

ME 300: Engineering Thermodynamics
Course Policy
Spring Semester 2008

135 Reber Building
11:15 AM - 12:05 PM

Required Text: *Thermodynamics Concepts and Applications*, Stephen R. Turns, Cambridge University Press.
Property Tables for Thermal Fluids Engineering, Stephen R. Turns and David R. Krieger, Cambridge University Press.

Prerequisite: CHEM 110, MATH 141

Instructor: G. Talmage, Professor of Mechanical Engineering
306 Reber Building (ME Building)
863-3204

Office Hours: 12:30 PM - 2:00 PM, MWF

Course Description: This course serves as an introduction to thermodynamics. The course will treat the basic concepts and definitions associated with the field of thermodynamics, and then consider properties of pure substances and equations of state. Following this introduction to thermodynamics, we will discuss the notion of energy and energy transfer mechanisms, which will lead us to the first law of thermodynamics. Since the first law of thermodynamics is not always sufficient in a thermodynamic analysis, we will study the second law of thermodynamics. Associated with the second law is the thermodynamic property known as entropy, which will be discussed. Towards the end of the course, we will consider applications of the first and second laws through the study of power and refrigeration/heat pump cycles.

Course Objectives and Outcomes:

http://www.mne.psu.edu/undergrad/ugmanuals/ME_Manual/ME_Required_Courses/ME300.htm

Grading Policy:

Final Grade Construction and Tentative Examination Dates

Homework	15 %	Due Friday at beginning of class
Exam 1	22 %	Monday, February 18 (Evening Exam)
Exam 2	22 %	Monday, March 24 (Evening Exam)
Exam 3	22 %	Monday, April 21 (Evening Exam)
Final Exam	24 %	To be announced by the University - check eLion

Note that the dates and times of Exams 1, 2, and 3 are tentative.

Typical Letter Grade Construction

A-	90
B-	80
C	70
D	60
F	< 60

Evaluation

Homework: Every Friday (with some exceptions) a homework set will be due at the beginning of class. Each homework set will contain one or more problems representative of the material covered in the previous lectures. It is expected that you solve these problems on your own. Copying problem solutions will lead to disciplinary action, and no credit will be given. A solution to the problems will be provided in the Engineering Library after the due date. No late homework will be accepted.

Exams: Three examinations and a comprehensive final examination will be given. The exams are closed book, closed notes.

Absence from an Exam: Makeup exams will be given only under extremely unusual circumstances. A written request for a makeup exam must be presented at least one week prior to the exam. It is possible that the makeup exam will be oral. In addition, the student must apply to the Registrar for a conflict final exam.

Grade Appeal: Students may appeal the grading of an examination by discussing the examination with the course instructor. This appeal must be made within one week after the examination has been returned. After that time, no appeals will be accepted.

Cheating on Exams: Students caught cheating will be dealt with according to University Policy.

Class Attendance: It is expected that the student attend all classes. Arriving late three times, three unauthorized absences, or any combination thereof may result in an automatic 10% grade reduction.

Late Drop -- deadline April 11. As a reminder, students may drop a course (late drop) up until the late drop deadline. However, a WP (passing), WF (failing), WN (no grade) symbol will be entered on the student's academic record. Whether the student obtain a WP, WF, or WN will depend on the student's performance. Usually, a 70% average on the homework and the Exams is sufficient to obtain a WP.

Problem Solving Format

One objective of ME 300 is to develop the student's engineering problem solving skill. There is a preferred approach to problem solving. It is characterized by a systemic format consisting of the following steps:

- 1) **KNOWN:** After carefully reading the problem, state briefly and concisely what is known about the problem. Do not repeat the problem statement.
- 2) **FIND:** State briefly and concisely what is to be found.
- 3) **SCHEMATIC:** Draw a schematic of the physical system. If application of the conservation laws is anticipated, represent the required control surface by dashed lines on the schematic.
- 4) **ASSUMPTIONS:** List all pertinent simplifying assumptions.
- 5) **PROPERTIES:** Use a table format to compile property values needed for subsequent calculations. Identify the source from which they were obtained.
- 6) **ANALYSIS:** Begin the analysis by applying appropriate conservation laws. Develop the analysis as completely as possible before substituting numerical values. Perform the calculation needed to obtain the desired results. Clearly identify the final results.
- 7) **COMMENTS:** Discuss the results. Such discussion should include a summary of key conclusions, an inference of trends, and a critique of the original assumptions.

