Phys 366 Mathematical Methods of Physics Fall 2016

Objectives and Policies

2016 August 19

This course will be administered through its web site:
http://info.phys.unm.edu/~caves/courses/phys366-f16/info.html .

All the documents mentioned herein, including the course syllabus and this document, can be found at the web site. There are links to the course web site on the P&A web site and on my home page (http://info.phys.unm.edu/~caves). The course syllabus provides a complete schedule for the course and is your gateway to course materials, including lecture notes, special handouts, homework assignments, challenge problems, and solution sets, all of which will be available as pdf files linked to the course syllabus.

The course has three objectives:

- To develop facility with basic mathematical methods used in physics. The topics to be covered are the following: complex numbers; vectors and vector calculus; linear algebra and complex vector spaces; tensor analysis; Fourier series and transforms; special functions; and partial differential equations. The aim will be to present the mathematical methods and techniques within a context of physics concepts and problems.
- To develop your nascent skills as a physicist—in particular, to develop your skill in using the physics approach to formulating and solving problems. *Most important in this regard is making the transition from freshman-sophomore ways of learning, based on learning recipes and regurgitating memorized solutions, to a more mature way of learning, based on mastering concepts and techniques so that they can be applied in situations not encountered previously.* Since the course is not focused on any particular subject in physics, it provides a particularly good opportunity for learning how to apply concepts and techniques generally, instead of in a particular situation.
- To develop self-discipline and work habits that are useful both in academic course work and in the real world.

These objectives are important: they're the reason I'm giving the course and the reason you're taking it. Please note that the second two are not specific to this particular physics course. Following now is a list of ruminations, policies, and practices, with all of which you should become familiar. Most of the items are somehow connected with the three objectives.

1. Why bother learning mathematical methods?. This is an easy one. You can't do physics without doing quite a bit of mathematics. Moreover, although you take many math courses on your way to a physics degree, one of the hardest things about becoming a physicist is learning how to relate physical concepts to the corresponding mathematical representations and techniques. Most physics students find it much easier to learn and to remember mathematical techniques when they are presented and used within the context of a physics subject or problem. That might be what makes us physicists instead of mathematicians, so as noted above, it is a major aim of the course. One way to think

about this course is that I am exposing you to the mathematics in a physical context that I wish students had known before the junior-senior-level physics courses when I taught those courses.

2. Prerequisites. Your math background should include the required calculus courses leading up to and including ordinary differential equations at the level of Math 316 (Applied Ordinary Differential Equations).

3. Textbook. We will be using the 3rd Edition of Mary L. Boas's *Mathematical Methods in the Physical Sciences*. The textbook is not as strong as it could be on relating mathematical techniques to physical concepts, so doing that will be one aim of the lectures.

4. Lectures. It is impossible and unnecessary to cover in the lectures everything that's in the textbook. The purpose of the lectures is to cover major concepts and techniques in an environment where you can ask questions. *Please ask them! There is no such thing as a dumb question. Any question you need to have answered is a good question and is more important than getting through some prescribed set of lecture material.* The value of the lectures is enhanced by your having given the material a first reading *before* the lecture. The topic of the lectures and the relevant reading material are listed on the course syllabus.

5. Homework assignments. To learn physics requires doing problems, both to gain familiarity with the material and to master problem-solving techniques. The eleven homework assignments are aimed at providing a representative sample of problems. The homework assignments will count 40% toward your grade.

Consult the syllabus for the schedule of homework assignments. Homework assignments will be posted to the web site on the date listed on the syllabus (or sooner if available) and will be due *at the lecture* on the date given on the assignment (and also on the syllabus). *Late homework assignments will not be accepted unless a prior arrangement has been made with the TA.* Assignments should be turned in at the lecture or to the TA's mailbox. *Do not turn in assignments to my mailbox.*

One of the most effective ways to learn is to work with peers. You are encouraged to consult other students about homework problems and to work in groups, but the *final product you hand in must be prepared solely by you.*

The syllabus is linked to a document that spells out standards for preparing homework assignments. You should be familiar with these standards and prepare your assignments accordingly.

