

Course # 13983 (3 credits)

**Instructor:** Dr. Alan R. Denton                      alan.denton@ndsu.edu  
Department of Physics, NDSU              Tel: 701-231-7036  
<http://www.ndsu.edu/pubweb/~denton/>

**Meetings:** TTh 3:30 – 4:45 p.m.      **Office Hours:** Drop in or arrange a meeting  
South Eng. 221    South Eng. 214B

**Bulletin Description:** Review of thermodynamics and statistical mechanics; Monte Carlo and molecular dynamics simulation; applications to phase transitions.

**Prerequisite:** PHYS 462/662 Thermal and Statistical Physics (or equivalent)

**Objective:** Develop conceptual and technical mastery of theoretical and computational methods of statistical physics and applications to a variety of many-particle systems.

**Preparation:** Basic knowledge of mechanics, thermodynamics, statistics, and mathematical methods. Some experience with programming and numerical methods.

**Student Responsibilities:** Attend all classes. Read assigned material in advance. Come prepared for discussion. Be curious; ask questions. Complete assignments on time.

**Textbooks:** R. K. Pathria & P. D. Beale, *Statistical Mechanics*, 3rd ed. (Elsevier, 2011); D. Chandler, *Introduction to Modern Statistical Mechanics* (Oxford, 1987).

<b>Evaluation:</b>	Homework	100 pts	
	Exams	150 pts	(50+50+50)
	<u>Total</u>	<u>250 pts</u>	

The (optional) makeup exam during finals week will replace your lowest midterm score. According to NDSU Policy 333 ([www.ndsu.edu/fileadmin/policy/333.pdf](http://www.ndsu.edu/fileadmin/policy/333.pdf)), attendance in classes is expected. *More than three unexcused absences may result in failure.*

**Homework:** Assignments will be posted on Blackboard (<https://bb.ndsu.nodak.edu>). While discussion of homework with classmates is encouraged, submitted work must be your own. Similarity to work of other students or to internet solutions will yield no points. Since solutions will be discussed on the due date, *late assignments cannot be accepted.* Partial credit may be given for incomplete work, so submit whatever you have finished.

**Grading:** A:  $\geq 90\%$ , B: 80 to  $< 90\%$ , C: 70 to  $< 80\%$ , D: 60 to  $< 70\%$ , F:  $< 60\%$

*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](http://www.ndsu.edu/academichonesty).*

**Preliminary Schedule**

(PB=Pathria &amp; Beale; C=Chandler)

Dates	Topic(s)	Reading
Jan. 8-10	The Canonical Ensemble	PB 1-3; C 1-3
Jan. 15-17	The Grand Canonical Ensemble	PB 4; C 3
Jan. 22-24	Quantum Statistics: Bosons and Fermions	PB 5; C 4
Jan. 29-31	Theory of Simple Gases	PB 6; C 4
Feb. 5-7	Ideal Bose Systems	PB 7; C 4
Feb. 12-14	Ideal Fermi Systems	PB 8-9; C 4
<b>Feb. 19</b>	<b>Midterm Exam 1</b>	PB 1-7; C 1-4
Feb. 26-28	Statistical Mechanics of Interacting Systems	PB 10-11; C 5, 7
March 5-7	Statistical Mechanics of Interacting Systems	PB 10-11; C 5, 7
March 11-15	Spring Break	
March 19-21	Phase Transitions, Critical Phenomena, Scaling	PB 12; C 5
<b>March 26</b>	<b>Midterm Exam 2</b>	PB 7-11; C 3-5
April 2-4	Phase Transitions: Exact Solutions of Various Models	PB 13; C 5
April 9-11	Phase Transitions: Renormalization Group Theory	PB 14; C 5
April 16-18	Statistical Mechanics of Nonequilibrium Systems	PB 15; C 8
April 23-25	Computer Simulations	PB 16; C 6
<b>April 30</b>	<b>Midterm Exam 3</b>	PB 10-16; C 5-8
<b>May 8, 10:30 a.m.</b>	<b>Makeup Exam</b>	PB 1-16; C 1-8

**Homework Schedule**

Homework	Date Assigned/Date Due	Reading
1	Jan. 8/22	PB 1-3; C 1-3
2	Jan. 22/31	PB 4; C 3
3	Jan. 31/Feb. 12	PB 5-6; C 4
4	Feb. 12/March 5	PB 7; C 4
5	March 5/19	PB 8-9; C 4
6	March 19/28	PB 10-11; C 5, 7
7	March 28/April 9	PB 12; C 5
8	April 9/April 18	PB 13-14; C 5
9	April 18/30	PB 14-15; C 5, 8

*All access to NDSU computers must respect NDSU Senate Policy, section 158:*

*Acceptable use of Electronic Communication Devices*

<https://www.ndsu.edu/fileadmin/policy/158.pdf>

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