Physics 7221: Classical Mechanics
Fall 2006

Instructor: Gabriela González

1 The course

Physics 7221, Classical Mechanics, is a required "core" course for graduate studies in physics and astronomy at LSU. We will meet Mondays, Wednesdays and Fridays, 11:40am-12:30pm, in 108 Nicholson.

The web page for the course is

`http://www.phys.lsu.edu/faculty/gonzalez/Teaching/Phys7221/`

A tentative schedule, homework assignments and solutions, and general annoucenments will be posted there, check it often!

2 The instructor

- Name: Gabriela González
- Email: gonzalez@lsu.edu
- Office: 271-C Nicholson, 578-0468.
- Office hours: Mondays and Wednesdays, 4-5pm (or by appointment).

I am generally available in my office if my door is open, do not hesitate to stop by. However, the best way to find me is by email. If you need help and cannot make it to my office hours, we can make an appointment.

3 Exams, Homework, Grades

There will be one hour-long midterm exam, and one two-hour long final exam. The grade will be decided according to the average score from the exams and homework, with the final exam worth 50%, the mid term 25% and the homework 25%.

I generally consider an A for scores 85% or more, a B for 70%-84%; a C for 60%-69%, a D for 50%-59%, and F for 49% or less. However, the exact cutoffs will be decided at the end of the course, although they will not be higher than the ones above.

There will be weekly homework sets. We will drop the lowest score before calculating the homework score towards the final grade. You can (and are advised to) work in groups, but the submissions should be individual, and handwritten. You should make sure you explain how you solve the problems using as many words as possible, not using just formulas and equations (although there will be plenty of those). Please, do not submit identical sets: the equations may be universal, but everybody writes them differently, and the words should be all yours! If you work with friends on the sets (highly recommended!), I suggest you discuss the problems with your group, solving them on a blackboard. Then you take your own notes from what's on the blackboard, go away and neatly write the solution on your own.

4 Material and textbook

The course is on the basic concepts of the theory of Classical Mechanics, including Hamilton's principle and Lagrange's equations. At the end of the semester, you should be able to :

- know how to identify generalized coordinates and write a Lagrangian for many systems;
- derive equations of motion from a Lagrangian;
- solve equations of motion for some common systems (systems of particles, simple constrained systems, harmonic oscillators, systems with a central force);
- recognize the concepts learned in this course when similar concepts are used in other fields (Variational principles, Lagrangian and Hamiltonian functions, oscillators, etc are also found in Quantum Mechanics, Statistical Mechanics, Field Theory, etc).

This course assumes you have taken an advanced undergraduate course on mechanics, following a textbook similar to "Classical Dynamics of particles and systems" by Marion and Thornton. This textbook (or whichever one you used) should be a good reference you should keep handy, since we will go over mostly the same material, in greater depth. It will be useful for you to go over your notes for that class in the first couple of weeks of the semester, to refresh your memory.

We will follow the classical textbook for this course in most schools, "Classical Mechanics" (3rd Ed) by Goldstein, Poole, and Safko. We will cover only the basic chapters: 1-6 and 8. These chapters are very similar to previous editions, so if you have an older edition, you can use it. (I personally like the 2nd ed. better than the 3rd...) Notice that the homework assignments will be taken from the problems in the 3rd edition.

Beware of typos in the textbook !! All known typos for each printing of the Addison-Wesley 3rd edition are listed in `http://astro.physics.sc.edu/goldstein/`. Make sure you correct the typos before you study the chapter or try solving the problems!! The Pearson paperback edition has the same typos as the first printing of the Addison-Wesley edition.

Depending on the desires of the class (and of the teacher) we will choose some extra material from the other chapters to cover in the last couple of weeks, but they will not be included in the final exam.

We will not cover many chapters in the textbook that may be useful if you want to pursue theoretical physics (although in that case you will see that material in a more specific context). However, if you find you have time and desire to go over more material than what we plan to cover, I will be happy to answer questions in office hours, and even suggest problems to try out. This will not earn you any extra credit, but it may make you happy! Chapters I especially like are Special Relativity (Ch 7), Canonical Transformations (Ch 9), Perturbation Theory (Ch 12) and Continuous Systems (Ch 13).

Other useful material:

- "Mechanics", L. Landau and E. Lifshitz, Elsevier, 1976: a beautiful, concise, book, although difficult to follow, geared towards the education of theoretical physicists. Landau's physical intuition can be enjoyed in every chapter. Great problems at the end of the chapter (with solutions!), which are the inspiration for many exam problems.
- "Classical Dynamics: A Contemporary Approach", J.V. José and E. J. Saletan, Cambridge University Press, 1998: a more modern approach to a very old subject.
- "Classical Mechanics", N. C. Rana and P. S. Joag, Tata McGraw-Hill, New Delhi, 1991. Not easy to find, but a very nice book with lots of physical examples and thorough explanations.
- M. Morii, `http://huhepl.harvard.edu/~masahiro/phys151/lectures/` This website contains the pdf files for a beautiful set of powerpoint lectures given by Professor Morii at Harvard.