AME 50531–Intermediate Thermodynamics
Fall 2010

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Course web site: http://www.nd.edu/∼powers/ame.50531

Listserver address: ame50531-01-fa10@acadlist.nd.edu. When e-mail is sent to this address, the entire class will receive a copy of the mail.

Lecture time and location: MWF 12:50 PM-1:40 PM, 223 DeBartolo

Prerequisites: AME 20231, Thermodynamics

Catalog description: "This course will expand the student's knowledge and interest into moist air processes, psychrometrics, gas mixtures and real gas behavior. The course will also present the basics of chemical equilibrium and chemical reactions. Energy-related problems will pose the focus; for example, problems including vapor and gas cycle analysis."

Course Objectives: This second course in thermodynamics is designed to give an undergraduate student a thorough preparation in classical engineering thermodynamics. The course builds directly on the foundation laid in the first thermodynamics class. The successful student will leave with an ability to analyze a wide variety of thermodynamic power and refrigeration cycles relevant to the energy and transportation industry, will understand the fundamental analysis techniques for non-ideal equations of state, will be introduced to the theory of mixtures and psychometrics, as well as equilibrium and non-equilibrium chemistry and combustion.

Topics Covered

- Review of first law, second law, and equations of state,
- Thermodynamic cycle analysis,
- Mixtures and psychrometrics,
- Non-ideal state equations,
- Phase and chemical equilibrium,
- Combustion systems,
- Finite rate chemical reactions.

Primary Text

C. Borgnakke and R. E. Sonntag, 2009, *Fundamentals of Thermodynamics*, Seventh Edition, John Wiley (required). This will be the main text for the course.

J. M. Powers, 2010, *Lecture Notes on Intermediate Thermodynamics*, University of Notre Dame, available online at http://www.nd.edu/∼powers/ame.50531/notes.pdf

Secondary Texts

M. M. Abbott and H. Van Ness, 1989, *Thermodynamics with Chemical Applications*, Schaum's Outline Series, McGraw-Hill (recommended). This book is filled with example problems, and has a useful chemical engineering perspective on thermodynamics.

J. M. Powers, 2010, *Lecture Notes on Thermodynamics*, University of Notre Dame, available online at `http://www.nd.edu/~powers/ame.20231/notes.pdf`

Tertiary Texts

W. C. Reynolds, 1968, *Thermodynamics*, Second Edition, McGraw-Hill This is a useful classical text on thermodynamics which has a particularly lucid style combining both good physical insights with good fundamental analysis.

S. R. Turns, 2000, *An Introduction to Combustion*, Second Edition, McGraw-Hill. This will be a useful additional source for the thermodynamics of combustion and reactive mixtures.

H. C. Van Ness, 1969, *Understanding Thermodynamics*, Dover. This short book, written by an expert in the field, has a simple description of basic concepts in an inexpensive edition.

M. Planck, 1926, *Treatise on Thermodynamics*, Dover. This short book, by the Nobel-prize winning physicist, has a readable, sophisticated discussion of thermodynamics, packaged in an modestly priced edition.

E. Fermi, 1936, *Thermodynamics*, Dover. This is a short compilation of introductory lectures on thermodynamics by the famous Nobel-winning physicist; the text is highly readable, and the price is low.

Required Work and Grading

Exams will be open book, closed notes and held in class. The final exam will be comprehensive.

Homework will be assigned weekly, and generally due at the beginning of class on Friday. All homework will be graded and returned. Homework must be done on *one side only* of 8 1/2" by 11" *engineering* paper with no frayed edges. Multiple pages must be stapled. You should briefly restate the problem, give a sketch if helpful, give all necessary analysis, and place a box around your final answer. All plots must be computer generated, trimmed, and taped to engineering paper. Label all axes. Raw Mathematica or Maple output will not be graded. Neatness and effective communication are considered in grading as well as the final answer itself.

Each homework will usually require a one paragraph summary of a work from the thermodynamics literature. The summaries are required to be written in a LaTeX format and will be checked primarily for style, format, grammar, and content. Near the end of the term each student will choose one of the topics and prepare a relevant ten-fifteen minute oral presentation to deliver to the class.

An Office of Student Affairs-approved written excuse will be required in order for any consideration to be given for any required work (for example, examinations, quizzes, or homework) which is not completed at the expected time. The instructor reserves the right to require all work to be completed to receive a passing grade.

Grades will be assigned based on students' performance on examinations, quizzes, homework, and papers. Pertinent information is as follows:

Exam I	20	Friday, 1 October 2010
Exam II	20	Friday, 12 November 2010
Final Exam	35	Thursday, 16 December 201, 8:00 AM-10:00 AM
Homework	20	generally on Fridays
Oral Presentation	5	Monday, 6 December 2010
Total	**100**	

Honesty Policy

As a member of the Notre Dame community, I will not participate in or tolerate academic dishonesty.
–University of Notre Dame Academic Code of Honor.

Academic honesty is expected. When confronted with an apparent violation, I will enforce the appropriate University regulations to the best of my ability. I will also try to make my expectations clear. By and large, though, these issues are out of my control and as such I do not seek out violations. Instead, I depend upon your basic integrity to prevent any problems.

In brief my expectations are as follows. I encourage you to freely discuss the homework amongst one another as you formulate your solutions *individually*. *Your* written work should represent *your* understanding of the problem. In practice this means copying (in whole or in part) another student's homework, exam, computer program, or paper is *not* permitted. If you choose to discuss your work with a colleague, it should be a discussion in which one teaches another or both work to a mutual understanding. As a counter-example, it is not acceptable to give a friend your homework five minutes before class so that friend can copy your work. I also consider it unacceptable to copy work from a student who was in the class in a previous year. In your written reports, be careful to correctly use quotation marks for words that did not originate with you. Paraphrasing should be held to a minimum, but if used, the paraphrased section should be specifically identified and unambiguously cited. It is not sufficient to simply list a reference but not indicate where a specific quotation or paraphrase was employed. In addition all sources used should be fully cited. As is done in the scientific literature, you should *briefly* acknowledge in writing any significant discussions or interactions you had regarding the work you submit. As a general principle, I do not accept the justification that you were not sure of my intentions. If you feel you may be in an ethical grey area, then you should consult with me *before* acting.