Physics 136, Caltech: Applications of Classical Physics
Fall Term, 2006 — Michael Cross

Website

The course website is http://www.pma.caltech.edu/Courses/ph136/yr2006/

Course Description

This course has been taught here at Caltech since the 1980s, mainly by Roger Blanford and Kip Thorne based initially on their notes and later on drafts of a textbook, which is now being finalized for publication. Recently Roger moved to Stanford to organize a new Center for Particle Astrophysics and Cosmology there. This year I (Michael Cross) am teaching the first term, and Kip will then take over for terms two and three.

This course is designed to introduce students to the fundamentals of all the major branches of classical physics (except classical mechanics, electromagnetic theory, and elementary thermodynamics, which we assume the students have already learned elsewhere), and also to expose students to many of the exciting modern developments involving classical physics. For a longer discussion of the philosophy and contents of the course, see the Preface and Contents to the book.

The amount and variety of material covered in this course may seem overwhelming. If so, please keep in mind the key goals of the course: to teach the fundamental concepts, which are not so extensive that they should overwhelm, and to illustrate those concepts. The goal is not to master the many illustrations, but rather to learn the spirit of how to apply the concepts.

The course material will also seem much more manageable and less overwhelming when one realizes that the same concepts and problem solving techniques are appearing over and over again, in a variety of different subjects and applications. We shall identify these unifying concepts as the course proceeds and shall remind the student of where they have arisen before.

Texts

In the first term I will be closely following the content and structure of the Blanford-Thorne text. The entire textbook is available on the web, at the course website. We will study one chapter per week, covering chapters 1-9 in the first term. Please note that Blanford and Thorne will be revising (finishing?) the text over the course of the term, so that improved versions of the chapters may become available before we need them. *I therefore advise you not to print out all the chapters at this stage.* I am sure that Kip and Roger welcome any suggestions and corrections you might have. Although the course will follow the textbook, I encourage students to attend lectures rather than relying solely on the book. The amount of material being covered is large, and it goes by at high speed; the lectures (I hope) will help in gaining perspective on it and mastering it. I have placed the following textbooks that you might also like to consult on reserve

1. *Gravitation* by Misner, Thorne and Wheeler, QC178.M57
2. *Statistical Physics*, by Landau and Lifshitz, QC175.L32 1969
3. *Introduction to Modern Statistical Mechanics*, by Chandler, QC174.8.C47 1987
4. *Fundamentals of Statistical and Thermal Physics*, by Reif, QC175 .R43
5. *Thermodynamics and an Introduction to Thermostatistics*, by Callen, QC311.C25 1985
6. *Principles of Optics*, by Born and Wolf, QC355.B63 1999
7. *Optics*, by Hecht QC355.2.H42 1998

Homework and Grading

Problem Sets

Problems will be assigned on each Wednesday. Your solutions must be turned in to me [Michael] *at the beginning of class (1pm)* on the following Wednesday. Late homework will not be accepted, unless prior arrangements have been made with the TA—or, at a minimum, a request for an extension has been e-mailed to the TA prior to 1PM on the homework due date, and the TA deems the justification for lateness acceptable. In order to turn in homeworks late, you *must have a compellingly legitimate reason*, such as illness or travel in connection with research. Any homework extensions longer than one week must be approved in advance by me [Michael].

Some of the homework problems will involve numerical calculations. We presume that all students are computer literate—that, at a minimum, they can use Maple, Mathematica, Macsyma, MatLab, or some other user-friendly software to generate numerical solutions of equations and to produce two and three dimensional graphs. Any student who is not computer literate should get a student account at CCO or in the East-Bridge computer lab, on a machine that has Maple, Mathematica, Macsyma, or MatLab, and should invest a day or two in learning to use it.

Solutions

Solutions will be placed on the web. (This is in lieu of discussing the solutions in class.) Some of the same problems have been used in previous years; for them there are many copies of solutions on campus. *You are not allowed to consult those solutions until after your own homeworks have been turned in*. We take very seriously this rule and press for its enforcement under the Caltech honor system. On the other hand, *you are encouraged to discuss the problems with each other, while you are trying to solve them*, with the proviso that *after the discussions you must write up your solutions yourself, independently of anyone else*.

Grading

The default course grades will be Pass-Fail for all students. Students who wish to switch to the ABCDF system can do so by petition through the registrar's office, plus personal arrangement with me. The course grade will be based on homeworks and a final exam in the following manner. Students who score 60% or more on the homeworks will pass the course without having to take the final. If they do not take the final, their grades will be P for people graded PF, and for people with letter grades: homework scores above 90% - A; between 75% and 90% - B; between 60% and 75% - C; below 60% - F. Students who are failing on the basis of homeworks and those who wish to improve their letter grades must take a final examination drawn from 50 elementary questions which will be distributed for study at the last lecture. Eight of these questions must be answered closed book. In this case the homeworks and the exam will both influence the final grade—with the proviso that the exam will never be used to diminish a grade.