PHYS 303: Classical Mechanics

Classes
Place: EXPL L111
Time: MWF 11:30–12:20
Web site: www.physics.gmu.edu/~joe/PHYS303.html

Instructor
Joe Weingartner  (call me Joe)
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Course Objective
Classical mechanics is one of the core theoretical subjects in the physics major and a foundation for more advanced physics. Your objective in this course is to thoroughly master it.

Textbook
Classical Mechanics, John R. Taylor (University Science Books)
We will cover Part I of the textbook (chapters 1 through 11). Some of the basic material in chapter 13 appears on the Physics GRE, so I have also prepared course materials for this chapter. This is solely to help you prepare for the GRE—you will not be responsible for chapter 13 in this course.

Evaluation
In-class exams (80%)
9 exams of equal weight, all announced in advance. See the schedule on the course web site.

Final exam (20%)
This will be held on Dec 16, 10:30–1:15, in the same room as class.

Letter grades for the course will be determined from total numerical grades as follows:
A range:  87-100%
B range:  74-87%
C range:  64-74%
D:  55-64%
F:  < 55%
**Study Strategy**

To truly succeed in this course, you must do the following two things:

1. *Actively* read the textbook
2. Do LOTS of problems

**Active Reading:**

Active reading means constantly challenging yourself to make sure you understand the text, including

(a) **Logical steps in arguments.** For example, pp. 18 and 19 show that if the net external force on a system of two particles is zero, then the momentum of the two-particle system is constant. After reading that conclusion, you should pause to make sure that you can identify the crucial arguments that led to the result. You might imagine that you’re trying to explain the argument to a classmate, without looking back at the text.

Sometimes the text prompts you to read actively. At the bottom of p. 28, it says that “by inspecting this figure, you should be able to convince yourself that ...”. It’s never OK to just read on in such circumstances; you must pause to study the figure carefully and make sure you understand how it implies the claimed result.

(b) **Mathematical steps.** Whenever steps are omitted in a mathematical derivation, you should fill them in on your own.

(c) **Statements made without explanation** (because the author presumes that you already understand it or can work it out on your own with some thought).

In example 4.7 (p. 130), the text states that the normal and friction forces both do no work and that the length $BC$ is the distance the cube has rolled around the cylinder. No justification for either statement is made; you are obligated to provide these yourself.

Whenever you encounter something that you cannot make sense of, make a note of it and ask me in class, via email, or at my office.

**Problems:**

The main goal in this course is to develop the skills needed to solve problems involving classical mechanics. As with most skills, the only effective way to learn is through repeated practice. If you want to learn this stuff, you just have to do a lot of problems. There’s really no other way, no shortcuts. I’ll assign a lot of problems, but won’t collect them. That way, you can quickly move past the ones that are easy for you and you don’t have to spend time prettying up your solutions for submission. You will be responsible for budgeting your time so that you don’t fall behind on the problems. The course web site contains detailed solutions to the problems, but you should always work hard to solve them on your own before consulting the solutions. The web site also contains tutorials to guide you through the solution steps for selected problems—use these if you cannot solve the problem without assistance. Once you’ve completed a problem, you should always study my solution carefully. Even if you got it right, my solution might take a different (perhaps more efficient) approach and may contain additional commentary. Of course, always ask if there’s something you don’t understand.

**Effective Study Time:**

Actively reading the textbook and solving lots of problems are time-consuming and require concentration. I strongly suggest that you schedule significant blocks of uninterrupted time for study: no people to talk to, no TV or music in the background, no phone or other device nearby.
Study sessions with classmates can also be highly valuable, but only if you put in serious study before the session. I mentioned above that it can be helpful when actively reading to imagine that you are explaining something (a logical argument, a step in a problem solution, etc.) to a classmate. Actually doing so is even better. Explaining something to another person forces you to confront gaps in your understanding that you didn’t realize were there. In other words, striving for clarity of expression helps you to achieve clarity of thought.

**Course Structure**

The course is structured to support your active-reading and problem-solving activities. I will provide a study guide with brief notes to accompany your reading. Reading and problem assignments will be due at each class meeting (except those with an exam). The first priority in class will be answering your questions about the reading and problems. During any remaining class time, I will work out example problems or review concepts from the reading and/or give you time to work individually or in small groups. Bring the textbook, paper, and a pencil or pen to each class. Exams will contain questions to test your understanding of the reading and problems related to the assigned problems. It won’t be possible to cover everything from the assigned problems on the tests, so I’ll pick quasi-randomly. (I’ll aim for a balance among topics, but won’t favor particular types of problems.) You might think that the more lengthy/involved of the assigned problems would be too difficult to incorporate on tests, but I can find ways. It’s important that you master all of the assigned problems.