Course: Phys.526 Statistical Physics
Term: Spring 2017
Room: GRB W212
Class: MWF, 10:00-10:50

Instructor Contact Information

Instructor: Huey Huang
Office: Brockman Hall 252
Email: hwhuang@rice.edu
Office Hours: MTu 2-5 or by appointment

Course Objectives and Learning Outcomes

Course Learning Objective: This course extends the undergraduate thermal physics to a more advanced level so as to prepare the graduate students for the research literature on the subjects of modern statistical physics.

The topics covered and approximate schedule will be:
Phys 526 (spring semester)

1. Principles of Thermodynamics--review of undergraduate thermodynamics.
2. Principle of Statistical Mechanics--ensemble theories and simple examples.
3. Boson gases--black body radiation, Debye theory, Bose-Einstein condensation.
4. Fermion gases--electron gas in a magnetic field, magnetism.
5. Phase Transitions and Critical Phenomena—order-disorder phase transitions, Maxwell construction, Ising and other models, mean field theories, Landau theory, correlation functions, critical exponents, scaling hypotheses, renormalization group theory, topological phase transitions, quantum phase transitions.

Topic Learning Outcomes: By the end of the course, students will be able to
(1.) converse with correct concepts of thermodynamics and statistical mechanics,
(2.) understand statistics of particles and statistics of fields,
(3.) perform mean field calculations,
(4.) understand various models in statistical mechanics,
(5.) understand the significance and characteristics of critical phenomena,
(6.) understand the concepts of universality and scaling laws,
(7.) understand the essence of the renormalization group theory.

Required Texts and Materials

We will use the textbook "Statistical Mechanics, 3rd Ed., by Pathria and Beale. We will cover the topics related to Chapter 1-8, 12 and 14, and some examples from the remaining chapters. The remaining chapters that we will have no time to cover are special topics which are excellent references for research.

Assignments

Homework assignments will be selected from the current and previous textbooks: "Equilibrium and Non-Equilibrium Statistical Thermodynamics" by Le Bellac, Mortessagne, and Batrouni and "Statistical Mechanics," by K. Huang. (Students don't need to have these two books.) There is no better way of testing your comprehension by trying out these problems. I will assign homework in the Owlspace at least a week ahead of the due time. One set of homework will be due every Wednesday (unless specified otherwise). You are asked to turn in your homework at the beginning of the Wednesday class. We will then discuss the homework solutions—this is part of the course lectures; some homework problems will

require the students to read sections of the textbook not explicitly covered in the lecture. No printed solutions will be distributed.

It is impossible to overemphasize the importance of homework. You learn the most from doing the problems yourself, including making and correcting mistakes. You are allowed to discuss homework with fellow students and with me, but ONLY after you have tried the problems yourself. Note: the first step of the solution is usually the key; the rest is usually straightforward. If you habitually rely on others to help you on the first step, you probably have not learned the subject.

Grade Policies

The course grade will be determined by the homework (40%), a midterm (30%), a final (30%) and class participation (subjective) (extra 5%).

Late Homework Policies

Homework assignments are due at 10 am on the due date. One problem set will be accepted late, without question, as long as it is submitted by the start of the next class period.

Rice Honor Code

In this course, all students will be held to the standards of the Rice Honor Code, a code that you pledged to honor when you matriculated at this institution. If you are unfamiliar with the details of this code and how it is administered, you should consult the Honor System Handbook at http://honor.rice.edu/honor-system-handbook/. This handbook outlines the University's expectations for the integrity of your academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process.

Problems sets in this class are covered by the honor code. You are encouraged to work together and discuss subjects in the course, but you must write up your own solutions. You should never copy the work of another student. You may not look at solution sets from previous years or solution sets found on the internet.

Final is a pledged take home examination. You have to follow the rules written for this exam. No discussion with anyone else is allowed.

Disability Support Services

If you have a documented disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Disability Support Services (Allen Center, Room 111 / adarice@rice.edu / x5841) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

Syllabus Change Policy

This syllabus is only a guide for the course and is subject to change with advanced notice.