

PHY 4523 - Statistical Physics
Spring 2007



Instructor

Prof. Steve Hagen
2362 New Physics Building
Tel. 352 392 4716
Office hours: Mondays 10:00am – 12:00pm (or by appointment)
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Please contact me if you have questions or comments about anything related to this course. I encourage the use of email for asking simple, non-technical questions. For anything else, see me immediately before or after class, or else visit me during office hours. If those options aren't convenient for you, feel free to propose an appointment time; just please avoid those unannounced drop-in visits.

Grader

Yuning Wu
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Class Meetings

Monday, Wednesday, & Friday
8th Period (3:00 - 3:50 pm)
1002 New Physics Building

Textbook

Introductory Statistical Mechanics
Authors: Roger Bowley & Mariana Sanchez
Paperback: 352 pages, List price \$50.00
Publisher: Oxford University Press; 2nd edition
ISBN: 0198505760

Website

The class website is maintained on the UF WebCT server. This allows us to post confidential student grade information, homework and exam solutions, etc. without violating either student privacy or copyright law. The Instructor (that's me) will assume that all students regularly visit the WebCT site and read the announcements and other information posted there. Since all policies & procedures outlined in this syllabus are subject to change, you should consider the website to be the definitive source of current information about policies and procedures. To access the site, go to

<http://lss.at.ufl.edu>

and look for WebCT Vista Log In. Use your Gatorlink ID to log in.

Description

This course introduces "statistical physics", a microscopic approach to the physics of systems consisting of a large number of particles. The course begins with a quick review of macroscopic thermal physics. We will then discuss kinetic theory and statistical mechanics as an introduction for more advanced study of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics. You can think of statistical mechanics

as an extension of macroscopic thermodynamics, or a more microscopic approach to the same problem of systems of many particles. It is one of the most successful theories in all of physical science, and so you may count yourself as fortunate to have been born after its creation.

Since we deal with microscopic physics, the quantum mechanical nature of real particles is important. Although a background in undergraduate quantum mechanics is not required, most students find it useful to have taken the first semester of quantum mechanics before taking this course. But if you haven't studied quantum mechanics yet, don't worry: Ludwig Boltzmann (1844-1906) didn't know any quantum mechanics and he did pretty nicely in statistical physics. The course attempts to be fairly self-contained, introducing various topics and tools as needed.

Students enter this course with a wide variety of backgrounds. As a consequence, we will spend some class time introducing material that may already be familiar to you. Do not let this fool you – there is plenty of new material to be learned. If you really find the class moving too slow, please understand that the pace must accommodate some students whose background may not be as comprehensive as your own. If you are truly bored, talk with me. We can make arrangements/adjustments or suggest some more challenging readings and problems. I have reading materials (beyond the textbook) that can give you a deeply satisfying statistical physics experience.

The course is designed on the assumption that everyone in the class will engage intellectually with the material. I will assume that you are reading the book and working the examples and homework. You are expected to keep up pace in the course. The quizzes and examinations are designed to help guide you in this effort. Cramming before an examination will not work!

A final word about success in the course: there is no secret. If you attend class (and participate), read the textbook, and work the problems and examples, then you will learn the material. The most common mistake made by students in any physics course is ... failure to do enough homework problems! When in doubt, WORK MORE PROBLEMS. This should be a fun subject: statistical physics is a system of fascinating ideas that are implemented with powerful tools, with consequences that are sometimes stunning. Discovering these ideas and tools should be an eye-opening experience for you.

Goals

The ultimate goal of the course is for the students to learn the basic concepts of statistical mechanics, and to learn how to use the machinery of mathematics to solve general problems in this area. Our goal is to learn to apply the concepts and use the tools – not to memorize examples and formulas. Once you have the basics, you are ready to tackle the many applications of statistical physics through advanced courses in physics, chemistry, and engineering.

