

Supplementary material, including screencasts, is available at
https://chethermo.net/

Grading

The weightings for the exams and assignment are given below.

First exam	15 %
Second exam	15 %
Final exam	20 %
Homework*	20 %
Weekly quizzes	30%

*Lowest two scores dropped and scaled to 20%.

Final grades will be based on the following table. The table represents grade guarantees. I reserve the right to lower the scale and to reevaluate the scores of students who just do poorly on the first exam, for example. The high score in the class will be used to scale all other scores. For example, if the high score is 95%, all scores will be divided by 0.95. I reserve the right to lower the score used for scaling.

Percentage	Grade
95-100	A
90-95	A-
85-90	B+

80-85	B
75-80	B-
70-75	C+
65-70	C
60-65	C-
50-60	D
< 50	E

Quizzes

All quizzes are open book, notes, and homework. They will take place on Wednesdays between 9:40 and 10:20 and will be delivered through Canvas. During the quiz, I will be available in my zoom room:

https://utah.zoom.us/j/9198853047

This room has a waiting room feature, and I will let you in.

I will also review the quiz and answer any questions about the quiz or other materials after 10:20. Quizzes sometimes offer the opportunity for fun and prizes ☺.

Examinations

All examinations are open book, notes, and homework. You may not communicate with classmates or others during the exam. An equation sheet and required conversion factors and data will be provided with the exams. Sample exams will be available in Canvas. Exams 1 and 2 will be 55 minutes long, from 9:40 AM to 10:30 AM, on the dates specified in the class schedule. Answers to the exams must be submitted by 10:35 AM on the day of the exam, or they will not be accepted. You must also take an image of your work and send submit this through Canvas with the exam. If you are having trouble uploading this information, you have a 20 minute grace period to get this submitted. *Failure to submit your work can result in a score of zero for the exam.* The final, comprehensive exam will be 120 minutes and is scheduled from 8:00 – 10:00 AM on Friday, December 11 through Canvas. *Set two (or three) alarms*.

To receive credit for your solutions, you must write out all equations that you use and you must state all values substituted in those equations. You must show all of your work to receive credit for solutions on exams. No make-up exams will be given except in exceptional circumstances. If you must miss an exam, please notify me before the exam. After an exam is graded and returned, you will have one week to submit written requests for the regrading of problems. These requests will not be accepted after one week.

During the exam, I will be available in my zoom room.

https://utah.zoom.us/j/9198853047

This room has a waiting room feature, and I will let you in.

I will also be available by e-mail. I will send clarifications to any exams out through Canvas.

I will also review the quiz and answer any questions about the quiz or other materials after quizzes are submitted. Quizzes sometimes offer the opportunity for fun and prizes ☺.

If you are unable to get internet connectivity during your exam or quiz, you have the option of taking an oral exam/quiz. If you were unable to connect and wish an oral exam, you must contact me in writing within three days of the exam or quiz to organize a time for an oral exam or quiz.

Announcements

I will make announcements through CANVAS.

Homework

Solutions to the homework are due by 6:00 PM on Fridays and must be submitted electronically through CANVAS as a single PDF file. The submission of multiple files will result in a 20 % reduction in your score for that assignment.

Late homework will not be accepted unless you have made prior arrangements with me. Late homework will not be accepted after the solutions have been posted. The neatness, organization, and completeness of your homework are important. It is important that you develop a systematic, organized approach that works for you.

To receive full credit for your homework solutions, you must write out all equations that you use and you must state all values substituted in those equations. You must show all of your work to receive credit. You are responsible for writing clearly and providing a legible quality scan. Repeated submissions of unreadable homework will result in a score of zero for the assignment. The two assignments with the lowest scores will be dropped. The solutions will be posted in CANVAS. I encourage you to work with other students on the homework but you must turn in your own solution. You may not turn in identical copies. You should be sure that you can set-up, solve, and understand all of the problems on your own.

Using E-mail

I will be using your utah.edu email address. You should check it regularly or arrange to have it forwarded. I will generally not be using the mail system that is part of Canvas.

Academic Misconduct

Instances of academic misconduct will be handled in accordance with the Student Code (http://regulations.utah.edu/academics/6-400.php).

Addressing Sexual Misconduct

Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability,

veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

Students with Disabilities

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access, http://disability.utah.edu/, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and Prof. Kelly to make arrangements for accommodations.
All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.

College of Engineering Procedures for Appeals, Withdrawals, Repeating the Class and Adding the Class

https://www.coe.utah.edu/students/current/semester-guidelines/

Safety

The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu

Submitting homework, exams, and wifi connectivity

You will need to be able to scan your homework and submit your homework through Canvas. Most phones have this capability. If you need a laptop or wifi connectivity, the Marriott library has loan options for students:
https://lib.utah.edu/coronavirus/checkout-equipment.php

If you still lack the ability to scan, upload, and submit your homework or exams, please contact me.

Contacting me

I will do my best to respond to questions within 24 hours. You can call me Prof. Kelly, Dr. Kelly or Kerry. My preferred pronouns are she, her, hers.