Syllabus for Chemical and Mechanical Engineering 2300, Thermodynamics I, Fall Semester 2015

Conventional and Online Sections

University of Utah

Last revised 2015 September 1

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Office hours: Stop by anytime or by appointment

TA: Ryan Durr Dylan Wilson
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Tutoring hours: Thursdays 3:30 PM – 5:30 PM Thursdays 10 AM - noon

TA: Brad Dallin (online section only)
Office: 1622 WEB (tutoring center)
e-mail: brad.dallin@gmail.com
Tutoring hours: Tuesdays 8:30 AM – 10:30 AM

Meetings: Monday, Wednesday 08:35 – 09:25, WEB L104.
Study Session: Question and answer session, Friday 08:35 – 09:25, WEB L104

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


Suggested Reference

H. C. Van Ness, Understanding Thermodynamics, Dover Publications, Inc., New York, 1969. This short introduction is on reserve in the Marriott Library and can be checked out for a day.

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 thermodynamic properties, open and closed systems, equations of state, heat and work, the first law of thermodynamics, the second law of thermodynamics, the Carnot cycle, and an introduction to power and refrigeration cycles.

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.
5. Analyze and solve thermodynamic problems involving ideal gases, 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

The lectures will be recorded and will be available through a link given in CANVAS.

Grading

The weightings for the exams and assignment are given below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Weighting</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>30 %</td>
</tr>
<tr>
<td>Homework</td>
<td>10 %</td>
</tr>
<tr>
<td>Muddiest point</td>
<td>5 %</td>
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</tbody>
</table>

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>93-100</td>
<td>A</td>
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<tr>
<td>90-93</td>
<td>A-</td>
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<tr>
<td>85-90</td>
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<tr>
<td>80-85</td>
<td>B</td>
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<tr>
<td>75-80</td>
<td>B-</td>
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<tr>
<td>70-75</td>
<td>C+</td>
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<tr>
<td>65-70</td>
<td>C</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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</tbody>
</table>

Examinations

All examinations are closed book, notes, and homework. You may bring one 8.5-by-11-inch, handwritten sheet of notes into the exams. All required conversion factors and data will be provided with the exam. The notes will not be turned in with your exam. Sample exams are available on the class website. Assigned seating will be used for all exams.

Exams 1 and 2 will be 55 minutes long, from 08:35 AM to 09:30 AM, on the dates specified on the class website. The final, comprehensive exam will be 120 minutes and is scheduled from 08:00 – 10:00 on Thursday, December 17, in WEB L104.

Exams for the conventional and online sections will be held at the same time and place. All exams will be held in WEB L104. Online students who live outside the Salt Lake area should contact Prof. Silcox so that proctored exams can be arranged through Teaching and Learning Technologies (TLT).
Calculators are permitted 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.

No make-up exams will be given except in exceptional circumstances. If you must miss an exam, please notify me before the exam.

**Homework**

Solutions to the homework are due by 5:00 PM on Fridays and must be submitted electronically through CANVAS as a PDF file.

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. The text (Ch 1, Sect 11 or 12) outlines a useful approach for problem solving. You need not follow that outline, but it may be helpful. It is important that you develop a systematic, organized approach that works for you.

To receive full 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.

Homework assignments will be equally weighted. 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.

**Muddiest Point of the Week**

What is the muddiest point (MP) of the week for the material covered on Monday and Wednesday of the current week? What concept, definition, problem formulation, or solution caused you the most difficulty? The MPs are due by 5 PM on Fridays and should briefly state the muddiest point and provide an attempted solution or explanation. The MPs must be submitted through CANVAS as a single PDF file. I will respond to these points in class.

**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**

All 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 Services, http://disability.utah.edu/, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and Prof. Silcox 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 Services.