PHYS 462/662 THERMAL AND STATISTICAL PHYSICS

BASIC INFORMATION

Course prefix, catalog number, and title: PHYS 462/662, Thermal and Statistical Physics
Number of credits: 3 credit hours
Term and year: Fall 2023
Classes: Tue, Thur 3:30 - 4:45 pm, South Engineering 221

Instructor's name: Prof. Yongki Choi
Office location: SE 220A/R1A 1114
Office hours: Tue, Thur 3:00 - 5:00 pm and by appointment
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BULLETIN DESCRIPTION

Classical postulates and laws of thermodynamics; cyclic processes and entropy; thermodynamic potentials, equilibrium, stability, and phase transitions; Maxwell-Boltzmann distribution, applications to classical gases and magnets; quantum statistics, Bose-Einstein and Fermi-Dirac distributions, applications to quantum gases.

COURSE OBJECTIVES

The main objective of the course is to develop the conceptual and quantitative methods that are critical for a working knowledge of thermodynamics and statistical mechanics. After completing this course, student will be able to explain concepts in thermal physics, demonstrate the ability to analyze conceptual and practical problems, and construct quantitative models and descriptive predictions of physical behavior.

REQUIRED STUDENT RESOURCES

Textbook: *An introduction to Thermal Physics* by Daniel V. Schroeder, Oxford University Press
Supplemental references: Thermal Physics (Kittel), Statistical Physics – An Entropic Approach (Ian Ford), Thermodynamics and Statistical Mechanics (Greiner), Fundamentals of Statistical and Thermal Physics (Reif)

SYLLABI ON WEB PAGES

Syllabus, Announcements, and Notes will be posted on our Blackboard course homepage: https://bb.ndsu.nodak.edu

HOMEWORK ASSIGNMENTS

Weekly homework will be posted on our Blackboard course homepage. All homework assignments are due on the dates specified. ***Late submission will not receive credit.***

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic	Reading /Assignment
1	Thermal equilibrium	Chapter 1
2	Ideal gas, heat, work	Chapter 1
3	Two state System	Chapter 2
4	Large systems	Chapter 2
5	Entropy / Exam1	Chapter 2
6	Temperature	Chapter 3
7	Mechanical equilibrium	Chapter 3
8	Heat Engines	Chapter 4

9	Refrigerators / Exam2	Chapter 4
10	Free energy	Chapter 5
11	Phase transformations	Chapter 5
12	Chemical equilibrium	Chapter 5
13	The Boltzmann factor	Chapter 6
14	The equipartition theorem	Chapter 6
15	Boltzmann statistics	Chapter 6
16	Quantum statistics	Chapter 7
17	Final Exam	

PHYS 462 : EVALUATION PROCEDURES AND GRADING CRITERIA

Final letter grades for the course will be computed using the following weights:

- Homework Assignments 20 %
- Exam 1 20 %
- Exam 2 20 %
- Final Exam 40 %
- Total 100 %

NO MAKE-UP EXAMS ARE ALLOWED

Grades A: ≥ 90 %, B: 80 to < 90 %, C: 70 to < 80 %, D: 60 to < 70 %, F: < 60 %

PHYS 662 : EVALUATION PROCEDURES AND GRADING CRITERIA

Final letter grades for the course will be computed using the following weights:

- Homework Assignments 10 %
- Exam 1 20 %
- Exam 2 20 %
- Project* 20 %
- Final Exam 30 %
- Total 100 %

NO MAKE-UP EXAMS ARE ALLOWED

*Requirements and assessment of the research project are described in the attached document.

Grades A: ≥ 90 %, B: 80 to < 90 %, C: 70 to < 80 %, D: 60 to < 70 %, F: < 60 %

ATTENDANCE

According to NDSU Policy 333 (www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

AMERICANS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (www.ndsu.edu/disabilityservices) as soon as possible.

ACADEMIC HONESTY

The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct

records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.

*The instructor reserves the right to adjust or modify this syllabus if it is deemed beneficial to student learning

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PHYS 662 PROJECT

PURPOSE

The project is intended to measure students' research-associated qualities including independent thinking, critical reasoning, and research skills.

GENERAL INFORMATION

Program a code that performs a simulation of 2D Ising model on a square lattice and examine order parameters (Chapter 8).

DESCRIPTION

- Introduction and Background: describe Monte-Carlo simulation of 2D Ising model (Chapter 8): 1-2 pages
- Methods: explain your program code: a few pages (depends on the length of your code)
- Results: show plots of Energy vs T, Magnetization vs T, Specific Heat vs T, Susceptibility vs T
- Results: show snapshots of the spin/lattice configurations
- Conclusion: summarize your project (0.5 - 1 page)

DEADLINES

Final written report: Due Tuesday, November 30.