**ME EN 2300 CH EN 2300: Thermodynamics I**
**Spring 2007**

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| Office hours: | Monday 3-4:30 |
| | Tuesday 4-5 |
| | Wednesday 3-4:30 |

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| | Wednesday 12-1 | Tuesday 9-10 |

Class time: M, W 10:45 – 11:35 EMCB 105
Prerequisites: PHYS 2210 and MATH 1220
Text: Yunus A. Cengel and Michael A. Boles, Thermodynamics: An Engineering Approach, 5th or 6th Edition, McGraw Hill.

**Homework:**
Homework will generally be assigned on Wednesday, and due the following Wednesday at the end of class. Hand in your assignment at the end of the lecture to avoid a string of over 100+ students walking to the front of class at the beginning of the lecture. Late homework will be graded at 50%. No credit for homework 1 week late or later.

**Lecture Notes:**
A nice set of lecture notes is available electronically. These were prepared by Prof. Geoff Silcox in Chemical Engineering. Since the course content is consistent regardless of which department is teaching the course, these will provide a good additional reference. Lectures in this class will closely follow these notes. They are available as PDF files at
www.eng.utah.edu/~mcmurtry/Notes

**Course Content and Objectives**

Thermodynamics is the study of energy and its transformations. It 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, combustion, 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 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 english, SI and metric units systems.
3. Define concepts of (a) system (b) surroundings (c) intensive and extensive properties, (d) equilibrium, (e) heat, (f) work, (g)state functions, and (h) path functions.
4. Apply the rate form and the accumulation form of the accounting equation to the extensive properties of mass, energy, and entropy to solve practical engineering problems.
5. Analyze and solve thermodynamic problems involving the ideal gas, 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 or process equipment.
13. Apply energy and entropy balances to analyze power and refrigeration cycles.

**Grading:**

Points for homework and exams are as follows:

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| Two one-hour exams: | 25% each |
| One final Exam: | 40% |
| Homework: | 10% |

Grading Scale:

| 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 |

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**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/index.htm, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

**Examinations**

All examinations are comprehensive. Useful tips on taking tests and information on reducing test anxiety are found at http://disability.utah.edu/test.htm

All exams are open book, open notes, open homework. To receive full credit for your solutions you must write out all equations that you use and must state all values substituted in those equations. You must show all work to receive

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## Lecture and Exam Schedule

| Day and Date | Lecture number and Topic | Text |
|---|---|---|
| M 1/8 | 1. Background, Introduction, Energy is conserved | Chapters 1 &2 |
| W 1/10 | 2. Properties, equilibrium, processes | 1-4, 1-7, 1-8, 3.6 |
| M 1/15 | M.L. King Holiday | |
| W 1/17 | 3. Internal, potential, kinetic energy. Mass, force, work. | Ch. 2 |
| M 1/22 | 4. Energy transfer by work. Moving boundaries. | 2-4, 4-1 |
| W 1/24 | 5. Energy transfer by heat. | 2-3 |
| M 1/29 | 6. First law for closed systems. Efficiency | Ch.2 and 4-1,2 |
| W 1/31 | 7. Properties of pure substances. P-v. P-T diagrams, PvT surfaces | 3-1 to 3-4 |
| M 2/5 | 8. Evaluation of properties, enthalpy | 3-5 |
| W 2/7 | Review for 1st exam | |
| M 2/12 | Exam 1 | |
| W 2/15 | 9. Ideal gas EOS, compressibility factor. | 3-6 to 3-8 |
| M 2/19 | Presidents day holiday | |
| W 2/21 | 10. Internal energy, enthalpy, specific heats of ideal gasses, solids, and liquids. | 4-3 to 4-5 |
| M 2/26 | 11. Conservation of mass and energy for CV. | 5-1, 5-2 |
| W 2/28 | 12. Steady flow devices, unsteady flow. | 5-3 to 5-5 |

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| M 3/5 | 13. Introduction to the 2nd law. | 6-1 to 6-3 |
| W 3/7 | 14. Refrigerators, heat pumps. Reversible and Irreversible processes. | 6-4 to 6-6 |
| M 3/12 | 15. Carnot Cycle, Thermodynamic temperature. | 6-7 to 6-11 |
| W 3/14 | 16. Entropy, increase of entropy principle. | 7-1 to 7-2 |
| M 3/19 | Spring Break | |
| W 3/21 | Spring Break | |
| M 3/26 | 17. More on Entropy. | 7-3 to 7-9 |
| W 3/28 | 18. Changes in entropy, isotropic processes. | 7-3 to 7-9 |
| M 4/2 | Review for 2nd exam | |
| W 4/4 | Second Exam | |
| M 4/9 | 19. Entropy balance | 7-10, 11, 13 |
| W 4/11 | 20. Reversible steady flow work | 7-10 |
| M 4/16 | 21. Isentropic efficiencies | 7-12 |
| W 4/18 | 22. Vapor power cycles | 10-1, 10-2 |
| M 4/23 | 23. Carnot Cycle, Otto Cycle | 9-1 to 9-5 |
| W 4/25 | Review for final | |

Final Exam: Thursday 5/3 10:30 – 12:30