PHYSICS 328

Fall 2012

Instructor: Dr. David B. Slavsky
Class Meetings: Lectures: T, Th 1:00-2:15 in Mund 506
Office Hours: T, Th 2:30-3:30 and M, W from 10:00-11:00 in Cudahy 420 or by appt.
Contact Information: Cudahy 420, phone 773-508-8352, fax 773-508-3506, email dslavsk@luc.edu
Text: An Introduction to Thermal Physics, Schroeder
Course web page:
http://www.luc.edu/faculty/dslavsk/courses/phys328/phys328-2012.shtml
Pre-requisites : Modern Physics, math through Phys 301; fluency in Mathematica (at the level used in Phys 301) is required and assumed

Course Description

One of the most important cross-cutting concepts in all of science is energy, and perhaps no course treats energy more thoroughly and intensively than thermal physics. In the coming semester, we will investigate both classical thermodynamics and statistical mechanics. The former deals with the macroscopic implications of the 3 laws of thermodynamics, the latter begins with microscopic processes to derive expressions for thermodynamic parameters.

In terms of the text, I anticipate we will cover Ch 1 (sections 1-6), all sections in Chs. 2 and 3; sections 1-3 in Ch. 4 and Ch. 5, and all of Chs. 6 and 7.

During the semester, we will need to invoke some of the results of quantum mechanics you learned in Modern Physics, although there might be some occasions when we will have to develop new quantum results. The course will also draw heavily on your past mathematics studies, although we will learn some new techniques involving gamma functions. The statistical nature of the topic will require development of basic probability theory. If you have had a course in probability this will be review; and if you have not, it will be interesting and very useful new material.

Grading

Your grade in the course will be determined by grades on homework assignments, two hour exams, in-class work, a group presentation, and a final exam.

1) **Homework** will represent an important component of this course: mastering the concepts and skills of this course (or any advanced science/math course) requires in-depth investigation of the material. Homework assignments will provide the

practice you will need to achieve fluency in thermal physics. I anticipate that homework will be assigned each week throughout the semester (usually due on Thursdays). Homework assignments will be due at the beginning of class on its assigned due date and must be submitted in hard copy in class; there will be no option to submit homework assignments on line this semester. I will post solutions to the course website and will make these solutions public as soon as I collect homework, so assignments must be submitted at (or before) the start of class on the assigned due date. There will be no credit given for assignments submitted after the solutions are made public. Assignments will typically include problems that can or must be solved using the Mathematica (and only Mathematica) software package.

2) **Hour Exams** will be given twice during the semester. The first will be on Thursday, Oct 11 and the second hour exam will be on Tuesday, 20 Nov. The first hour exam will cover all material presented in class or assigned for reading from the beginning of the term through the day of the exam; the second exam will cover material done in class or assigned for reading from approximately Oct. 16 through the date of the second exam, although for purposes of continuity, some material from the first half of the semester might appear on the second exam. The exact scope of the exams will be discussed thoroughly in class prior to exam dates.

3) **In-class work:** Each day this term (or almost every day) we will spend approximately 15-25 minutes working on problems that I give the class. I will break the class into groups of 5-6 students, and each group will write up a solution to the problem(s) that they will submit for grading. Each day, I will select one group to present its solution to the class. It is important to come to class each day with your text, a calculator and paper on which to write your solutions. The grading procedure for in-class work is described below. Unexcused absences will yield a grade of zero for that day's in-class work.

4) **Group presentations:** There are many more interesting topics in thermal physics than we can feasibly cover with any depth this semester, thus there may well be topics that you find interesting but will not be included in lecture material. To address this, we will devote the final two days of class (Dec. 4 and 6) to group presentations. Each group will choose a topic of interest and give a 25-35 minute presentation to the class (the time will depend on how many groups we have at semester's end). These topics may be chosen from:

- Astrophysical thermodynamics
- Meteorological thermodynamics
- Operation of heat engines; engineering thermodynamics
- Phase transformation of mixtures
- Thermodynamics of biological system
- Transport phenomena

By mid-semester I would like the groups to have formed and chosen one of these topics. If your group would like to do a topic that is not in this list, please discuss it with me first. As the semester evolves, I will provide more details for the content and format of these presentations and. The grading policy for group work is described below.

5) The **final exam** will be given in this room on Thursday, Dec. 13, from 1:00-3:00. The final exam will be comprehensive, covering everything we have studied during the semester.

Your **final grade** will be calculated according to:

Final average =

0.20 x homework avg + 0.30 x hour exam avg. + 0.075 x in class work + 0.075 x group presentation grade + 0.35 x final exam

Final averages > 90% will earn an A for the course; final averages > 80% will earn a B for the course; final averages > 60% will earn at least a C- for the course; passing (with a grade of D) will require a final average > 50%. I reserve the right to lower the thresholds for certain grades, in other words, final averages in the 80s might earn A's, but I will not under any circumstances raise the thresholds for grades.

Grading Group Work

Two of the categories of grading this year will involve group work, the in-class problems and the end of term group presentation. This section describes how group work will be graded.