Your involvement with a homework assignment does not end when you hand in the assignment or even when the graded assignment is returned to you. You should examine your work critically with an eye to making sure you *really* understand the problem and its solution. Solution sets for each homework assignment will be posted to the web site shortly after the assignment is due. The best way to improve your understanding of a problem is to consult the solution set, which represents many hours of faculty time in writing a solution that helps you to improve your understanding. Even on problems that you did successfully, it is advisable to consult the solution set because it might present a more thorough solution or alternative approaches that you haven't considered. If you still

have questions about a homework assignment after carefully going over the solution set, you should see me or the TA with your questions.

6. Problem sessions. Roughly one out of the three class sessions, usually the Friday session, will be devoted to solving a "challenge problem." The problem session will be conducted by me and the TA.

On each homework set, the "challenge problem" will be held in reserve and assigned at the problem session. You will be divided into groups of three or four to work on the problem, while the TA and I circulate among the groups to see what you're up to. This allows us to help you directly with the material—to see how you think and to help you correct misconceptions before they get you into serious trouble. *This is the most valuable contact time in the course. It is essential that you participate.*

7. Quizzes. There will be six *open-book* quizzes, each counting 10% toward your grade. Each quiz will be given during a class session, and you will have an hour and 25 minutes to complete the quiz. The schedule for these quizzes and the lectures they cover are listed on the syllabus. There will no mid-term exams and no final exam.

You must take the quizzes during the scheduled time, so set these times aside now. If you fail to take a quiz at the scheduled time, you will receive a grade of zero, unless you have a valid reason for not taking the quiz *and* you have discussed your reason with me *before* the quiz.

Each quiz will have one to three problems, covering material from the preceding two to three weeks of lectures. The problems will be at the level of or less ambitious than the homework problems. Because the quiz problems are meant to be relatively straightforward, there will not be a liberal assignment of partial credit.

The quizzes are *open-book*. You may use the textbook, your own notes, your own homework assignments, all class handouts, including solution sets for homework assignments, and a pocket calculator (though you won't need one), but you should not consult books other than our textbook or other material, including other online material.

I am giving many quizzes, instead of a few exams, for several reasons:

1. I get more timely feedback on how you are doing.
2. Each quiz covers a clearly defined block of recently covered material. This makes it easier for you to study for a quiz and easier for me to make up a problem that represents fairly the relevant material.
3. Each quiz makes a relatively small contribution to your total grade, thereby reducing the pressure on you.

8. Grading. The course will be graded on a curve, with the homework counting 40% and each of the six quizzes counting 10%.

9. Solution sets. Solution sets for homework assignments and quizzes will be posted to the web site shortly after the assignment or quiz is due. Thereafter, if you do not find a posted solution, please contact me to remind me to post it.

10. Getting help from the instructor and TA. You are my first priority, and you are encouraged to get personal help from me at any time. During my office hours, which are

on Friday, 1:00 pm–3:30 pm, I pretty much guarantee to be available in my office (or in Room 30a, next to my office, if enough of you come to see me). Outside of office hours, I will talk to you unless I have some other, overriding obligation, in which case I will schedule an appointment with you at the earliest convenient time. I am in the building every weekday, except that I sometimes try to stay at home on Monday. You can also get help from the TA. The TA's office hours are on Monday, 2:00 pm–4:00 pm, in his office, Room 22.

11. Additional resources. If you are having trouble, you can get additional, personal tutoring help at the Center for Academic Program Support (CAPS).

12. Punctuality. Lectures and other class meetings will start precisely on time.

13. Academic integrity is important for everyone. All students at UNM have a responsibility to uphold University principles of academic integrity and to support each other and the faculty in maintaining a classroom atmosphere that is conducive to orderly and honest conduct. You should be familiar with the following policy laid out in the *The Pathfinder* (UNM Student Handbook, available at http://pathfinder.unm.edu/index.html):

> ACADEMIC DISHONESTY. Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course. Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

You should also be familiar with Article 3 (Academic Dishonesty) of the Student Conduct and Grievance Procedures.