

**Physics 340 Thermal Physics (3 Credits)
General Information, Fall 2018**

August 25, 2018

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 Fairchild Lab 206 and Lewis Lab 124.

Email: hdo0@lehigh.edu. Phone: x83920 (Office) or x85720 (Lab).

General Plan: The class meets three times per week for 50 minutes each, in Lewis Lab 512, 10:10 to 11:00, Monday, Wednesday, and Friday.

Textbook: “Thermal Physics” by Ralph Baierlein (Wesleyan University), Cambridge University Press, 1999. Selected topics from Chapter 1 to 12 will be covered.

Other books:

Young and Freedman, University Physics, Pearson Addison Wesley, Volume 1 (review of PHY11)

Kittle and Kroemer, Thermal Physics, second edition, Freeman (great book, concise)

Reif, Fundamentals of Statistical and Thermal Physics, Waveland Press (classic)

Tabor, Gases, Liquids and Solids, 3rd Edition, Cambridge (physical intuition)

Goals for the course:

The students are expected to learn the physical concept and 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 Systems
- 4) Canonical Probability Distribution: how partition function leads to calculation of energy, entropy, pressure and other thermodynamic functions
- 5) Photon and Phonon Statistics: blackbody radiation, heat capacity of solids
- 6) Helmholtz Potential and Chemical Potential
- 7) Fermion and Bosons: Bose-Einstein condensation
- 8) Van der Waals Equation of State: Phase Transition

Grading and grade distributions:

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

Homework: The objective of the quizzes (pop quiz), and homework assignments (approximately once per week) is to encourage the students to preview the conceptual course materials before the lectures, to learn how to formulate and solve the problems with methods you have learned from the textbook, lectures, and class discussions. Solutions to the homework will be provided before the due date of the next homework. The homework will be graded mostly on the effort rather than on the right answers. Students are encouraged to work with each other on homework assignments. You are also welcomed to come to see me if you need help. However, use of solution sets from previous years or published solution manual is considered an act of cheating, both for the current students and for the students who provided the solution sets.

Exams: All exams will be in class (no take home exams). 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. Phones of any kind are not permitted in the exam room and anyone found with a phone during the exam period (either within or outside the exam room) will be given a grade of zero on the exam. Any student found at any location outside the exam room during the exam (except the restroom), without explicit permission, will also receive a grade of zero for that exam.

Notes and Equation Sheet: The exams are closed-book. The information on the inner pages of the front and back covers of the book will be provided at the exam. A single page of self-prepared *hand-written* notes is permitted.

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 as the missed exam. It will be an incomplete if a final exam is missed.

Attendance Policy: Attendance to the lectures is highly recommended.

Office Hours: Office hours can be arranged with the instructor in person or by email in advance.

Disability: The Office of Academic Support Services in the Dean of Students office addresses requests for accommodations for learning and/or physical disabilities 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.