Grading

Regular homework will be assigned, but it will not be collected or graded. Instead, short quizzes will be given in class, at least once a week in “normal” weeks. Quiz problems usually resemble recent homework problems. Students who attend class and have mastered the homework need not fear the quizzes. Most (but not all) quizzes will be announced in advance. There may be a few take-home

quizzes. There will also be three 50-minute exams held in-class, and a two-hour final exam. The final course grade will be calculated as follows:

- 35% In-class quizzes
- 15% Midterm Exam1 (50-minutes) *Exam dates to be announced later*
- 15% Midterm Exam2 (50-minutes)
- 15% Midterm Exam3 (50-minutes)
- 20% Final Exam (2 hrs)
- 100% Total

PHY4523 students seem to prefer grade accuracy to grade certainty. Therefore, students will not receive letter grades on exams and quizzes during the semester. Instead I will simply give out numerical scores for each quiz and exam. After the final exam, I will calculate each student's numerical average and then set the letter grade boundaries that will determine everyone's final letter grade. This scheme is definitely more accurate (i.e. fair) although it may result in some anxiety for those who prefer knowing their letter grade on each quiz and exam.

All quizzes and exams are closed-book. However, we will maintain an "official" Phy4523 formula sheet, and you will receive a copy of this sheet during each quiz and exam. Other than this formula sheet, no other books or notes are permitted during quizzes and exams. See *Academic Honesty*, below.

Final Exam

There will be a two-hour, comprehensive final exam (group 2D):
3:00-5:00 pm , Wednesday May 2, 2007

Make-up Exams

Make-up exams are intrinsically unfair. This unfairness can be mitigated (but not eliminated) by keeping the number of make-ups to an absolute minimum. A make-up for a missed exam will be granted only in the most dire situation. Note that DIRE means "desperately urgent" or "warning of disaster". It does not mean "characterized by difficulty or inconvenience." A student who lacks diligence in contacting the instructor once this dire situation arises is unlikely to be granted the make-up.

There will be no make-ups for missed quizzes. Some students may suffer from a severe personal or family emergency that forces them to miss a quiz: Therefore, the two lowest quiz scores will be dropped when final grades are calculated.

Attendance & Participation

Regular class attendance is definitely expected. Mastery of the course material will require each student to make a sustained and consistent investment of effort throughout the semester. Class attendance is part of that effort. A student who stops participating in the class – i.e. who ceases attending class, doing homework, communicating with the instructor, taking quizzes/exams – should drop the course, because otherwise a failing grade is certain. No special end-of-semester arrangements (such as make-up work, late-drop petitions, incomplete grades, signatures on various documents, etc.) will be provided to any

student who simply disappeared for a substantial portion of the semester. Such services are only available to students who have participated in class and kept in regular contact with the instructor during the term.

Registration Status

Unfortunately I cannot approve requests to audit PHY4523. Every student must register formally and take the class for credit. Classwork of unregistered students will not be graded.

Incomplete Grades

UF policy aims to discourage instructors from giving incomplete grades. Per this policy, a student may request a grade of Incomplete only if (a) an unusual hardship prevents the student from completing the course, and (b) the student carries a passing grade average at the time the request is made, and (c) the student shows diligence and responsibility in making the request in a timely fashion once the unusual hardship arises. The request certainly cannot be made after the final examination. I adhere blindly and rigidly to this policy.

Appropriate classroom behavior

It is a sad commentary on the 21st century that some people need to be reminded of appropriate classroom behavior. Frequent lateness, entering and leaving the classroom during the lecture, reading the ALLIGATOR during class, clacking away at email or instant messaging during class, cellphone rings, etc., are all rude and distracting. They disrupt the orderly operation of the classroom -- in violation of the Student Conduct Code. Please show courtesy and respect for yourself and your colleagues by avoiding such distracting behavior.

Students with Disabilities

It is the policy of the University of Florida that the student, not the instructor, is responsible for arranging accommodations when needed. Students who will require a classroom accommodation for a disability must contact the Dean of Students Office and request proper documentation. Upon bringing that documentation to the Instructor, the student will be given the appropriate accommodations. No accommodations are available to students who lack this documentation. I will not remind a student to schedule accommodations prior to each quiz or exam. If you require extra time for in-class work, you must initiate this request at least seven days before each exam or quiz.

Academic Honesty

All students are expected to hold themselves to a high standard of academic honesty. It is normal and reasonable for students in a physics course to work together on ungraded homework: however, students must work alone on all graded assignments (tests, quizzes, exams). Giving or receiving any unauthorized assistance during such an assignment will be treated as a deliberate violation of the UF Academic Honesty policy and the Student Conduct Code. This will result in a failing grade in Phy4523 and unpleasant attention from the Dean of Students office.