Physics 333: Thermal and Statistical Physics
Winter 2016

Class: Tuesday, Thursday, 8:35-9:55. Room: RPhys 115

Midterm In-class Tuesday, March 15, 2016
Final TBA

Instructor
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TAs
Bernard, Simon
Carrier-Vallieres, Martin
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TA Tutorials / Interaction Periods: TBA
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Undergraduate Tomlinson Teaching Fellow
Wolf, Julian

Course Materials
Notes, additional readings, and homework will be available on myCourses. Weekly TA tutorials will provide a valuable opportunity to work on concept problems as well as short problems together with classmates and TAs. This interactive, hands-on problem-solving training, which is supplemental to the graded homework, is ideally suited to learning physics.

Evaluation
Your grade will be the weighted sum of:

• 30% Homework: problems sets will be assigned approximately every 1-2 weeks; posted on myCourses and due approximately 10 days after they
are assigned. Your work should be submitted in-class on the assigned date and solutions will be posted on myCourses soon after. You are encouraged to discuss the problems with your colleagues, but you must write up your own solutions in your own words. The solutions you hand in should reflect your own work and understanding. Your lowest problem set grade will be dropped but completing all problem sets is highly encouraged to take advantage of the feedback and engage in this active learning process.

• 20% Midterm: will tentatively be held on the Tuesday March 15 in-class (1.5 hours). It will be a closed book exam (no external texts or notes allowed). A sheet of expressions and constants will be provided and will be posted online in advance, providing you with the tools you need. If you miss the midterm and have a valid excuse (such as major illness and doctor’s note, as per University policy), the final grade will be 70% Final and 30% homework. In handling large numbers of students fairly, exceptions are a challenge to make.

• 50% Final: held during the exam period at a date and time to be determined. It will be a closed book exam (no texts or notes allowed). A sheet of expressions will be provided and you will know it in advance. Covers all material. Run formally by the university.

Text
D. Schroeder. “An Introduction to Thermal Physics”. Available at McGill Bookstore. This text is good: the material is well chosen, pedagogical, and modern. I will use it for some homework. Weekly TA tutorials will use it extensively for problem-solving sessions in groups.

Outline
We will cover the following topics, for which parts of Ch 1-3 (background) and Ch 5-7 (covered by this course) of Schroeder will serve as excellent book. To support my lectures, I will assign weekly readings from this text and follow my notes. I encourage everyone to attend class because questions, exchanges, “live problem solving,” and demonstrations are both fun and valuable to the learning process! I will assume that you are coming to the course with a grasp of concepts covered in Ch 1-3, based on the course pre-requisites. It
is recommended to review those Chapters at the start of the term, for fresh background. Our PHYS 333 experience and learning will focus on Statistical Mechanics, emphasized and established in Ch 5-8. Our work together will build on what you have learned with review, new perspective, and new applications to support our study of Statistical Mechanics. Hope you will enjoy!

Topics

- Introduction: bridging the microscopic and macroscopic worlds with Statistical Mechanics
- Boltzmann distribution
- Applications to paramagnetism and molecular systems
- Equipartition theorem
- Maxwell Boltzmann distribution
- Thermal bath, equilibrium, heat, entropy
- Partition function
- Composite systems
- Revisiting the ideal gas, deBroglie volume, heat capacity
- Gibbs factor, Grand partition function
- Applications to molecular systems
- Bosons and Fermions
- Degenerate Fermi Gases
- Blackbody radiation
- Debye Theory
- Bose Einstein Condensation
- Applications to the Sun and Earth
- Weekly interacting systems
• Debye theory of solids
• Advanced thermodynamics
• Phase transitions
• Applications to mixtures
• Applications to osmotic pressure
• Fluctuations and critical points
• Critical behaviour and magnetization

Rights/Responsibilities
McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offenses under the Code of Student Conduct and Disciplinary Procedures (see http://www.mcgill.ca/integrity for more information).

In accord with McGill University’s Charter of Students’ Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

Instructors who may adopt the use of text-matching software to verify the originality of students’ written course work must register for use of the software with Educational Technologies (Email) and must inform their students before the drop/add deadline, in writing, of the use of text-matching software in a course.