

# Physics 301

## Introduction

Welcome to Physics 301, *thermo and stat mech*. In this class, we will be studying some of the most elegant and powerful mathematical tools in physics. The prediction of a substance's gross physical properties by averaging the behaviour of its constituent parts is as satisfying today as it was a hundred years ago. I hope you all do well in this class. You may find, however, that to succeed here may require more work than was necessary in your lower level classes. I urge you to make use of the two most important tools in this class, me and your classmates. Please come see me if you are having problems, and I will try my best to try and correct them. I cannot help what I do not know about. Also, I cannot stress enough the importance of studying with your classmates. They will understand better than anyone what you are going through.

## General information

PHYSCS 301, "Thermodynamics and Statistical Mechanics", Call number 19275, Cr 03, MW 11-12:15 in room 184 of the Physics and Astronomy building. And please don't forget to sign up for the problems class, PHYSCS 451 Section 060, Call number 13453, Cr 01, T 6-6:50 in room 5 of the Physics and Astronomy building. Your instructor is Mark Morgan-Tracy (though I often drop the Morgan and use the simpler Mark Tracy moniker). My office is located in Room 17 in the Physics and Astronomy building. My email address is [mtracy@phys.unm.edu](mailto:mtracy@phys.unm.edu) and is the best way to reach me. The required text is *Introduction to Statistical Mechanics and Thermodynamics* by Keith Stowe. I will, however, be supplementing class topics using *Thermal Physics* by Kittel and Kroemer. I am not requiring it for class as it may be a little advanced for our use, but I would also not discourage you from trying to find a copy. It is an excellent book.

## Office Hours

I will hold office hours on Monday afternoons from 2:00 until 3:30 in my office. Also, I should be somewhere in the physics department most Tuesday and Thursday mornings from 9:30 until 11:00 if you need to find me. I realize these times may be inconvenient for some students, and I encourage you to contact me to set up an appointment at a different time if you have questions or problems. You can reach me by email or by calling the Physics and Astronomy main desk at 277-2616 and leaving a message. I will try my best to accommodate your schedule.

## Course grade

Your grade for this course will be determined by the combination of exams and homework scores. There will be three exams held during the semester, two regular exams (worth 25% of your final grade) and a comprehensive final exam (worth 30%). The regular exams will be held on October 13 and November 19 while the final exam will be held Wednesday, December 17 at 10:00 AM. Exam scores may be curved depending on class performance. Exams will be inspired by the homework problems and lectures and will consist of three to five problems. Homework will determine the final 20% of your grade.

Your final grade will be determined by the following scale,

A+	98 – 100	A	93 – 97	A-	90 – 92
B+	87 – 89	B	83 – 86	B-	80 – 82
C+	77 – 79	C	72 – 76	C-	70 – 71
D+	67 – 69	D	63 – 66	D-	60 – 62
F	below 60.				

## Homework assignments

Homework will be assigned throughout the semester. I will be creating three to five homework problems for each assignment and will attempt to schedule one assignment per week. Completed homework will be due in my mailbox by 5:00 PM on the day noted on each assignment. I encourage you to form study groups with your classmates and work on the homework together.

Questions about the homework can be directed to me at any time, but my office hours and our problems class will be the surest way of finding me.

## **Finding lecture notes and homework solutions**

I have set up an extremely simple webpage for this class. On it you will be able to find copies of my lecture notes and homework solutions (Useful for studying for exams.). The webpage can be found at <http://info.phys.unm.edu/~mtracy/phys301/index.html> . Even though it's not the prettiest site on the web, hopefully you'll find it useful for this class.

## **Lecture attendance**

I am not your father and certainly not your mother, and as such, I will not guilt you into attending lectures. You are all adults. If you are not in class, I will assume there is a legitimate reason for your absence. However, I must stress that I have chosen both the homework and exam questions directly from my lecture notes. It will make your life much easier for you to attend class. Moreover, we will be covering some topics in class that are not found in the book. I promise to give advance warning of such lectures and copies of my notes will be available on our website.

When in class, please feel free to interrupt me if you have questions. We have a small class, so this is the perfect opportunity for making yourself heard. Also, if I say or do something that you don't understand then most likely other students aren't getting it either, so think of it as doing everyone a favor. If calling attention to yourself in this manner is not appealing, then please email or come see me at office hours with your questions.

## **Course Content**

There are many topics that could be covered this semester, however, I feel that this course should concentrate on quality over quantity. To this end, I have not set a rigid schedule of reading and homework assignments; instead, I have chosen a set of topics which we shall cover at pace determined by the class (These topics are fairly standard, so not covering some of them really

isn't an option. I have faith that we can do them all!). The topics covered can be split into three categories: thermodynamics, classical statistics, and quantum statistics. The exam dates have been set according to my convenience and the holiday season, so there may be some arbitrariness in the cutoff for exam subjects. It is my hope that the exams will correspond to the completion of the thermodynamics and classical statistics class portions.

Here is a listing of class topics to be covered along with the corresponding reading in Stowe.

### **Thermodynamics**

- Probability and application, Chapters 1,3,4
- Internal energy, Chapters 5,6
- Entropy, Chapters 7,8
- The thermal interaction, Chapter 9
- The mechanical interaction, Chapter 10
- The diffusive interaction, Chapter 11
- Ideal gas, Chapter 12
- Engines and refrigerators, Chapter 15

### **Classical Statistics**

- Probability and microscopic behaviours, Chapter 16
- Equipartition, Chapter 17
- The Maxwell distribution, Chapter 18
- Magnetic properties of matter, Chapter 20
- The partition function, Chapter 21
- Chemical equilibrium, Chapter 22

### **Quantum Statistics**

- Quantum state occupation, Chapter 24
- quantum gases, Chapter 25
- White dwarf stars as a Fermi gas, Non-book material
- Bose-Einstein condensation, Non-book material
- Black body radiation, Chapter 26

## Important dates

Finally, here is a list of academic and class related dates for the semester.

August 25	Classes begin.
September 1	Labor day. No class!!
September 5	Last day to add class.
September 19	Last day to change grading option.
October 3	Last day to drop class without a grade.
October 13	Exam One.
October 15	Instructor out of town day. No class!!
October 16-17	Fall break.
November 14	Last day to withdraw without Dean's approval.
November 19	Exam two.
November 27-30	Thanksgiving.
December 10	Last day of class.
December 17	Final Exam, 10:00 AM.