Additional Rules:

- Perform all work on one side of the "Engineer's Computation Pad" paper. Do not write on the back of the page. Place your name, the date, the assignment number, and the page number in the right-hand corner of each page.
- Use one (1) staple in the upper left-hand corner.
- Exercise care when treating units. Answers without appropriate units are meaningless.
- Be neat. If the work is sloppy, it will not be graded.
- Final answers clearly identified and given to three significant digits.

From *Fundamentals of Heat and Mass Transfer* by Frank P. Incropera and David P. DeWitt. Published by John Wiley and Sons: New York, 1990, pp. 22-23.

If the student's homework does not follow the "Problem Solving Format" or any of the "Additional Rules", then it will not be graded.

ME 300: Thermodynamics Syllabus - Tentative
Fall Semester 2008

Course Objectives and Outcomes:

http://www.mne.psu.edu/undergrad/ugmanuals/ME_Manual/ME_Required_Courses/ME300.htm

Required Text

Thermodynamics Concepts and Applications, Stephen R. Turns, Cambridge University Press.
Property Tables for Thermal Fluids Engineering, Stephen R. Turns and David R. Kraige,
Cambridge University Press.

Mathematics Prerequisites: Linear Interpolation; Simple Differentiation and Integration; Solution of First-Order, Linear, Coefficient-Ordinary Differential Equations

Period	Topic	Reading Assignment
1	Introduction - What is thermodynamics?	Chapter 1
2	Concepts and Definitions	
3	Energy and Work	pp. 225-234
4	Energy Transfer via Heat	pp. 223-224
5	The First Law of Thermodynamics	
6	Energy Balance for Closed Systems	
7	Energy Analysis of Cycles	
8	Phase Diagrams	pp. 94-115
9	Thermodynamic Property Data	
10	Internal Energy and Enthalpy - Two Thermodynamic Properties	pp. 51-53
11	Problem Solving	pp. 116-123
12	Equations of State	p. 58
13	The Ideal Gas Model	pp. 59-81
14	Polytropic Processes	pp. 80-81, Tables 4.2 & 7.5
15	EXAM #1	
16	Conservation of Mass	Chapter 3: pp. 162-193
17	Conservation of Energy for a Control Volume	pp. 309-324
18	Steady-State Analysis	pp. 310-320
19	Problem Solving	
20	Transient Analysis	pp. 320-324
21	Transient Analysis	
22	Problem Solving	
23	The Second Law of Thermodynamics	Chapter 6
24	Irreversible and Reversible Processes	pp. 356-358
25	Second Law Corollaries for Thermodynamic Cycles	
26	Refrigeration and Heat Pump Cycles	
27	EXAM #2	
28	The Carnot Cycle	pp. 361-365
29	Entropy and the Clausius Inequality	pp. 366-372
30	Entropy Changes	

31	Internally Reversible Processes	
32	Entropy Balance and the Increase in Entropy Principle	
33	Entropy Rate Balance for Control Volumes	
34	Problem Solving	
35	Isentropic Processes	
36	Steady-State Flow Processes	
37	The Rankine Cycle and Thermal Efficiencies	pp. 5-7 & 520-528
38	Modifications to the Rankine Cycle	pp. 529-537
39	EXAM #3	
40	The Brayton Cycle	pp. 568-572
41	Modifications to the Brayton Cycle	
42	The Otto Cycle	pp. 79
43	Refrigeration/Heat Pump Cycles	pp. 572-583
44	Review	