Physics 369, Thermodynamics and Statistical Mechanics, Spring 2006

Section: Unique #59245, Meets MWF, 9-10 AM, RLM 7.104

Pre-requisite: Credit or registration for Phys. 373.

Instructor: Dan Heinzen Office: RLM 10.211; Phone: 471-3960; e-mail: heinzen@physics.utexas.edu

Office Hour: M 10-11 AM, or by appointment

TA: tba TA Office hour: tba

Text: Daniel V. Schroeder, *An Introduction to Thermal Physics* (Addison-Wesley, 2000).

Course content: Approximately, Chapters 1 through 7 of the text, omitting later parts of Chs. 4 and 5. Course content may be adjusted as the course proceeds.

Course Web Site: http://www.ph.utexas.edu/classes/heinzen/phy369/ Lecture notes, handouts, and assignments will be posted here.

Blackboard and e-gradebook: Solutions to homework and exam problems will be posted on Blackboard. Grades will be posted on e-gradebook.

Homework: Assigned approximately once per week. You may work together on the homework. However, each student must hand in his or her own solution, and must contribute substantially to the solution of any problem he or she hands in. No late homework will be accepted without advance permission for a legitimate reason (illness, etc.). In computing the final grade, the lowest homework score will be dropped.

Review/Help Sessions: Review/help sessions will be scheduled as needed during the semester.

Tests: There will be two in-class tests and a take home mid-term. The lowest of these three test scores will be dropped in the calculation of the final grade. Tests may only be missed with advance permission of the instructor. If you must miss one test, there will be no make up test - that will be the score that is dropped. If you must miss more than one test for legitimate reasons (illness, etc.) and *with* advance permission, special arrangements will be made depending on the individual circumstances.

Final: There will be a comprehensive final exam at the end of the class.

Grade: Homework 25%, highest two test scores 20% each, and final exam 35%.

Schedule for Tests

In-class test 1: Monday, Feb. 20

Take home test: Assigned March 31; Due April 3

In-class test 2: Monday, May 1

Thermal Physics Texts

It's difficult to write a good textbook for this course. The problems are that the range of topics covered is quite broad for a one semester course, and that many of the key concepts, such as entropy, are rather unfamiliar, abstract, or counter-intuitive. This subject is not like ordinary mechanics or electromagnetism, because you haven't gotten a lot of preparation in your first and second year courses. And it is not like modern and quantum physics, which is spread out over three our four upper division courses. In my opinion, the book I've chosen, by Schroeder, is the best of the available of options. I think most of you will want to study primarily from this book. But if you are interested in looking at other texts, these are some of your options:

Feynman, *The Feynman Lectures on Physics* (1963). (chs. 39-46) Full of great insights and wonderfully clear explanations. Every student of physics should own this. But, these lectures can be difficult to fully appreciate for a beginner (even though the lectures were intended for sophomores), and tend to grow on you as you learn more. Does not cover the full range of topics normally included in this course.

Reif, *Statistical and Thermal Physics* (1965). This was the standard textbook for many years after its 1965 publication. It is very detailed, treats a full range of topics in depth, and has many nice physics discussions. However many of the discussions in the book are very lengthy, and the level of the coverage is quite high. These days it looks more like a graduate than an undergraduate text, especially for a one-semester introductory course.

Kittel and Kroemer, *Thermal Physics*, 2nd ed. (1980). This was also a very popular book for a long time, and it is still used fairly often. Unlike Reif, the treatment is very terse. For that reason, a lot of professors like it. But students learning thermal physics for the first time sometimes find it too terse and difficult to follow. Another disadvantage is that it tends to give short shrift to purely thermodynamic arguments in favor of statistical ones.

Callan, *Thermodynamics and an Introduction to Thermostatistics*, 2nd ed. (1985). This is probably the best textbook on classical thermodynamics. However, its treatment of thermodynamics is too extensive for our purposes, and its later chapters on statistical physics are not as good as some of the other books.

Huang, *Introduction to Statistical Physics* (2001). This book is written by someone who really understands the subject. All the important topics are covered in a very compact book. However it shares the flaw of Kittel and Kroemer that it is probably too difficult to follow for a student learning the subject for the first time.

Sturge, *Statistical and Thermal Physics* (2003). This book was used last semester for this course. Its pros and cons are rather similar to Reif.

Carter, *Classical and Statistical Thermodynamics* (2001). This book has been used recently for several semesters at UT. It is easier to follow than Reif, Kittel and Kroemer, or Sturge. But I think it is a bit too dumbed-down, has far too little application to physical systems, and contains some serious physics errors.

Schroeder, *An Introduction to Thermal Physics* (2000). (Chosen text for this course.) The discussions in the book are relatively clear, and at about the right level for this course. The book strikes a good balance between thermodynamic and statistical arguments. It has a nice variety of application to different physical systems. Pretty good, relative to the other options.