

Statistical Mechanics and Thermodynamics I. Fall 2016

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Text: This book is required.

- **L.D. Landau, E.M. Lifshitz et al**, *Statistical Physics*, 3rd edition, Butterworth-Heinemann, ISBN 0750633727.

This book is recommended.

- **R. Kubo et al**, *Statistical Mechanics*, 12th repr. 1992 edition, Elsevier Science, ISBN 0444871039

Grading:	Exam: 30%	Final (comprehensive): 40%	Homework (weekly): 30%
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ROOM: Tuesdays: MPHY 332, Wednesdays and Thursdays: MPHY 333

Exam on **October 11, Tuesday, 9:35-10:50am**; MPHY 332

Final exam: **December 9, Friday, 12:30-2:30pm.**

Syllabus:

Themes:

- **Thermodynamics:** Entropy, Temperature, Macroscopic motion, Thermodynamic potentials, Relation between measurables, Joule-Thomson process, Maximum work, Thermodynamic inequalities, Dependence on the number of particles, Chemical potential, Equilibrium and chemical potential, Phase Transitions, Mixtures.
- **Statistical mechanics:** Stat. independence & fluctuations, Fluctuations of additive observables, Liouville's theorem, Microcanonical distribution, Statistical matrix, Quantum Liouville's theorem, Role of energy, Quantum microcanonical distribution, Entropy, WKB, Level spacing, Quantum microcanonical distribution, Gaussian integrals, Fluctuations of fundamental thermodynamical quantities, Canonical distribution, Maxwell distribution, Ising model, Grand canonical ensemble, Occupation numbers, Classical Ideal gas, Internal degrees of freedom, Magnetism of gases, Fermi and Bose gases, Degenerate electron gas $T = 0$, Degenerate electron gas, Magnetism of degenerate electron gas, Magnetism of degenerate electron gas, Degenerate Bose gas, Black-body radiation, Phonons, Non-Ideal gas, Van der Waal's equation, Second order phase transitions, FDT.

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"Ludwig Boltzmann, who spent much of his life studying statistical mechanics, died in 1906, by his own hand. Paul Ehrenfest, carrying on the work, died similarly in 1933. Now it is our turn to study statistical mechanics."

- From the introduction to States of Matter by David L. Goodstein -