

**Physics 340 Thermal Physics
General Information, Fall 2021**

July 15, 2021

Subject matter: Basic principles of thermodynamics, kinetic theory, and statistical mechanics, with emphasis on applications to classical and quantum mechanical physical systems.

Prerequisites: ([PHY 013](#) or [PHY 021](#) or [PHY 023](#)) and ([MATH 023](#) or [MATH 032](#) or [MATH 052](#))

Instructor: H. Daniel Ou-Yang, professor of physics.

Office: Physics Building Fairchild Lab 206

Email: hdo0@lehigh.edu (I check email regularly. This is the best way to contact me.)

Phone: x83920 (Office) (Please leave a voice message, but this is slower than emails.)

General Plan: The class meets three times per week for 50 minutes each, in Lewis Lab 512, 9:20 to 10:10, Monday, Wednesday, and Friday.

Office Hours: Immediately after the lectures and by scheduling with the instructor

Individual interactions outside the regular class meetings:

- 1) Please schedule at least two individual meetings with the instructor during the semester
- 2) Additional individual meetings can be scheduled by emails to the instructor.

COVID-19 Safety Rules and Regulations:

Students should follow government and university COVID-19 safety rules and regulations announcement from the Health and Wellness Center.

<https://mail.google.com/mail/u/0/#search/Lehigh/WhctKJVzcLIRFggpdckcxPvbNLznjwCcjlrrbsrmXjNfLNkjQWTxqWQbNkNwlvXbHSMmNV>

Specifically, students are expected to follow the simple safety rules:

1. Wear a facemask whenever there is possibility to encounter another person within a distance of 6 feet.
2. Avoid crowded environment at all times and especially crowded indoor environment.
3. Wash hands with soap for at least 20 seconds after you have touched surfaces that might have been contaminated.
4. Self-monitor symptoms (complete [the self-screening tool](#) if coming to campus) and absolutely stay-at-home if you don't feel well or have other symptoms.

Textbook: "Thermal Physics" by Ralph Baierlein (Wesleyan University)
Cambridge University Press, 1999 (Selected topics from Chapters 1 to 12)

Required Reading:

Einstein's Fridge: How the Difference between Hot and Cold explains the Universe, by Paul Sen, Scribner Simon and Schuster, 2021

e-book is available at the Leigh Library

<https://ebookcentral.proquest.com/lib/lehighlibrary-ebooks/detail.action?docID=6503766>

Other books (that might be helpful for the course):

Kittel, Elementary Statistical Physics, 1967

Kittel and Kroemer, Thermal Physics, second edition, Freeman, 1980

Reif, Fundamentals of Statistical and Thermal Physics, Waveland Press, 2009

Swendsen, An Introduction to Statistical Mechanics and Thermodynamic, Oxford, 2012

Tabor, Gases, Liquids and Solids, 3rd Edition, Cambridge, 1991

Goals for the course:

We expected the students to learn the physical concepts of and the necessary mathematical tools to solve the following problems:

- 1) The first law of thermodynamics: internal energy, energy exchange by heating and energy exchange by doing work.
- 2) The second law of thermodynamics: multiplicity, entropy and temperature
- 3) Entropy in Quantum and Classical Systems
- 4) Canonical Probability Distribution: how partition function leads to calculation of energy, entropy, pressure and other thermodynamic functions
- 5) Photon Statistics: thermal radiation
- 6) Helmholtz Free Energy, Gibbs Free Energy, Chemical Potential
- 7) Fermion and Boson statistics
- 8) Van der Waals Equation of State: Phase Transition

Grading and grade distributions:

Homework/attendance/Quiz: 20%, Hour Exam I: 20%, Hour Exam II: 20%, Final Exam: 40%

Homework and Quizzes:

There will be homework assignments for each lecture. The purpose of the homework is to encourage students preview course materials before the lectures. The homework will also serve to inform the instructor about the subject matters with which a majority of students are having difficulty so more discussions will be devoted to these subject matters.

to learn how to formulate and solve the problems using methods and examples learned from the textbook, lectures, and class discussions.

- (1) Homework: due midnight before the next lecture

- (2) Instructor's homework solutions: provided before the due date of the next homework.
- (3) Grading: based more on the effort than the correctness of the answers.
- (4) Collaboration with others: students are encouraged to work with each other on homework assignments.
- (5) Consultation with the instructor: the students are encourage to discuss with the instructor before as well as after the homework is due
- (6) Academic ethics: copying from others in class, from solution sets from previous years or published solution manual are considered an act of cheating.

Exams: there will be two hour-tests and a final exam

All exams will be conducted in class

Notes and Equation Sheet: The exams will be closed book tests. Equation sheets will be provided by the instructor.

Copying from papers of other students, collaborating on exams, and use of notes or references that are not explicitly permitted, are obvious forms of cheating that will be dealt with by referral to the Discipline Committee.

No Makeup Exams: No make-up exams for hour tests or the final exam are given under any circumstance. If an hour exam is missed for a legitimate reason, the corresponding portion of the final exam that covers the same course materials will be counted toward the grade for the missed exam. It will be an incomplete if a final exam is missed.

Attendance Policy: Attendance to the lectures is required.

Disability: Disability Support Services in the Dean of Students office addresses requests for accommodations for undergraduate and graduate students. For more information, I encourage you to visit the web site at:

<http://www.lehigh.edu/%7Einacsup/disabilities/>

In addition, Maria Zullo, Assistant Dean of Students, would be pleased to discuss the program with your department. She may be reached at 84152 or maz317@lehigh.edu.

Lehigh University is committed to diversity, inclusion and engagement [<http://www.lehigh.edu/diversity>]. That commitment is captured in [The Principles of Our Equitable Community](#). The Principles have been endorsed across Lehigh and by the Board of Trustees.