PHYS 711: Statistical Mechanics (Spring 2023)

Thu 4:30-7:10 pm

Course Description

This is a graduate-level introduction to the statistical mechanics of classical and quantum many-particle systems. Topics include: thermodynamics (state functions, equilibrium, three laws of thermodynamics, entropy, heat engines, thermodynamic potentials, response functions, stability), probability and statistics (probability distributions, central limit theorem), equilibrium statistical ensembles (phase space, canonical distributions, fluctuations), non-interacting classical systems (ideal gas, magnets, etc.), phase transition basics (gas-liquid coexistence), quantum statistical mechanics (degenerate Bose and Fermi gases, metals, superfluids, blackbody radiation), and non-equilibrium statistical mechanics (time permitting: hydrodynamics, transport, Boltzmann equation).

Prerequisites: none required; competence in calculus is essential.

Suggested Textbooks

- *Statistical Physics of Particles*, Mehran Kardar (Cambridge University Press)
  ISBN-10: 9780521873420, ISBN-13: 978-0521873420
- *Thermodynamics and Statistical Mechanics*, W. Greiner, L. Neise and H. Stocker
- *Course of Theoretical Physics, Volume 5 "Statistical Physics"*, L. D. Landau and E. M. Lifshitz

Lectures

Predrag Nikolic
Email: pnikolic@gmu.edu

Office Hours

after class or by appointment

Grading

- Homework 20%, midterm exam 40%, final exam 40% (of the final score)
- The final letter grade is based on the final score and the overall class performance.

Homework

- Assigned on Blackboard once a week to help you develop problem-solving skills.
- Due by midnight on the following Thursday (upload scans of your work to Blackboard). Solutions will be promptly posted on Blackboard.
- Effort matters – evidence of serious attempts and work on all assigned problems earns substantial credit.
- If you want feedback, please write legibly and follow "homework and exam requirements" posted on Blackboard.

Exams

- Both midterm and final exams cover all prior lecture and homework subjects.
- Based solely on problem solving. Problems are not identical (and sometimes not even similar) to homework, so developing analytical skills and understanding course concepts is crucial. Solving homework and practicing problems, *after mastering the theory*, is the only effective preparation!
- Format: 2.5-3 hours (class time), 4-5 problems, closed book with a formula sheet (tentative).
- It is the responsibility of each student to attend classes during scheduled examinations as listed in the syllabus regardless of work or family considerations. Make-up exams will be given only to students with a valid medical excuse provided they contact the instructor a week in advance or as soon as possible.

Important dates

Jan 30:	Last day to add classes
Feb 06:	Last day to drop classes with no tuition penalty
Feb 13:	Last day to drop classes with 50% tuition penalty
Feb 27:	Unrestricted withdrawal period ends (100% tuition liability)
Mar 13-19	Spring break
May 08-09	Reading days

Tentative class, homework and exam schedule

Jan	26	Thu	1.
Feb	02	Thu	2. HOMEWORK 1 OUT
Feb	09	Thu	3. HOMEWORK 1 IN, HOMEWORK 2 OUT
Feb	16	Thu	4. HOMEWORK 2 IN, HOMEWORK 3 OUT
Feb	23	Thu	5. HOMEWORK 3 IN, HOMEWORK 4 OUT
Mar	02	Thu	6. HOMEWORK 4 IN, HOMEWORK 5 OUT
Mar	09	Thu	7. HOMEWORK 5 IN
Mar	16	Thu	spring break – no class
Mar	23	Thu	8. MIDTERM EXAM, in class
Mar	30	Thu	9. HOMEWORK 6 OUT
Apr	06	Thu	10. HOMEWORK 6 IN, HOMEWORK 7 OUT
Apr	13	Thu	11. HOMEWORK 7 IN, HOMEWORK 8 OUT
Apr	20	Thu	12. HOMEWORK 8 IN, HOMEWORK 9 OUT
Apr	27	Thu	13. HOMEWORK 9 IN, HOMEWORK 10 OUT
May	04	Thu	14. HOMEWORK 10 IN
May	11	Thu	FINAL EXAM, 4:30–7:15 pm