

## COURSE SYLLABUS -- Physics 5305, Spring, 2009 *Statistical Physics*

10:00-10:50 am, Monday, Wednesday, Friday, Science Room 010

**Instructor:** Dr. C.W. Myles, Professor, Dept. of Physics. **Office:** Sc. Rm 18. **Phone:** 742-3768.

**Office Hours:** Right after class plus 3pm – 4pm MWF & *by appointment*.

**Web Page:** <http://www.phys.ttu.edu/~cmyles/>. **Email:** [Charlev.Myles@ttu.edu](mailto:Charlev.Myles@ttu.edu). An email distribution list will be developed & we can have discussions (homework, etc.). I make **important announcements** by email! ***It's vital that I have your correct email address & that you check your email DAILY!!***

**Course Web Page:** <http://www.phys.ttu.edu/~cmyles/Phys5305/5305.html>. There, you can find this Syllabus, **SOME**: Solutions to homework, exams & solutions, lectures (Power Point) & **IMPORTANT ANNOUNCEMENTS**. **Please get into the habit of checking this page often!** As TTU students, you can get Power Point & Word for *free or almost free!* The page <http://www.phys.ttu.edu/~cmyles/Phys1306/PPT.txt> tells you how.

**Objective:** To introduce students to *graduate level statistical physics* & its applications & for the students *to learn the fundamentals of this important topic*. See separate list of Course Objectives (Learning Outcomes).

**Student Responsibilities:** *Come to class prepared, do the homework, READ the material BEFORE I lecture over it, and keep up as we go along.*

**Physics Level:** This course is designed to be similar to the standard (nationwide) graduate core course (for Physics MS & PhD students) in Statistical Physics. This is a **GRADUATE** course!

**Prerequisites:** A knowledge of the *mathematics of probability & statistics* is assumed! A knowledge of *elementary quantum mechanics* is assumed. Some knowledge of *the Hamiltonian Dynamics part of Classical Dynamics* would be helpful, but isn't essential. It would be helpful (but it isn't vital) to have had (at least) a **good** senior level course similar to our **Physics 4302**. & from a book at the level of the book by Keith Stowe.

**Textbook:** *Fundamentals of Statistical and Thermal Physics*, by F. Reif. **NOTE!!** This book is old! The original publisher, McGraw-Hill, stopped printing it. However, **Waveland Press** publishes it now. It's available (\$92.95) on-line from them. As of Jan. 6, they have it. Our bookstore ordered a rush shipment. Topics will be discussed in approximately the same order as the book table of contents, however, material from many sources other than this book may be used. An on-line search finds new, used, hardcover & paperback versions. A google search gets 36,700 hits with prices from \$43 - \$190!! **I encourage you to shop for the best price for you!** Given the cost, don't you think it would be worthwhile to **READ IT???**

**Undergrad Text:** *Introduction to Statistical Mechanics and Thermodynamics*, by K. Stowe. (John Wiley, 1984) Few viable *graduate level* supplements exist! I've looked & have not been successful! For web resources, see below. **NOTE:** There are **many** books on Statistical Physics (Statistical Mechanics) at various levels of depth & difficulty. In Rm. 18, I have a few. The library has more. Mine are available to check out. In a **GRADUATE** course, ***I expect you to go to other sources*** to obtain different treatments of the material! Lectures will come mainly from the book by Reif. I may sometimes lecture on outside material. pp 631-635 of Reif has a large bibliography. **USE IT!!!!**

**Course Topics:** The course covers the basics of statistical & thermal physics. As a 1 semester course, topics must be covered rapidly. ***An approximate*** schedule of topics is below. A **goal** is to cover Chs. 1- 9 & possibly Ch. 10 of Reif. Similar or related topics from other texts may also be discussed as appropriate. If time permits, selected topics from other chapters of Reif will also be covered.

