

**Instructor:** Ashis Mukhopadhyay, Associate Professor  
258 Physics Building  
Tel: (313) 577 2775; Email: ashis@wayne.edu  
Office hours: T & Th 3:00 pm – 4:00 pm, or by appointment

**Lecture time and location:** T & Th 12:30 pm – 2:10 pm, 185 Physics Building

**Textbook:** *Statistical Mechanics* by R. K. Pathria & P. D. Beale (Third edition).

**Additional References:**

*Entropy, Order Parameters, and Complexity* by J. Sethna (available online)  
*Thermal Physics* by C. Kittel and H. Kroemer  
*Statistical and Thermal Physics* by F. Reif

**Homework:** Will be posted on Blackboard. Due 1 week after assigned.  
Late solutions will NOT be accepted. You will get credit on each HW for completing more than 80% of the assignment.

**Exams:** Two midterm exams: October 3 (Tuesday) & November 14 (Tuesday)  
Final exam (Cumulative): December 14 (Thursday), 12:30 pm – 2:30 pm.

**Grading:**

1st exam:	20%
2nd exam:	20%
Final exam:	30%
Quiz (in class):	20% (No make-up quizzes will be given)
Homework:	15%

**Grading Scale:** A: Above 80%, B: 65%-79%, C: 50%-64%, D: 35%-49%, F: 0-34%.

**Course Description:** This course is aimed for graduate students. It is expected that students have successfully completed Thermal Physics (PHY 6500). We will cover chapters 1-8 and chapter 12 of the text book. If time permits, we will cover chapter 15 on fluctuations and non-equilibrium statistical mechanics. We will start with the ideas of probability theory and different statistical ensembles. Applications of statistical mechanics to condensed matter physics, materials science, and astrophysics will be illustrated with simple models of crystalline solids, magnetic systems, classical gases, phase transitions, white dwarf stars, and blackbody radiation.

**Learning Objectives:** At the completion of this course, you should be able to

- Understand the concepts of microstate and macrostate of a system.
- Describe thermodynamic variables, such as entropy, temperature, and free energies from the perspective of statistical mechanics.

- Apply Boltzmann distribution, Fermi-Dirac, and Bose-Einstein distributions to model systems.
- Define conditions of phase equilibrium and identify types of phase transitions.

**Course Content:**

The Statistical Basis of Thermodynamics

Ensemble Theory: Micro Canonical Ensemble, Micro Canonical Ensemble, Grand Canonical Ensemble

Formulation of Quantum Statistics: Bose Systems, Fermi Systems

Introduction to Phase Transitions

Fluctuations and Nonequilibrium Statistical Mechanics (time permitting)

**STUDENT DISABILITY SERVICES:** If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

Please be aware that a delay in getting SDS accommodation letters for the current semester may hinder the availability or facilitation of those accommodations in a timely manner. Therefore, it is in your best interest to get your accommodation letters as early in the semester as possible.