1. I have taught this course for many years as instructor and occasionally as lecturer.

2. I want you to do well in the course.

3. By now, I pretty much know what works and what doesn’t work.
   Too many students come to me towards final exam time who didn’t listen to me.

4. **What doesn’t work:**

   (a) **Don’t memorize recipes.**
   
   Most students get trained in high school to memorize recipes. The teacher does a problem in class, you memorize the recipe, you get the same problem on the exam, you regurgitate the recipe.

   That won’t work here. Here, you’ll need to be able to do problems that are not exactly the same as the problems we do in class. They will use the same principles, the same ideas, but they won’t be exactly the same.

   Physics is a collection of intellectual tools — ideas, principles, laws — that give you reliable knowledge of how the physical world works. Reliable knowledge is power — the power to predict what will happen, the power to make something that will work reliably.

   All of technology is based on physics.

   The laws of physics are reliable. But they give us power only if we use the laws of physics reliably. *You* have to be able to use them reliably. You have to master the tools, understand how they work, what they’re good for, so you can use them reliably.

   A recipe works for only 1 problem. Controlling ideas as tools works for many problems. So don’t “study”. Practice using the ideas as tools to solve problems.

   (b) **Don’t wait until the last minute.**

   You need to practice. It takes a while to get control over the tools, to master the tools. You can’t do it the night before.

   Don’t wait until you do badly on the 1st exam. I can’t count how many students have come to me after the 1st exam asking “*can I still get an A in the course (or a B, or …)*”. It is possible to recover — some students do it — but why put yourself in that position?

5. **What does work:**

   (a) **Bring questions** to class, to office hours, to lecture.

   Try problems — the examples in the textbook, the homework problems, extra problems you find on the web.

   Do this before the lecture, and especially before the recitation. You cannot do well without priming your brain with questions before recitation and before lecture.

   Bring questions and problems to my office hours.

   You don’t have to solve the problems. You want to form questions and then bring up your questions — before class, and in class, and after class, and in office hours.
Questions prime the brain. You can ask me “how do I solve problem 8?” but that will sound like you’re asking for a recipe. Try to solve it yourself, get stuck, then try to figure out what’s getting you stuck and ask about that.

Ask yourself: “how does this work?” Your aim is to get eventually to “Oh, now I get it, that’s how it works!” This isn’t necessarily easy, but it is definitely possible.

You’re learning to use new tools. Think about tools you have learned to use (cooking, sewing, carpentry, auto repair, . . . ). Think about what it took to learn how to use a new tool.

Read and listen skeptically. Read the example problems in the textbook like the author is a used car salesman trying to sell you a lemon. Be suspicious. Demand to understand before you buy. Ask: Why is he doing that? what’s the idea? Don’t let him get away with anything.

(b) Come to my office hours

Bring problems and questions to my office hours.

Bring any questions you want. I will be glad to help.

The is a big course, so it is necessarily rather mechanical. Even the recitations are large. My office hours are meant to be an antidote. I like teaching face to face, talking with small groups of students who want to do better.

Also, it is a way to meet other students and form study groups. Doing problems cooperatively in study groups of 2-4 students can be a very effective way to learn.

(c) Know your weaknesses and compensate for them

If you are prone to algebra mistakes and/or arithmetic mistakes, develop techniques to compensate. When you finish a problem, tell yourself that you probably made a little mistake, then go back and find it. It’s a waste to lose exam points because of little mistakes, when you know the ideas.

Your goal is to be reliable. Errors are normal and ok as long as you notice them and correct them. All that counts is to be reliable in the end. Make error-correction machinery for yourself, so you notice and fix your errors before they do damage.

(d) Get control of vectors from the beginning

Vectors are going to be used throughout the course.

Make sure you understand vectors and how to use them.

When students comes to ask why they are doing badly, the answer almost always includes weakness with vectors.

(e) Get control of units from the beginning

Physical quantities come in units (distance in meters, time in seconds, etc.)

Keeping track of units is a useful way to protect yourself against errors. If you are calculating a distance and your answer is in seconds, you know you made a mistake.

If you just calculate with numbers, you might or might not get the right answer, but you won’t be able to check for yourself that the units came out right.