

PHYS 5365: Advanced Statistical Mechanics (CRN: 10425)

Term: Fall 2025

Course Credit: 3

Course Meeting: Tuesday and Thursday, 12:00 pm – 01:20 pm (PSCI 222A)

Instructor: Fhokrul Islam

Office: PSCI 121E/PSCI 210

Email: mfislam@utep.edu

Office Hours: Monday, 10:00 am -11:00 am

Textbooks: Statistical Mechanics, Donald A. McQuarrie

Statistical Mechanics (3rd edition), R. K. Pathria, Paul D. Beale

Statistical Mechanics (2nd edition), Kerson Huang

Course Objectives (Learning Outcomes):

The objective of the class is to provide students with a rigorous description of equilibrium systems whose particles are either independent or effectively independent, with the final goal of improving students' problem-solving abilities.

We will study the following topics: Statistical Ensembles, Boltzmann, Fermi-Dirac, and Bose-Einstein Distributions, Ideal Gases, Classical Statistical Mechanics, Quantum Statistics, and introduction to phase transitions.

Grading Policy:

Grades in this course will be based on your scores on one midterm exam, a final exam (comprehensive; but with emphasis on the last part of the course), homework assignments, and class performance.

Midterm exam:	25%
Final exam:	35%
Homework:	25%
Class participation:	15%

Letter Grading Scheme:

A	86 -100%
B	70 - 85%
C	60 - 69%
D	50 - 59%
F	< 50%

Course Activities/Assignments:

It is essential that students become well versed in problem solving methods, which means developing the writing skills to set up a problem, including diagrams and mathematical manipulation to achieve the final answer. A numerical score will be assigned for each homework set based on graded and counted problems.

Feel free to form study groups with your classmates and seek help from your lecture professor during her office hours. Make sure that you understand the solutions and write them up yourself. **There is a strong correlation between homework scores and exam scores!**

Exams

Exams will consist of problems similar to the worked examples in class and the assigned homework problems. Exams will be open notes. The best way to prepare for the exams is to study the example problems and work out the assigned homework problems regularly. Students are strongly encouraged to solve problems in addition to those that are assigned.

Course overview

- Content 01: Review of Thermodynamics
- Content 02: Elements of Ensemble Theory
- Content 03: Canonical Ensemble
- Content 04: Grand Canonical Ensemble
- Content 05: Boltzmann Statistics
- Content 06: Ideal Monatomic Gas
- Content 07: Ideal Diatomic Gas
- Content 08: Quantum Statistics
- Content 09: Statistical Mechanics of Crystals
- Content 10: Introduction to Phase Transitions

Course Schedule

Week	Content
Aug 26 – 28	Introduction and Review of Thermodynamics
Sep 02 – 04	Review of Thermodynamics
Sep 09 – 11	Review of Classical and Quantum mechanics
Sep 16 – 18	Elements of Ensemble Theory
Sep 23 – 25	Canonical Ensemble
Sep 30 – Oct 2	Grand Canonical Ensemble
Oct 07 – 09	Boltzmann Statistics
Oct 14 – 16	Midterm, Thursday Oct 16
Oct 21– 23	Ideal Monatomic Gas
Oct 28 – 30	Ideal Diatomic Gas
Nov 04 – 06	Quantum Statistics
Nov 11 – 13	Statistical Mechanics of Crystals
Nov 18 – 20	Introduction to Phase Transitions
Nov 25 – 27	Introduction to Phase Transitions
Dec 02 – 04	Review of the course
Dec 08 – 10	FINAL EXAM (Comprehensive) Tuesday Dec. 9, 1:00-3:45 PM PSCI 222A

Attendance Policy:

Attendance is critical for your success in this class. Please notify me of any extenuating circumstances that may prevent your attendance. In the event of an absence, the student must make up and submit any missed work within one week from the absence. It is the student's responsibility to contact the professor immediately to find out how to make up any missing work.

Academic Integrity Policy:

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as one's own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at

El Paso must be reported to the [Office of Student Conduct and Conflict Resolution \(OSCCR\)](#) for possible disciplinary action. To learn more, please visit [HOOP: Student Conduct and Discipline](#).

Netiquette:

Always consider audience. Respect and courtesy must be provided to classmates and to professor at all times. No harassment or inappropriate behavior will be tolerated. Remember that members of the class and the instructor will be reading any online postings. When reacting to someone else's message, address the ideas, not the person. Post only what anyone would comfortably state in a face-to-face situation. Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted on in these online spaces is intended for classmates and professor only. Please do not copy documents and paste them to a publicly accessible website, blog, or other space. If students wish to do so, they have the ethical obligation to first request the permission of the writer(s).

Accommodation Policy:

The University is committed to providing reasonable accommodations and auxiliary services to students and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the [UTEP Center for Accommodations and Support Services](#) (CASS). Contact the Center for Accommodations and Support Services at 915-747-5148, or email them at cass@utep.edu, or apply for accommodations online via the [CASS portal](#). The student is responsible for presenting to the instructor any accommodation letters and instructions.