**PHYS 1341/2341: Thermodynamics and Statistical Mechanics, Spring 2022**

**Class:** Tue/Thu 9:30-10:45am, 11 Thaw

**Professor:** Andrew Mugler (he/him), 206 Allen, andrew.mugler@pitt.edu

**TA:** Brenda Gomez Cortes (she/her), 109A-5 OEH, bdg43@pitt.edu

**Books:** Fermi, *Thermodynamics* | Kennett, *Essential Statistical Physics*
Optional: Reif, *Fundamentals of Statistical and Thermal Physics*

**Office Hours:** Andrew: By appointment—please do not hesitate to email.
Brenda: Tue 12-1pm, https://pitt.zoom.us/j/9133369627

**Credit:** 40% Homework quizzes* | 20% Midterm exam | 40% Final exam
*Last 15 min on Thu, random HW problem, possibly modified
*Makeup quiz must be excused in advance and taken within 1 week

Virtual | Pre-recorded | No class | Exam | Homework quiz | Ungraded HW quiz (virtual)

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|---|---|---|---|
| Jan 11 | Introduction | Jan 13 | Probability/statistics 1.2 |
| Jan 18 | Micro/macrostates 1.3, 1.4, 5.1.1 | Jan 20 | Microcanonical ensemble 2 |
| Jan 25 | Temperature, entropy 2.1, IV.13 | Jan 27 | Pressure |
| Feb 1 | Heat capacity II | Feb 3 | State transitions I, II |
| Feb 8 | Heat engines III | Feb 10 | Refrigerators III |
| Feb 15 | Thermodynamics survey | Feb 17 | Thermodyn. potentials V B.3 |
| Feb 22 | Canonical ensemble 4, 4.4 | Feb 24 | **Midterm exam** |
| Mar 1 | Kinetics 5 | Mar 3 | Partition function 4.2 |
| Mar 8 | **Spring break** | Mar 10 | **Spring break** |
| Mar 15 | Gibbs' paradox 4.5 | Mar 17 | Equipartition theorem 4.7 |
| Mar 22 | Non-ideal gases 4.6 IV | Mar 24 | Phase transitions |
| Mar 29 | Critical points | Mar 31 | Grand canonical ensemble 6 |
| Apr 5 | Chemical potential 6.1 | Apr 7 | Quantum gases 7 |
| Apr 12 | Quantum statistics 7.3 | Apr 14 | Blackbody radiation 9.1 |
| Apr 19 | Ising model 10 | Apr 21 | Conclusion |
| Apr 25-29 **Final exam** (day/time TBD) | | | |

**Learning Objectives:**

- Demonstrate understanding of the concepts, principles, and laws of thermodynamics and statistical mechanics.
- Describe a physical situation using multiple representations as necessary, such as written conceptual statements, mathematical equations, diagrams, and graphs, and be able to translate from one representation to another.
- Apply mathematical concepts and methods such as probability and statistics, algebra, calculus, and trigonometry as necessary to analyze and solve problems.
- Use physical reasoning and units to obtain order-of-magnitude estimates.

Academic Integrity is of paramount importance. Violations will not be tolerated.
Disability Resources and Services are available for accommodations.
Title IX mandatory reporters include professors. I am required to report violations.