

STATISTICAL PHYSICS PHYS912 SEC 001 Fall 2023

Statistical Physics - Fall 2023

PHYS 912

TR 9:30-10:45 AM

JH 247

Instructor: Prof. Kirill Belashchenko

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Individual meetings: stop by the office for quick discussions or request an appointment by email.

Prerequisites: PHYS 911 and 916, or permission.

Content summary: This course starts with phenomenological thermodynamics and then covers the basic principles and applications of statistical physics, including ensemble theory, classical and quantum ideal gases, magnetic systems, and phase transitions.

Textbooks: E. Fermi, Thermodynamics (Dover paperback); H. Gould and J. Tobochnik, Thermal and Statistical Physics (download at <http://stp.clarku.edu/notes> [Links to an external site.](#)).

Additional sources: There are many good books on statistical physics. Here are a few suggestions:

R. K. Pathria and P. D. Beale, Statistical Mechanics (3rd edition)

F. Reif, Fundamentals of Statistical and Thermal Physics

L. D. Landau and E. M. Lifshitz, Statistical Physics

K. Huang, Statistical Mechanics

Format: This course will be taught predominantly in the flipped-classroom format. In and out of class, students will work on tutorial assignments (see below). Key points will be discussed and student questions answered by the instructor as needed. Physics education research indicates that collaborative learning in small groups is a highly effective way to develop understanding of physics concepts and problem-solving skills.

Pre-class assignments will usually involve reading from the textbook, but there will also be occasional video lectures assigned through Canvas. It is very important to complete these assignments before the deadline specified in Canvas and submit an online quiz to self-attest that the pre-class assignment has been completed. The quiz will have space to include your questions about the material for possible discussion in class, and it may also occasionally include quiz questions on the assigned material.

Tutorials: Each tutorial includes action items aiming at the conceptual understanding of a topic, such as exercises from the textbook or filling in the missing steps in derivations. Timely completion of pre-class assignments is crucial for making good progress. Typically, a tutorial will be assigned for about a week and will require substantial amount

of work both in and out of class. Students are strongly encouraged to collaborate in groups of 2 or 3. Tutorials are learning instruments rather than tests; if you are unsure how to proceed, always ask the instructor for a hint or clarification. Each student should submit his or her own work on the tutorial. While discussions are strongly encouraged, each student should work out the technical steps individually. Simple copying of the work of others is not allowed.

Problem sets: In addition to tutorials, problem sets may be assigned from time to time. The solutions should clearly explain all the important steps. In contrast to the tutorials, problem sets are individual assignments. You may discuss ideas and approaches with other students *after* you have spent some time thinking about these problems. However, you are required to complete all the technical steps yourself. You are not allowed to copy the work of others or use problem solutions obtained from any source.

How to submit: Each student should complete and submit written assignments individually. Submissions should be neatly written and scanned (or neatly typeset in software) and submitted electronically through Canvas in PDF format. Leave good margins on the sheets and use a flatbed scanner to obtain high-quality images. Only use smartphone cameras or other such equipment if you are able to achieve image quality comparable to a flatbed scanner. To facilitate anonymous grading, do not write your name on your submission. Hard copies or email submissions will not be accepted. Occasional late submissions will be accepted, but they may lose a percentage of points unless excused (typically 5-25% for delays of up to 2 weeks).

Grading: Assignments will be graded by a teaching assistant. Grades may be appealed to the instructor within a reasonable time (2-3 weeks). Students are expected to review the graded assignments and learn the correct solutions.

Exams: There will be a 1.5-hour **midterm exam** in the middle and a **two-hour final exam** at the end of the semester. Unless expressly stated otherwise, it is not allowed to use any books, notes, or other materials on the exams. The midterm exam will take place near the end of the seventh week of classes outside of the regular class schedule.

Participation: Students are generally expected to attend all classes (but see *Missed deadlines* below) and actively participate in classwork. This effort will be evaluated by a single participation grade at the end of the semester.

Missed deadlines and exams: You should notify the instructor if you expect to miss or have missed classes, assignment deadlines, or exams for a legitimate reason, such as illness, quarantine, or family emergency (be prepared to provide supporting documentation). Make-up exams will not be offered. If you miss the midterm or the final exam, discuss your situation with the instructor; a grade of Incomplete may be an option.

Scores and Grades: Your total score will be compounded as follows (subject to change depending on the actual schedule of assignments):

Tutorials and problem sets: 30%

Midterm exam: 25%

Final exam: 35%
Quizzes: 5%
Participation: 5%

The scores for all assignments will be posted in Canvas. Total scores for all students may be scaled at instructor's discretion. Based on the total score, the final grades will be determined as follows: A+ [92-100], A [88-92], A- [85-88], B+ [82-85], B [78-82], B- [74-78], C+ [70-74], C [65-70], C- [60-65], D+ [55-60], D [50-55].

Instructor replacements: Classes will occasionally be taught by a replacement instructor, which will provide a seamless continuation of the course. In particular, classes will be taught by Dr. Harindranath Ambalampitiya during the weeks of August 21 and September 4.

Instructional continuity: If in-person classes are canceled, students will be notified of the instructional continuity plan for this class by an announcement in Canvas and by email. In case of a university-wide closure, students will typically be expected to continue working on the current assignments at their own pace. The instructor will usually be available to answer questions by email.

Changes: This syllabus represents a reasonably accurate outline of the course, but some adjustments may be made depending on our progress.

Intellectual property and privacy issues: I invite all of you to join me in actively creating and contributing to a positive, productive, and respectful classroom culture. Each student contributes to an environment that shapes the learning process. Any work and/or communication that you are privy to as a member of this course should be treated as the intellectual property of the speaker/creator, and is not to be shared outside the context of this course. Students may not make or distribute screen captures, audio/video recordings of, or livestream, any class-related activity, including lectures and presentations, without express prior written consent from me or an approved accommodation from [Services for Students with Disabilities](#). If you have (or think you may have) a disability such that you need to record or tape class-related activities, you should contact [Services for Students with Disabilities](#). If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Failure to follow this policy on recording or distributing class-related activities may subject you to discipline under the [Student Code of Conduct](#).

Academic integrity: Students are expected to understand and adhere to the principles of academic integrity, which are explained in the [Student Code of Conduct](#) and in [this statement](#).

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in

course activities or to meet course requirements. To receive accommodation services, students must be registered with the [Services for Students with Disabilities](#) (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.