

Thermodynamics and Statistical Mechanics

PHYS 2305, Spring 2019

Lecturer: Prof. Dmitri Krioukov

Office: 227 177 Huntington Ave

Email: dima@northeastern.edu

Lecture hours: Tue, Fri, 9:50-11:30 AM

Classroom: West Village G 102

Office hours: Tue, 3:00 PM - 6:00 PM. Appointments may be scheduled for students who cannot make the official hours.

Textbook: *Thermal Physics*, 2nd Edition, by C. Kittel and H. Kroemer

Prerequisites: PHYS 1155 or PHYS 1165 or PHYS 1175, and MATH 2321

Course description and objectives: Thermodynamics and Statistical Mechanics is a one-semester calculus-based physics course. The objective is to understand the physics of large collections of particles. The course focuses on the canonical ensembles in statistical mechanics, entropy and equilibrium, quantum statistics, ideal gas, laws of thermodynamics, heat and work.

Grading

Your course grade will be based on three components: Proof of TRACE Evaluation (10%), Homework (20%), Midterm Exam (30%), and Final Exam (40%). The letter grade will be determined as follows: A (92-100), A- (88-92), B+ (85-88), B (80-85), B- (70-80), C+ (68-70), C (64-68), and C- (60-64).

Reading and Homework

This syllabus includes information on the required course reading and homework assignments. It is **VERY IMPORTANT** that you read and understand the material in the text before coming to class. There will be 10 homework assignments. Solutions to homework problems and exams will be posted on Blackboard.

Need Help?

1. Come to the office hours, Tue 3:00 PM - 6:00 PM at 227 177 Huntington.
2. Use the Blackboard course discussion forum to ask and discuss your course-related questions with other students who are strongly encouraged to help.
3. The Physics Workshop offers free help sessions by physics doctorate students. You can drop in at the times indicated on the Physics Workshop Schedule available at <https://web.northeastern.edu/ipl/the-ipl-experience/physics-workshop/>
4. Peer tutoring by undergraduate students is available on a first-come/first-serve basis. Follow the instructions at <https://undergraduate.northeastern.edu/peer-tutoring/>

Academic Integrity Policy

The Northeastern University Policy on Academic Honesty can be found at:

<http://www.northeastern.edu/osccr/academic-integrity-policy/>

Tentative Course Schedule

- Week 1 (Jan 8,11):** Introduction and Course Overview
- Weeks 2-3 (Jan 15,18,22,25):** Microcanonical Ensemble: States of a Model System (Chapter 1)
- Weeks 4-5 (Jan 29; Feb 1,5,8):** Thermal Equilibrium: Entropy and Temperature (Chapter 2)
Homework 1: chapter 2, problems 1, 2, 3, 4, 5, 6
- Weeks 6-7 (Feb 12,15,19,22):** Canonical Ensemble: Boltzmann Distribution and Helmholtz Free Energy (Chapter 3)
Homework 2: chapter 3, problems 1, 2, 3, 4, 7, 9, 10
- Week 8 (Feb 26; Mar 1):** **MIDTERM EXAM** (Feb 26: review; Mar 1: exam)
- Week 9:** **Spring Break**
- Week 10 (Mar 12,15):** Midterm aftermath
- Week 11-12 (Mar 19,22,26,29):** Grand Canonical Ensemble (Thermal and Diffusive Equilibrium): Chemical Potential and Gibbs Distribution (Chapter 5)
Homework 3: chapter 5, problems 6, 7, 8, 10, 11, 15
- Week 13-14 (Apr 2,5,9,12):** Ideal Gas (Chapters 3,6)
Homework 4: chapter 6, problems 1, 2, 3, 4, 6, 7, 8, 12, 13, 14, 15
- Week 15 (Apr 16):** Quick Review; Paradigmatic Problems (Carnot Cycle)
- Week 16 (TBD):** **FINAL EXAM**