**Grades; Exams; Homework:** Grades are based on: Homework = 25%, Midterm Exam (in the evening! ~ 1<sup>st</sup> week of March) = 25%, Final Exam (10:30am – 1pm, Sat., May 2!) = 25%, Paper/ Presentation (see below!) = 25%

**Homework:** (Note the high %!). Problems from the book by Reif & from other sources will be assigned regularly. Doing them is your best means of learning physics! It's **IMPOSSIBLE** to do so without working problems! Homework is ***due in my mailbox (or office) no later than 5pm the due date.*** To keep up, do assignments as soon as the material is covered. Problems are **NON-TRIVIAL!** If you wait to the last minute (or day!) to begin, you likely will run into trouble! ***No late homework will be accepted!*** Homework may be done individually or in consultation with others in the course. **I ENCOURAGE groups; this is how scientists work in real situations!** However, **NO CONSULTATION** with people who had this course previously is allowed! **NO** use of problem solutions posted in previous years is allowed! It does you no good to copy old solutions! Copying solutions will **NOT** teach you physics! On the web, there exist solutions to some or all of the problems in our text. Copying these (or copying solutions from previous years!) & handing them in as your own is **CHEATING!!** Anyone caught cheating will, **at minimum**, receive an "F" in this course! TTU has strict policies against cheating & severe penalties for it, including expulsion from the university. Cheating also defeats the purpose of solving problems, ***which is to TEACH you physics***. You should know by now that the **ONLY** way to learn physics is to **DO PHYSICS YOURSELF** (or with friends) by **WORKING MANY, MANY, MANY PROBLEMS!!**

**Library Research Paper & Talk:** On an advanced topic or application of statistical & thermal physics that we don't have time for in class. The paper is due near the end of the semester. Oral presentations on the same subject will take place then. ***You should have the topic picked by mid-semester!!!*** Topics must be approved by me before you begin. The paper should be 5-10 typed pages & written in scientific style, with all (***SEVERAL!!***) sources properly cited. The talk should be about ½ hour long. It can be (but isn't required to be) done in Power Point. Ideas on topics may be found in Chs. 11-15 of Reif or in many other texts.

**Helpful Hints:** This course is sometimes difficult for students. This is partially because it is mathematical & partially because it is (in places) abstract. Unless you are a genius, the only way to succeed in this course is by ***very hard work!*** This means devoting ***MANY hours*** outside of class for every hour in class. It also means at ***trying*** to work all assigned problems!

**Attendance:** I don't take roll & I have no specific attendance policy. However, isn't it obvious that (unless you are a genius) class attendance is required to get a good grade? If attendance appears to become a problem, I reserve the right to institute brief daily quizzes, to be added into the above mentioned homework grade.

***Approximate Grade Scale: 100 ≥ A ≥ 90 > B ≥ 78 > C ≥ 66 > D ≥ 50 > F ≥ 0***

***NOTE: I reserve the right to slightly alter these cutoffs! I reserve the right to assign a higher grade to any student whose efforts may not be reflected in their total points. This decision is mine alone to make. You can't receive a lower grade than indicated by the total points.***

**Math Level:** The math is at the level of a graduate physics course. Statistical & Thermal Physics is, of necessity, somewhat mathematical. However, a goal is to emphasize ***physical concepts & understanding*** over math. I may skip math details & derivations in favor of discussing ***the PHYSICS*** of results. This ***ISN'T*** a math course. If necessary, I'll attempt to fill in gaps in your background. If there is a math point you don't understand, ***please*** ask about it & ***read about it on your own!*** It's ***important*** that you not let the math get over your head to the extent that you lose sight of the ***PHYSICS.***

#### ***Approximate Lecture Schedule***

<b>Reif Chapter &amp; Topic</b>	<b><i>Approximate No. of Lectures</i></b>
1. Introduction to Statistical Methods	3
2. Statistical Description of Systems of Particles	5
3. Statistical Thermodynamics	6
4. Macroscopic Parameters and Their Measurement	4
5. Simple Applications of Macroscopic Thermodynamics	5
6. Basic Methods and Results of Statistical Mechanics	4
7. Simple Applications of Statistical Mechanics	4
8. Equilibrium Between Phases or Chemical Species	5
9. Quantum Statistics of Ideal Gasses	5
<u>10. Systems of Interacting Particles (Selected topics)</u>	<u>?</u>
<b>TOTAL</b>	<b>41</b>

This isn't meant to be rigid, but to give us an idea where we are going. Some topics in some chapters may be omitted. Similar or related topics from other texts may be discussed as appropriate.

