# P H Y S I C S
# *w i t h*
# C A L C U L U S

## Volume I -- Classical Mechanics

Third Edition, Fourth Year

by
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# Notes to the Student

ABOUT THIS TEXT BOOK:

1.) This text is a *reference source* designed solely for your use while taking advanced physics here at Poly. It is very much like an expanded set of class notes. That is, there is nothing within the text that will not be discussed in class, and there is very little that will be discussed in class that is not covered by the text. Put another way, if you are an *ear-learner* and absorb material by listening to lectures, you may successfully complete this class without ever opening the book (though I wouldn't suggest trying it). If you are an *eye-learner* and learn through reading, this book will do it all for you. In either case, the text is for your use and convenience. Utilize it in any way you wish.

2.) On the assumption that complex ideas are more easily absorbed when presented in chunks, this text has been written in an *outline form*.

3.) There are six to fifteen questions at the end of each chapter, many of which have multiple parts to them. If you can think each problem through to completion *without the use of your book*, you will understand both the *theoretical concepts* and the *mathematical techniques* involved in the chapter. This is what you should be shooting for.

In short, the problems are designed to make you *think about the ideas being presented*. You will not turn them in for a grade. In fact, the *complete answers* to *all the problems* are found at the end of the text.

**Note:** Though your use of the problems is strictly up to you, I give you fair warning. When you do the problems, I WOULD *STRONGLY SUGGEST* THAT YOU DO NOT LOOK AT A GIVEN PROBLEM, THINK ABOUT IT FOR FIFTEEN SECONDS, THEN GIVE UP AND LOOK AT MY SOLUTION IN THE BACK OF THE BOOK. Doing so simply rides on what *I* know, not on what *you* know, and that defeats the purpose of the problems.

Your best chance for survival on a given test depends upon your ability to look at a problem you have never seen before and have the wherewithal to

untangle it with nothing more than your brains and your wits at hand. If you can't do the chapter-end problems cold, you don't understand the material well enough to pass the next test.

My suggestion, then, is that you treat the chapter-end problems as though they were *test problems*. That is, do them without looking back in your book, asking friends, or above all else, looking at the solutions in the back of the book. You only have so many of these problems available to you. Don't squander them. Getting an answer isn't worth the paper it's written on if you didn't think through the *how to* of the problem totally on your own. Understanding the *how to* is what will help you when test-time comes.

ABOUT THE CLASS:

1.) Grades:

a.) You may expect from 4 to 6 tests per quarter (a test every one-to-two weeks). Tests will make up 75% of your grade.

b.) Labs will make up 25% of your grade. Labs will be held on Thursday or Friday, depending upon your free A/L periods. More will be said about labs during the first lab session.

c.) Formal homework assignments will not be given. You are big people--a year from now you will be roaming the college of your choice completely footloose and fancy-free. It is time for you to begin to develop study habits that will allow you to deal with all that freedom without going glug-glug in the process.

For those of you who feel naked without some kind of assignment guidance, here are my suggestions:

i.) YOU WANT TO LEARN THIS STUFF AS FAST AS YOU POSSIBLY CAN. The tests are going to require you to *think on your feet*. That means you need to give the ideas time to crash around in your head before you have to use them on a test. It also means that if you wait until a day or two before the test to try the chapter-end problems, etc., stuff is going to be swirling around you like a tornado when it comes time to take the test ( (this completely ignores the fact that approaching the chapter-end problems in this way will give you no time to come in and ask questions should you find yourself

confused). That is not going to help you deal with the test questions, *none of which you will have ever seen before*.

ii.) On the first night after you have taken a test, *skim* the next chapter of the book (even if you are an ear-learner). This should take no more than fifteen to twenty minutes (by skim I mean look at the headings and pictures, read a few captions, etc.).

iii.) On the second night after having taken a test, *skim* the associated chapter in the *Conceptual Manual*.

iv.) On the third night, though you don't want to be anal about this, read as much of the chapter as you can (if you can do the whole thing in a night or two, great!). Things always make more sense the second time you come in contact with them, so even if the reading makes little sense the first time around, the topics will make more sense than they otherwise might when I present them in class.

v.) At some point in that first three or four days, try the first end-of-chapter question (they are in relatively sequential order). If you cannot figure the question out, LEAVE IT. Allow your mind to chew on it for a while. DO NOT GO TO THE SOLUTIONS, at least not yet. There will still be plenty of time to do that later if need be.

iv.) NOT TRUE! Street wisdom and your gut probably suggest that you don't want to peek too soon, that you don't want to learn something so far ahead of the test that you forget it in the meantime. For this class, THIS IS NOT A GOOD WAY TO THINK.