The grade each student receives for any group work will be the average of a **group grade** and a **peer assigned grade.**

The **group grade** is the grade I assign to the entire group of students (I am guessing each group will have between 4-6 members this term); each student in the group will receive the same group grade for a specific assignment.

The **peer assigned grade** for each student will be determined by the other members of the group. Each student will assign a grade to all the other students in the group (but will not grade him/herself) on a scale from 0-10 (0 the lowest). Your grades must be integers, and the sum of all the scores you assign must not exceed 5*(N-1) where N is the number of students in your group; in other words, five is the maximum average grade you can assign. Additionally, you cannot give all members of your group the same grade.

Here is an illustration of how I will compute students' grades for group work. Let's consider a group of five students composed of Boltzmann, Clausius, Gibbs, Helmholtz and Kirchoff. Since this is a pretty high powered group, their group grade was a 95%. Boltzmann, who seemed to be cruising on his constant's laurels, received peer grades of 5, 4, 4 and 5, for an average peer grade of 4.5. Boltzmann's peer grade is then:

Peer grade = (average peer assigned grade/5) x group grade = (4.5/5) x 95% = 85.5%

Finally, Boltzmann's total grade for this assignment is the average of the group grade and peer grade, or 0.5 * (95+85.5) = 90.2 %

The purpose of the peer reviewed grade is to ensure that all members of a group contribute to the overall success of the work, and that no one earns a high grade by virtue of someone else's efforts. In my experience, it is extremely rare for any group member to receive a score above 6 or below 4.

Please submit your peer scores via email (to dslavsk@luc.edu) for all other members of your group by 5 pm the day before the next class (i.e., W afternoon for work done on a Tuesday, Monday afternoon for work done the previous Th.). Provide a justification for any score above 6 or below 4. Please remember to use only your Loyola email account when submitting these scores so that I can be assured of the author. Your grade for the assignment will be reduced by 10 percentage points for failure to submit group grades on time.

Peer grades must be confidential. You should not discuss these grades with anyone else in the class. Any form of collusion in the determination of peer grades will be considered a form of academic dishonesty and will receive the penalties described below in the section on academic integrity.

Format for Homework assignments

We will both spend a lot of time this term on homework. For homework assignments to serve the purposes we want, I ask for your help in facilitating my ability to grade them quickly and return them to you as soon as possible. As noted above, homeworks must be submitted in class before I make solutions public.

1) The assignments must be legible; if I can't read it, I can't grade it.
2) Homeworks must be stapled in the upper left corner (this prevents pages from getting separated in my brief case).

Homework submissions not adhering to these format guidelines will lose 20% of credit.

Policy for missed exams, assignments and in-class work

Students are expected to take exams on the scheduled dates and times. Students missing exams will receive a grade of zero on that exam unless at least one of the following conditions applies:

- Illness or hospitalization requiring physician's intervention.
- Death of a close family member.
- Unavoidable court date (including jury duty).
- Representing Loyola in an official capacity which requires your absence from class (i.e., debating team, model UN, intercollegiate athletics).
- Religious observance that prohibits normal work/school activities on that day.

Travel, unless it is travel for one of the reasons listed above, is not an approved reason for missing exams. In all cases, students must provide written, relevant and verifiable documentation of the circumstances in order to take a make-up exam.

As noted above, late homeworks will receive no credit. If the homework is late due to one of the five reasons listed above, I will work with the student to determine an appropriate alternate assignment.

Academic Integrity

It is my expectation that each of you will continue to meet the high standards of conduct that I have come to expect from Loyola students. I urge you to read Loyola's policy regarding academic integrity found at:
http://www.luc.edu/academics/catalog/undergrad/reg_academicintegrity.shtml

Homeworks must be the result of your own effort. While it is often very useful for students to work together on homeworks, be careful that the work you submit must clearly be the result of your own efforts. Students will receive a grade of zero for the first instance of copied homework during the semester; a second such instance will result in a grade of F for the course. Students will receive a grade of zero for the first instance of collusion in the determination of peer grades; a second instance will result in an F in the course.

Academic dishonesty on exams, which includes specifically but not exclusively copying from another's paper, using crib notes, transferring information to another student during the exam, will result in a grade of F for the course.

In all cases of academic dishonesty, I will send copies of the material to the Dean's Office for inclusion in your permanent Loyola file.

General Comments

This is a course where students are encouraged to be active participants in the study of thermodynamics and statistical mechanics. I urge you to ask questions in and/or out of class; don't leave class without asking those nagging questions that you can't figure out (but assume you will get upon further reflection doing homework). This is material that requires thought and practice, and the more ways we have of analyzing a problem the more we can expand and enhance your understanding of how to frame and solve interesting problems in physics.

It will be important to have done and studied the reading assignments prior to class; each day of lecture, come to class with your text, a calculator, and paper to do your in class work. (Hour exams will be closed book.)

I will make extensive use of email and the course website to communicate with the class in aggregate, so please check your (Loyola) email and the course website frequently.