Physics 664: Statistical Mechanics

Spring 2018 (664 section 1, 3 credits)

- Instructor: Jay Nadeau, 370 Science Research and Teaching Center, nadeau@pdx.edu, 503-725-8929
- Office Hours: Monday, Wednesday 1-2 pm and by appointment.
- Course Website: https://d2l.pdx.edu/

Course Description
Foundations of statistical mechanics and kinetic theory; statistical interpretation of thermodynamics; ensembles in classical and quantum systems; transport phenomena. Prerequisites: Ph 619 (Quantum Mechanics) (may be taken concurrently); Thermodynamics at the junior/senior level (PH 426 or equivalent).

Lectures: MW 10:15-12:05, FAB 49
Dates: April 2-June 6, 2018

The required textbook for this course is *Introduction to Statistical Mechanics* by John Dirk Walecka. There is a solutions manual for the problems also available.

Homework: There is biweekly assigned homework. Exam problems will be similar to homework problems. Homework will be due before Monday's class starting Week 2.

Exams: There will be two midterm exams and one final. The midterms will cover the material from preceding chapters, and the final is comprehensive. Midterm exams will have 4 open-ended problems, for which partial credit is possible. The final will have 5 problems for 20 points each. Exams are closed book but you may bring a 8.5"x11" single-sided sheet of handwritten notes with you to the exam. Standard calculators are also permitted. However, under no circumstances will the use of phones, laptops, tablets, or other communication devices be allowed. To each test bring a bluebook and a pencil. Make-up exams are not given. If you are taking the exams at the testing center, you will need to sit for the exam at the scheduled exam times.

Exam dates and material covered
Monday 04/23: Chapters 1-3
Monday 05/14: Chapters 4-6
Final Exam: 10:15AM-12:00PM: Chapters 1-8

Grading
The grade of each exam and the course will follow this scale unless curving becomes necessary.
A: 89-110%
A-: 85-88%

B+: 82-84%
B: 75-81%
B-: 70-74%
C+: 67-69%
C: 60-66%
C-: 55-59%;
D: 40-54%
F <40%

Calculating grades
Grade is calculated as Homework (30%)+ midterm 1 (20%) + midterm 2 (20%) + final (30%).

POLICY STATEMENTS

Academic Honesty: "Academic honesty is a cornerstone of any meaningful education and a reflection of each student's maturity and integrity. The Code of Student Conduct and Responsibility, which applies to all students, prohibits all forms of academic cheating, fraud, and dishonesty. These acts include, but are not limited to: plagiarism, buying and selling of course assignments and research papers, performing academic assignments (including tests and examinations) for other persons, unauthorized disclosure and receipt of academic information, and other practices commonly understood to be academically dishonest" – Portland State University Bulletin, General Catalog Issue, Vol. 50, 2016-2017. Cheating during an exam (e.g., copying, working in teams, using additional resources such as cell phones) will result in an automatic zero and referral to the office of student affairs. A no tolerance policy will be enforced.

Absence due to sickness – Exams cannot be rescheduled. If you are ill or there is an unforeseen emergency during an exam time, please contact me as soon as feasible (phone or email). I do not take attendance otherwise.

Title IX – Portland State is committed to providing an environment free of all forms of prohibited discrimination and sexual harassment (sexual assault, domestic and dating violence, and gender or sex-based harassment and stalking). If you have experienced any form of gender or sex-based discrimination or harassment, know that help and support are available. PSU has staff members trained to support survivors in navigating campus life, accessing health and counseling services, providing academic and on-housing accommodations, helping with legal protective orders, and more. Information about PSU's support services on campus, including confidential services and reporting options, can be found on PSU's Sexual Misconduct Prevention and Response website at: http://www.pdx.edu/sexual-assault/get-help or you may call a confidential IPV Advocate at 503-725-5672. Please be aware that all PSU faculty members and instructors are required to report information of an incident that may constitute prohibited discrimination, including sexual harassment and sexual violence. This means that if you tell me about a situation of sexual harassment or sexual violence that may have violated

university policy or student code of conduct, I have to share the information with my supervisor or the University's Title IX Coordinator or the Office of Affirmative Action. For more information about Title IX please complete the required student module Creating a Safe Campus in your D2L.

Disability Accommodations at PSU – PSU values diversity and inclusion; we are committed to fostering mutual respect and full participation for all students. My goal is to create a learning environment that is equitable, useable, inclusive, and welcoming. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me. The Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment. If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu, https://www.pdx.edu/drc.

Schedule:

Week	Dates	Topics, Readings, Assignments, Deadlines
1	**04/02/18** **04/04/18**	Lecture 1: Intro to the course, what is stat mech (Chapter 1) Lecture 2: Relationship between stat mech and thermodynamics (Chapter 1)
2	**04/09/18** **04/11/18**	Lecture 3: The Microcanonical ensemble I (Chapter 2.1-2.4) Lecture 4: The Microcanonical ensemble II (Chapter 2.5-2.6) **Homework 1 due: Chapter 1**
3	**04/16/18** **04/18/18**	Lecture 5: Molecular Spectroscopy (Chapter 3.1-3.2) Lecture 6: Paramagnetic/dielectric assembles, chemical equilibria (Section 3.3-3.4) + EXAM 1 Review
4	**04/23/18** **04/25/18**	**EXAM 1: Chapters 1-3** Lecture 7: The Canonical Ensemble (Chapter 4) **Homework 2 due: Chapter 2-3**
5	**04/30/18** **05/02/18**	Lecture 8: Solids (Chapter 5.1) Lecture 9: Imperfect Gases (Chapter 5.2)
6	**05/07/18** **05/09/18**	Lecture 10: The Grand Canonical Ensemble I (Chapter 6) Lecture 11: Boltzmann and quantum statistics (Chapter 7.1-7.2) (+ EXAM 2 Review **Homework 3 due: Chapter 4-5**
7	**05/14/18** **05/16/18**	**EXAM 2: Chapters 4-6** Lecture 12: Bosons (Section 7.3)
8	**05/21/18**	Lecture 13: Fermions (Section 7.4)

Week	Dates	Topics, Readings, Assignments, Deadlines
	05/23/18	Lecture 14: More applications of bose and Fermi statistics **Homework 4 due: Chapter 6-7**
9	**05/28/18** **05/30/18**	Lecture 15: Special topics: Solutions and crystals (Chapter 8.1-8.2) Lecture 16: The Ising Model (Chapter 8.3)
10	**06/04/18** **06/06/18**	Lecture 17: Special Topics: Lattice Gauge Theory (Chapter 8.4) **Review and recap** **Homework 5 due: Chapter 8**
Final Exam		Tuesday, June 12, 0800-0950