You will, on occasion, be running into new material the day before the test. If you master the topics as they come, all you'll have to worry about just before the test will be the new topic and a quick review of the material you've already learned. Leave everything until just before the test and you will end up with a mountain of stuff to master all at once. The natural consequence of that is that you will enter the test with everything swirling around you as mentioned above.

In other words, LEARN THE MATERIAL, ESPECIALLY THE MATERIAL AT THE BEGINNING OF A CHAPTER, *AS YOU RUN INTO IT*. You may forget a little between the time you learn it and

the time the test comes, but because you learned it once, just a little bit of review should bring it all back.

Put yet another way, don't put things off *especially* if there is a topic that looks absolutely awful at hand. If you don't master it on the spot, it will look just as awful the night before the test as it did the first time you saw it.

v.) Some time within three days of the test, come in and ask me questions about the material you don't understand.

2.) Assignment deadlines:

a.) Deadline extensions will be generally frowned upon unless unusual, extenuating circumstances dictate leniency in the policy.

b.) Having made the above statement, let me add a human touch to the pronouncement. I realize you will have a lot of things to do over the course of the year--much more than you probably realize considering the added burden of college applications, etc. I have been dealing with seniors for twenty years and know there will be times when things get a bit tight.

Requiring you to get things in on time is not my way of making your life miserable. I am trying to get you to think more about the way you study. You will know *exactly* when each lab is due (we will decide on a fixed day--it will be approximately one week after the completion of a given lab) and tests will be announced with at least *one weekend* between the test and the announcement (usually about a week in advance). If you are being conscientious, you should be able to adjust your study schedule to accommodate those deadlines.

IF YOU HAVE AN UNFORESEEN PROBLEM, DON'T BE BASHFUL ABOUT COMING TO TALK TO ME (I don't bite, at least not hard). I am *not* averse to giving deserving students a break if there is a good reason to do so.

c.) *Legitimate* absence (i.e. for sickness) is automatically grounds for an extension, but God help you if I find your "sickness" was intimately related to your need to write a paper for another class.

3.) A.P. review:

a.) Students characteristically have two major problems in preparing for both the A.P. test and a final exam. They are:

i.) At the end of the year, how does one bring to mind all of the itsy bitsy pieces of information that are relevant and important if one is to understand the physics that has been covered, but that also hasn't been thought about since the start of the second semester or, worse yet, since the beginning of the year?

ii.) Schools whose physics programs are only one year long (versus being two years long) have little time for in-depth classroom discussions of the conceptual consequences of the theories being presented. As such, given the fact that the A.P. folks are now stressing conceptually oriented questions in their multiple choice section (they don't even *allow* the use of calculators in that section any longer), how does one prepare for such questions?

b.) Solution: For review, you will find four *multiple choice tests* with *Solutions* at the end of each volume (there are a total of 125 questions in the mechanics volume and 160 questions in the E&M volume). The problems are mixed between calculator-driven questions designed to help you review processes, and conceptual questions designed to nudge you into thinking along conceptual lines. If you follow the provided *strategy for use* when the time comes, this should be a fairly effective way to remind yourself of all of the good things you've forgotten over the year while additionally allowing you to see how conceptual questions are presented. The Solutions will highlight how you *should* approach each.

4.) Cheating:

a.) The following will be discussed during our first few class periods:
i.) Cheating on labs;
ii.) Cheating on tests;
iii.) Cheating on homework;
iv.) Cheating on make-up tests.

5.) Final exam: There will be a final exam at the end of the first semester AND at the end of the second semester (just before you leave for senior projects). Both will be cumulative.

6.) Dropping the class: You may drop the class *without* teacher approval within the first three weeks of the first quarter. After that, you're all mine.

Parting Shot:

Physics can be a bit of a challenge, but it can also be a lot of fun if you get the knack of it. My job is to make it enjoyable while teaching you the fundamentals of the subject. If I do my job well and you are at all open-minded, the two of us should be able to make the class palatable, enlightening, maybe even a bit amusing while delving into the rigor of it all. This book is the first step. Use it well.