Physics 334: Thermal Physics Syllabus
Spring 2016

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Office Hours: Monday 11:10-12
Tuesday 9-11
Wednesday 11:10-12
Thursday 1-2

Course Description

Unified treatment of thermodynamics and statistical mechanics. Topics include state functions and variables, laws of thermodynamics, application to physical and chemical systems, kinetic theory, distribution functions, Fermi-Dirac and Bose-Einstein statistics, black-body radiation, and information theory.

Course Goals

The main goal for this course is for students to develop an understanding of the basic concepts of work, heat, and energy and to apply these ideas to various thermodynamic processes and systems. Statistical aspects of thermodynamics will be studied beginning with the kinetic theory of gases and progressing to statistical mechanics treatment of systems. Students will also experience a wide variety of experiments throughout the course, connecting the practical elements to the conceptual and mathematical material of the covered. The final lab project will be the design of an experiment, a proposal for this experiment, and a presentation of the data and analysis of the results. This will give students practice with several skills at the heart of the scientific process; trial and error, troubleshooting, knowing which questions to ask, and analyzing data that may not demonstrate the expected pattern.

Text

Classical and Statistical Thermodynamics by Ashley H. Carter, ISBN# 0137792085
DO THE ASSIGNED READINGS PRIOR TO CLASS- this will allow you to become familiar with the terms and topics and have questions about the material prepared before lecture

Course Materials

All course materials will be made available on Blackboard. These materials include this syllabus, grading rubrics, and any solutions I may provide.

Grading

Your letter grade is determined by a minimum weighted average which is as follows: A/93, A-/90, B+/87, B/83, B-/80, C+/77, C/73, C-/70, D+/67, D/63, D-/60, F/0. The breakdown of the grading will be as follows:

Classwork	5%
Homework	20%
Lab Work	25%
Designed Experiment	15%
Exam 1	10%
Exam 2	10%
Final	15%

Exams and Quizzes

There will be two exams during the semester. Each will be 50 minutes long. There will also be a final exam, which may be cumulative, but with heavy emphasis on material covered at the end of the course that has not previously appeared on an exam. **The final exam is Monday, May 2 at 11:30 AM.** Exams will include problem solving questions, but there may also be conceptually based questions to be answered with words.

Classwork

There will be short class work assignments due each day of class. During class we will discuss your solutions and determine if more time should be spent on any particular topic. From time to time, I will collect and grade these assignments, mostly based on effort.

Homework

Homework assignments comprise a large percentage of your final grade, the due dates of which are listed on the schedule given in this syllabus. These are longer than the classwork assignments and you will be given at least a week to work on them. These assignments may not be thoroughly reviewed in class and will be graded outside of class by the instructor. Please feel free to ask questions about the homework and to consult other sources, however **the final assignment that is submitted must be your own work**. Homework is very important. There is a strong correlation between completing the homework assignments and doing well on exams and in the course as a whole.

Attendance

Attendance is mandatory. If you cannot attend class for any reason, it is your responsibility to contact me with the reason for your absence and to obtain any material you missed. An absence will be considered excused and not count against you if it is due to reasons such as illness, death in the family, etc. **Missed exams and assignment deadlines will only be excused in the event of excused absences, in which case another time can be scheduled to take the exam or turn in an assignment.**

Lab Work

Each of the first nine weeks of the class everyone will complete the same experiment. Each experiment will be written up in LaTeX as a lab report. A general outline with questions that must be answered will be given as a LaTeXtemplate. Additional information can be given even if it is outside the scope of the questions on the template.

Designed Experiment

The last five weeks of the class will be used to design and implement an experiment that tests one of the principles studied in class. You will work in small groups. A prompt and the requirements for a scientific proposal, in line with what might be specified by an organization that distributes grants for scientific research, will be given. You will have to write a proposal for an experiment and explain the results you predict to see using the laws studied in class. You will present this proposal to the class and be given feedback. Based on this feedback, you can choose to modify your experiment or the theory used to explain it. After you run the experiment, you must analyze the data and determine whether it agrees with the hypothesis. If you find that there is no agreement, you must develop a new theoretical model. Your final results will be presented the to the class in the form of a 10 minute talk. Each phase of the project (the proposal, the experimental run and data analysis, and the final talk) will be graded by myself and your peers. The rubrics used to evaluate each phase will be distributed well before the final product is due.

Important Notes

Education is all about open communication. My responsibility is to communicate information and problem solving techniques to you. However, communication works both ways. You must also communicate to me if are having trouble with or questions about any material. Your questions are always welcome. I do not know what you do not know. The explanations and examples I give make perfect sense to me, but you may need further clarification. To that end, please feel free to email me or attend my office hours with any questions you may have. If you cannot attend any of the available office hours, please email me and we can schedule another time to meet.

