Syllabus for Chemical and Mechanical Engineering 2300, Thermodynamics I, Fall Semester 2017

Conventional and Online Sections

University of Utah

Last revised 2017 August 12

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Tutoring hours: TBD

Meetings: Monday, Wednesday 08:35 – 09:25, WEB L104.
Study Session: Friday 08:35 – 09:25, WEB 1248

Prerequisites: Grade of C or higher in PHYS 2210 and MATH 1220 or 1320.


Suggested Reference


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, the vapor-compression refrigeration cycle, and liquefaction.

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 systems.
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.
Streaming Video of Lectures

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

Grading

The weightings for the exams and assignment are given below.

<table>
<thead>
<tr>
<th>Exam</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>First exam</td>
<td>25 %</td>
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<tr>
<td>Second exam</td>
<td>30 %</td>
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<tr>
<td>Final exam</td>
<td>35 %</td>
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<tr>
<td>Homework</td>
<td>10 %</td>
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</tbody>
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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 miss a grade. 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.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
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<tbody>
<tr>
<td>95-100</td>
<td>A</td>
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<tr>
<td>90-95</td>
<td>A-</td>
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<tr>
<td>85-90</td>
<td>B+</td>
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<tr>
<td>80-85</td>
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<tr>
<td>60-65</td>
<td>C-</td>
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<tr>
<td>50-60</td>
<td>D</td>
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<tr>
<td>&lt; 50</td>
<td>E</td>
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Examinations

All examinations are closed book, notes, and homework. An equation sheet and required conversion factors and data will be provided with the exams. Sample exams will be available in Canvas. Assigned seating will be used for all exams.

For sections CH EN/ME EN 2300-001, Exams 1 and 2 will be 55 minutes long, from 08:35 AM to 09:30 AM, on the dates specified in the class schedule. The final, comprehensive exam will be 120 minutes and is scheduled from 08:00 – 10:00 on Friday, Monday, December 11 from 8 – 10 am, in our regular classroom, WEB L104.

For online students (CH EN/ME EN 2300-090), all exams will be on the same days as in the conventional sections but they must be scheduled in Canvas by going to the “Schedule Exams” label.
Calculators are permitted in exams but cell phones and smart watches must be stowed away and out of sight. If you must leave the room during an exam, your exam, phone, and watch must be turned over to me or a TA.

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.

**Homework**

Solutions to the homework are due by 4:00 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.

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 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.