Physics 435, 2018 Fall

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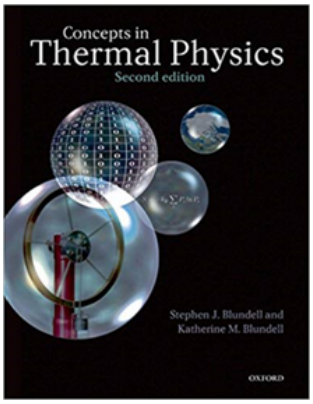
1 *Basic information*



Course title	Thermodynamics & Statistical Mechanics.
Instructor	Palash Banerjee
Contact	B125 Science, palash.banerjee@uwsp.edu.
Office hours	Tue, Wed, and Thu, 2 — 3 p.m.
Pre-requisite	Physics 250 and Math 222 (Calculus III).
Textbook	*"Concepts in Thermal Physics"* by Blundell and Blundell.
Required	Scientific calculator and a one-inch three-ring binder.

2 *Course description*

Thermodynamics is the study of heat transfer and mechanical work and engines. It is also the subject of the *greatest law* in all of physics — the 2nd law of thermodynamics. Statistical Mechanics is thermodynamics at the molecular level. This statistical theory lets us describe the average behavior of a very large number of particles. We use this theory to explain the laws of thermodynamics and discover where these laws come from. Finally, we merge statistical mechanics with quantum mechanics to form quantum statistics. The awesomeness of quantum statistics lets us discover the properties of white dwarfs and neutron stars and the cosmic microwave background radiation. At this point, the course regrettably comes to an end.

3 *Course objectives*

I want to give you the conceptual and mathematical tools you need to think about thermodynamics and statistical mechanics in contemporary terms. And I also want to show you how to write clearly and simply. If you write clearly, you will think clearly and this will sharpen your analytical skills. Therefore, we will spend the entire semester practicing these skills — *know your tools, and write well*.

4 *Course assignments*

1. **Homeworks:** Homework will be assigned every Friday in class. Part A of the homework will consist of short exercises and will be due the following Monday. Part B of the homework will consist of longer problems and will be due the following Friday. Part A of the homework will count for 10% of your grade; Part B of the homework will count for 20% of your grade. You may discuss concepts and ideas with each other but you *may not* copy each others' work. You may expect approximately 13 homeworks during the course and I will drop your lowest score in part A as well as part B.

2. **Class quiz:** There will be a class quiz on Monday. This will take up the first ten minutes of class time. The quiz will be based on the previous weeks' material. The class quiz will count for 10% of your grade. I will drop your lowest score in the quiz.

3. **Exams:** There will be *two* midterm exams during the semester. These exams will be held on a Thursday evening on Oct 4 and Nov 8. The midterm exams as well as your final exam each count for 20% of your grade. *All* the exams count and no score will be dropped. If you miss any exam, you will receive a zero for that exam.

5 *Course schedule*

Week	Chapter: Topic
(1) Sept 3	1: We become friends with the ideal gas law.
(2) Sept 10	3: We are introduced to probability theory, macrostates, and microstates.
(3) Sept 17	4: We meet the statistical definition of temperature.
(4) Sept 24	5: We derive the Maxwell-Boltzmann distribution and learn how to calculate averages.
(5) Oct 1	6: We revisit the ideal gas law and see where it comes from. Mid term exam 1, Thu Oct 4, 5:30 p.m.
(6) Oct 8	11: We meet the first law of thermodynamics.
(7) Oct 15	12: We study reversible processes and prepare to meet the heat engine.
(8) Oct 22	13: We encounter the *greatest law* in physics — the 2nd law of thermodynamics.
(9) Oct 29	13: We discover how the 2nd law imposes limits on the efficiency of heat engines.
(10) Nov 5	16: We meet the mysterious thermodynamic potentials and find a use for partial derivatives. Mid term exam 2, Thu Nov 8 5:30 p.m.
(11) Nov 12	19: We discover the equipartition theorem.
(12) Nov 19	20: We meet the partition function and find multiple reasons to use it.
(13) Nov 26	We merge Statistical Mechanics with Quantum Mechanics to form Quantum Statistics.
(14) Dec 3	We study Bose-Einstein statistics and the properties of a photon gas.
(15) Dec 10	We study Fermi-Dirac statistics and the properties of degenerate fermions.
(16) Dec 17	Final exam Thu Dec 20, 8:00 — 10:00 a.m., SCI-A106

6 *Other course policies*

1. Food is **not** permitted in the class room. You may bring a drink in a covered container.
2. Please put your phones inside your bag for the duration of the class.
3. I will accept **only one** late homework per student during the course. No excuses are needed but you need to tell me *before* the assignment is due that you will submit late.
4. Make-up work will only be accepted in the case of excused absences. Excused absences include death in the immediate family, illness with a note from the appropriate health care professional, religious observance, or an event in which you officially represent the University of Wisconsin-Stevens Point and the event directly conflicts with an exam or lab. Excused absences must be approved with documenting materials prior to the date of absence.
5. Please *do not* copy each others homeworks, class assignments, laboratory reports, and examinations and pass them off as your own. Any confirmed incidence of academic misconduct, including plagiarism and other forms of cheating will be treated seriously and in accordance with University policy.
6. The schedule for the finals is set by the University. I will not schedule an early final exam for whatever reason. Please don't ask.
7. I *do not* assign work for extra credit. There are *no* bonus points that you can earn. **Once you hand in your final exam, there is nothing more you can do to change your grade**.

7 *Grading and evaluation*

I will calculate your grade based on a weighted percentage of your scores as shown in the table to the left below. Your final letter grades will be determined as shown in the table to the right below.

Assignment	Value
Homeworks series A, short exercises	10%
Homeworks series B, in-depth problems	20%
Weekly quiz	10%
1st exam	20%
2nd exam	20%
Final examination	20%

Total score	Grade
90% and above	A
87–89%	A-
84–86%	B+
80–83%	B
77–79%	B-
74-76%	C+
70–73%	C
67–69%	C-
64–66%	D+
60–63%	D
below 60%	F

I do *not* grade on a curve. Scores will be rounded up according to the following example: 86.6 – 86.9% will be rounded up to 87% and become a A-, but 86.0 – 86.5% will remain at 86% and will earn a B+.