Disabilities and Medical Conditions

Moravian College adheres to the principles and mandates of the Americans with Disabilities Act of 1990 and the Rehabilitation Act of 1973. Students who wish to request accommodations in this class for a disability should contact the Academic & Disability Support Center, located on the first floor of Monocacy Hall (extension 1401). Accommodations cannot be provided until authorization is received from the Academic & Disability Support office. Special classroom set-ups, alternate testing, physical plant (campus) alterations, and other accommodations for students with documented disabilities are available on a case-by-case basis. It is the responsibility of students with disabilities to self-identify and request accommodation through the appropriate office. It is the responsibility of the student to request accommodation well in advance of the need in order to give the College a reasonable amount of time to evaluate the documentation and implement the request. Classroom accommodation requiring notification to faculty must be requested for each semester for which it is needed. Please see Disability Support Services in the Campus Offices and Services section elsewhere in the Moravian College Student Handbook for further information, and check the College's website for periodic updates concerning services for students with disabilities.

Academic Honesty Statement

Academic integrity is the foundation on which learning at Moravian College, Moravian Theological Seminary, and the Comenius Center is built. Students are expected to perform their academic work honestly and fairly. In addition, students should neither hinder nor unfairly assist the efforts of other students to complete their work successfully. In an academic community, students are encouraged to help one another learn. Because no two students learn in exactly the same way or absorb exactly the same things from a lecture, students are encouraged to study together. The boundaries on what is or is not acceptable work may not always be clear; thus, if at any point in academic work at Moravian, students are uncertain about their responsibility as scholars or about the propriety of a particular action, please see Academic Honesty in the Academic Life section elsewhere in the Moravian College Student Handbook for further information, and check the College's website for periodic updates.

Class Schedule

Date	Topic	Reading before class	Due
1/18	Math Review: Differential Equations		
1/20	Math Review & Nature of Thermodynamics	Chapter 1	
1/22	Equations of State	Chapter 2.1-2.2	
1/25	Equations of State	Chapter 2.3-2.4	HW 1
1/27	Equations of State	Chapter 2.5-2.6	
1/29	First Law of Thermodynamics	Chapter 3	
2/1	First Law of Thermodynamics		HW 2
2/3	Applications of the First Law	Chapter 4	
2/5	Applications of the First Law		
2/8	Consequences of the First Law	Chapter 5.1-5.2	HW 3
2/10	Consequences of the First Law	Chapter 5.3	
2/12	The Second Law of Thermodynamics	Chapter 6.1-6.4	
2/15	The Second Law of Thermodynamics	Chapter 6.5-6.8	HW 4
2/17	Catch up/Review		
2/19	**EXAM 1**	**CH 1-5**	
2/22	Applications of the Second Law	Chapter 7.1-7.4	HW 5
2/24	Applications of the Second Law	Chapter 7.5-7.	
2/26	Thermodynamic Potentials	Chapter 8.1-8.5	
2/29	Thermodynamic Potentials	Chapter 8.6-8.9	HW 6
3/2	Chemical Potential and Open Systems	Chapter 9	
3/4	The Third Law of Thermodynamics	Chapter 10	
3/7-11	**SPRING BREAK**		
3/14	The Kinetic Theory of Gases	Chapter 11.1-11.3	HW 7
3/16	The Kinetic Theory of Gases	Chapter 11.4-11.6	
3/4	The Kinetic Theory of Gases	Chapter 11.7-11.9	
3/21	Catch up/Review		HW 8
3/23	**EXAM 2**	**CH 6-10**	
3/25	**EASTER BREAK**		
3/28	Statistical Thermodynamics	Chapter 12.1-12.3	
3/30	Statistical Thermodynamics	Chapter 12.4-12.5	
4/1	Classical and Quantum Statistics	Chapter 13.1-13.3	
4/4	Classical and Quantum Statistics	Chapter 13.4-13.6	HW 9
4/6	Classical and Quantum Statistics	Chapter 13.7-13.9	
4/8	The Classical Statistical Treatment of an Ideal Gas	Chapter 14.1-14.4	
4/11	The Classical Statistical Treatment of an Ideal Gas	Chapter 14.5-14.8	HW 10
4/13	The Heat Capacity of a Diatomic Gas	Chapter 15.1-15.3	
4/15	The Heat Capacity of a Diatomic Gas	Chapter 15.4-15.6	
4/18	Heat Capacity of a Solid	Chapter 16.1-16.3	HW 11
4/20	Heat Capacity of a Solid	Chapter 16.1-16.3	
4/22	Heat Capacity of a Solid		
4/25	Lab Presentations		HW 12
4/27	Lab Presentations		
4/29	Review/Catchup		