**IMPORTANT DATES:** **Mon, Jan 19:** ML King Day, **NO CLASS!!** **Wed, Feb 4:** Last withdraw date-partial refund. **Wed, March 4:** Mid-Semester. **Wed, March 11:** Last drop/withdraw date. **Sat, March 14-Sun., March 22:** Spring Break, **NO CLASS!!** **Mon, April 13:** "Easter Monday", **NO CLASS!!** **Tues, April 28:** Last class. **Sat, May 2:** Final Exam!

**TO BE SCHEDULED: Thurs., April 30-Tues., May 5** (Final Exam week): ***Presentations!***

**Times I'm gone:** I'll be out of town a few times. I'll try to get a substitute.

**ACADEMIC INTEGRITY:** Academic dishonesty (cheating, etc.) will not be tolerated. Students caught in this type of behavior will be punished to the fullest extent allowed by TTU. See the TTU Student Handbook or the Catalogue.

**EXAMS:** The exams in this course are composed ***uniquely*** for this semester.

**COPYRIGHT STATEMENT:** All exams and lecture notes related to this course are copyrighted and owned by me! For students in this course, both are freely downloadable from the course web page. However, ***no other reproduction and/or distribution is allowed!***

**CIVILITY IN THE CLASSROOM:** Students are expected to assist in maintaining an environment which is conducive to learning. To assure that all students have an opportunity to gain from class time, students are prohibited from using cell phones/beepers, eating/drinking in class, making offensive remarks, reading newspapers, sleeping or engaging in any other form of distraction. Inappropriate behavior in the classroom shall result in, minimally, a request to leave class.

***Any student who, because of disabling conditions, may require some special arrangements in order to meet the course requirements should contact the instructor as soon as possible so that necessary accommodations can be made. Proper documentation must be presented from the Dean of Students Office!***

***PARTIAL listing of some World Wide Web resources on graduate Statistical & Thermal Physics***

**NOTE:** There is a lot of material on the web which is potentially useful for these topics. I have not had time to check out the details of most of these. I am listing some here just to give you an idea what is out there and to help you to get started searching yourself. For example, you might want to search on particular topics as we get to them in class. If you do this and find some sources that are interesting and useful, **PLEASE** let me and / or the rest of the class know by email or orally in class. Thanks!

1. **PHYSICS WEB.** Go to <http://physicsweb.org/>, a search engine for physics. (This is based in the U.K., so it has a U.K.–European flavor). Type in “statistical and thermal physics” into the search engine. This leads to 3862 entries! These range from very elementary to very advanced resources, including some research journals.
2. **THE AMERICAN PHYSICAL SOCIETY (APS).** Go to the <http://www.aps.org/>. Type in “statistical and thermal physics” into the search engine. This leads to 1900 entries! There are many other links that can be followed, but I’ve not taken time to do so. **NOTE:** APS is a 40,000 + member organization of professional physicists from around the world. **Everyone** who wants to be a professional physicist should join! If you are not a member, you should join. There is ***NO EXCUSE*** for not doing this! ***For students, the first year's membership is free*** (ask the office for an application form, which must be signed by the Chairman). You get free Physics Today, APS News, & discounted journals.
3. **GOOGLE:** <http://www.google.com/>. Type in “Statistical and Thermal Physics” or “Statistical Mechanics” into this or any of the other commercial search engines and you will get anywhere from thousands to hundreds of thousands of web pages!