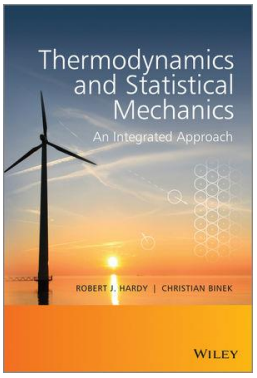
Syllabus Physics 431/831 – Thermal Physics
Fall Semester 2023

Lecture: MoWeFr 10:30-11:20 am, Jorgensen Hall 249
For potential face covering policy and other COVID19 related questions please refer to https://covid19.unl.edu/face-covering-policy

Instructor: Christian Binek
Charles Bessey Professor of Physics
Department of Physics and Astronomy
Nebraska Center for Materials and Nanoscience
University of Nebraska
N201A Voelte-Keegan Nanoscience Research Center
Lincoln, Nebraska 68588-0299
phone: 402-472-5231
e-mail: cbinek@unl.edu

Office Hours: Friday 2:30 pm-4:30pm

Course Goals and Objectives: Physics 431/831 is a 3 credit hour course providing an introduction into the field of thermodynamics, the science concerned with the macroscopic properties of matter. Thermodynamic relations are derived from a small number of principles which are generalizations of experimental experiences. The methods studied in this course have broad applications in varies fields of science and engineering ranging from the design of internal combustion engines to the understanding of basic material properties. The results of thermodynamics are fundamental and probably more widely used throughout science and engineering than any other theory.



Prerequisites: Physics 213 (General Physics III).

Textbook: Robert J. Hardy, Christian Binek
Thermodynamics and Statistical Mechanics: An Integrated Approach, 2014 John Wiley & Sons
ISBN: 978-1-118-50100-9

A rough outline of what we intend to cover this semester:

1. Introductory remarks and basic concepts
2. First Law of Thermodynamics
3. Mathematical Background and Applications
   3.1 Partial Derivatives
   3.2 Application of the Thermodynamic Notation
   3.3 The Simple Solid
   3.4 Thermal Expansion and Bulk Modulus
   3.5 Relationships between Partial Derivatives
4. Equilibrium Processes in Gases
   4.1 Processes in Ideal Gases
   4.2 Change in Temperature with Elevation
   4.3 Cyclic Processes
5. Reversible and irreversible Processes
6. Second Law of Thermodynamics
   6.1 Kelvin and Clausius Statements
   6.2 Carnot´s Theorem
   6.3 Absolute Temperature
   6.4 Differentials
   6.5 Entropy
   6.6 Thermodynamic Potentials
7. Phase Transitions
8. Basic Concepts of Thermochemistry
9. The Third Law of Thermodynamics
10. Kinetic Theory
11. Introduction to statistical mechanics (if time allows)

Classes begin	August, 21
Labor Day (student and staff holiday)	September, 4
Fall Semester break	October 16-17
Thanksgiving vacation	November, 23 -24

Homework:
Homework is due a week from the day of assignment. There will be about 10 assignments during the semester. All homework problems have an equal weight of 10 points unless indicated otherwise. The solutions should clearly explain all the important steps. You may discuss ideas and approaches with other students after you have spent some time thinking about these problems. However, you are required to complete all the technical steps yourself. Remember that homework is an important part of your learning. You will very likely fail your exams if you don't do it carefully.
Homework must be handed in personally during class a week from the day of assignment. Late homework will be accepted only as an exception for a compelling reason. Homework will be graded by a teaching assistant (e-mail and office address TBD). If you believe your grade is incorrect or unfair, please first approach the TA. If you can't settle the issue with the TA please talk to me before the due date of the next homework.

Exams:
Exams will be given in-person in JH 249

Midterm Test1	October, 4	(Wednesday)
Midterm Test2	November, 15	(Wednesday)
Final Exam	December, 15	(10:00 to noon Friday)

Equation sheets with other useful information might be provided as part of the exam. All exams are closed book.

Final grade:
Course grades will be assigned according to the following scale:

Homework	30%
Midterm Test1	20%
Midterm Test2	20%
Final Exam	30%

97	%	to	100	%	will display as	A+
94	%	to	97	%	will display as	A
90	%	to	94	%	will display as	A-
87	%	to	90	%	will display as	B+
84	%	to	87	%	will display as	B
80	%	to	84	%	will display as	B-
77	%	to	80	%	will display as	C+
74	%	to	77	%	will display as	C
70	%	to	74	%	will display as	C-
67	%	to	70	%	will display as	D+
64	%	to	67	%	will display as	D
60	%	to	64	%	will display as	D-
0	%	to	60	%	will display as	F

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.