Physics 1373/2373: Mathematical Methods in Physics

Course Syllabus

Tu & Th, 9:30-10:45 in 106 Allen Hall

Course Instructor

Instructor: Andrew R. Zentner
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Office Hours: Mondays at 3PM
Thursdays at 11AM
& By Appointment

I am a member of the Department of Physics and Astronomy at the University of Pittsburgh. My research specialty is theoretical cosmology.

Please do not hesitate to contact me with **any** questions or concerns about this course. I generally have an open door policy, so feel free to drop by if I am around. All too often, students wait until the end of the semester to express concerns, but by that time I cannot change anything. There is **no** question too insignificant and there is no need to wait to express a concern. Of course, I have to abide by University and Department rules and I have to work within the Physics & Astronomy curriculum, so I cannot accommodate all requests, but my intention is to make this course as fun and productive as possible.

The University of Pittsburgh CourseWeb site will be the primary means of communication throughout the class. It is the responsibility of the student to check the CourseWeb site **often** for updates and assignments. I will not distribute hard copies of materials in class and I will not be responsible for pointing you to assignments on the CourseWeb site.

Office Hours

I will hold office hours on Mondays at 3PM and Thursdays at 11AM. You may also make a specific appointment to meet at another time. However, I generally have an open door policy and if you see me around, you should feel free to drop by and ask questions. If you come to office hours for help with an assignment, please be prepared to demonstrate that you have put some effort into the problem(s). In particular, be prepared to describe

your thought process and the point at which you are stuck. I will **not** help with homework problems if you cannot first describe to me how you tried to solve the problem.

Course Description

This is a course in basic Mathematical Methods in Physics. For some of you, much of this course may be review, but it is important to make sure that all students have a solid foundation in basic mathematical manipulations in order to proceed through advanced Physics courses.

Course Topics in Detail

Here is a rough outline of what will be covered in the course. This plan may be modified according to student interests, student preparation, the general pace of the course, and/or questions that may arise during the course.

- Review of complex numbers. Review of the calculus of functions of several variables.
- Vectors, Vector Spaces, Matrices, Simultaneous Linear Equations
- Vector Calculus
- Fourier, Laplace, and other Integral Transforms
- Ordinary Differential Equations
- Special Functions
- Partial Differential Equations
- Complex Analysis, Cauchy's Integral Theorem
- Group Theory
- Tensor Analysis
- I intend to hold a review session prior to the final exam.

Graduate vs. Undergraduate Versions of the Course

This course is offered to undergraduates as PHYS 1373 and to graduate students as PHYS 2373. While the lecture is the same for everybody, the homework assignments and exams will differ for students enrolled in PHYS 1373 (undergraduate level) and PHYS 2373 (graduate core course). Each homework assignment will indicate which problems are

required for students of PHYS 1373, while the remaining problems are voluntary. Students enrolled in PHYS 2373 are expected do **all** problems on each homework assignment. **Note:** Physics graduate students must enroll in PHYS 2373.

Course Grades, Homeworks, and Exams

- Midterm Exam : 45%
- Final Exam : 55%
- Class Participation: A bonus of up to 10%.

The midterm exam will take place on **THURSDAY, OCTOBER 24, 2017**. The final exam will be scheduled by the Registrar's Office and held during finals week. Undergraduate students in the class will have fewer exam problems. Graduate students should keep in mind that the final exam also determines whether or not you have passed the Preliminary Evaluation and/or the Comprehensive Examination in Physics.

I will guarantee the following grades.

- A: For earning $\geq 85\%$ of possible points in the course.
- B: For earning $\geq 70\%$ of possible points in the course.
- C: For earning $\geq 55\%$ of possible points in the course.

I reserve the right to curve the course based on the performance of the students in the course, so the final grade may be higher than the guaranteed grade above. Your final grade can, of course, NEVER be lower than the guaranteed grade above.

You will notice that homework is **not** a part of your grade in this course. Please see my note on homework policy below.

Exam Policy

Exams will be **open book**. You may bring *Mathematical Methods for Physics and Engineering* 3$^{\text{rd}}$ Ed., by Riley, Hobson, and Bence to all exams. You may also bring two pages (front and back, so four sides of paper) of **handwritten** notes to the exams. These notes must be your own work. These are the only references of any kind that you may use during the exams. No electronic devices of any kind may be used during exams whatsoever. Any use of an electronic device during an exam will result in an exam grade of zero. Any

violation of these restrictions will be treated as a violation of the University's Academic Integrity Policy (see below).

Homework Policy

There will be approximately 8-12 homework sets during the semester. Working through homework assignments and other practice problems, such as the odd-numbered problems in the textbook (for which the book gives either hints or full solutions in the Student Solution Manual), is the single best way to learn the material. As a practical matter, it will be important to practice the material in order to perform well on the exams.

I will post homework assignments as well as my solutions nearly every week on the CourseWeb site. You should attempt the homework, without looking at the solutions, if you aim to master the material. Moreover, the homework problems give you guidance on the material that you should study for both success on the exams in this course and success in other advanced Physics courses. Graduate students (enrolled in PHYS 2373) and undergraduate students (enrolled in PHYS 1373) will not be responsible for the same material.

Graduate Students are responsible for the material covered in **all** homework problems.

Undergraduate Students are responsible for those problems on each assignment **not** marked with a "$\star$." Obviously attempting additional problems can only aid in mastery of the material.

You will notice that homework will **not** be part of your grade in this course. This is because it has become apparent to me that it is simply too easy to cheat on the homework. In previous courses, I have given homework significant weight. However, it has become increasingly impractical to use homework as a significant portion of the class grade. It is now too easy for students to take shortcuts on homework, such as looking up solutions to similar problems online or sharing solutions with friends here at the University of Pittsburgh or even at other institutions. This has at least three significant negative consequences. The first is that Instructors and Teaching Assistants are forced to spend large amounts of time determining the provenance of the homework solutions, dealing with issues of Academic Integrity and plagiarism, and grading copied homework. This is a waste of resources. Second, and more importantly, homework grades have become less representative of the effort the student has expended trying to master the material. Homework grades have therefore become less useful in predicting student success. Third, I have observed that a consequence of grading homework is that those students that spend the most time working on the homework in good faith often are penalized, while students that habitually cheat

receive higher grades (simply because they copied correct solutions). This, in turn, penalizes those students working hardest to master the material. It is for these reasons, that homework will not constitute part of your grade.

Nevertheless, the importance of homework is worth emphasizing. The fact that I am not grading homework is not a reflection of the importance of homework to understanding material. I personally think that individual work, such as that provided by homework problems, is indispensable in learning this material. Homework should be your primary way to practice the material and to prepare for exams. In order for homework to be useful, you must be honest with yourself. Spend time thinking about problems and making mistakes as a necessary part of the learning process. You must try solutions, you must work past mistakes. Looking up solutions on line is not effective and does not translate well to exam performance or research success. If you cannot solve most homework problems without significant prompting from some resource, then you are not sufficiently well prepared. The internet is a potentially fantastic source of information and educational material, but in order to master a subject, you must be able to construct original work yourself rather than simply follow the work of others. I am providing you with problems that I consider particularly worthy of your time as well as my solutions to these problems. These resources should help you to master the material covered in this course.

General Grading Guidelines for Exams and Homework

No credit will be given for correct answers that do not give proper justification.

No credit will be given for answers that do not have appropriate units (where applicable).

Partial credit will be given for incorrect answers if you acknowledge that your answer is incorrect, describe the manner in which you determined your answer to be incorrect, and speculate on the cause of the error.

No credit will be given for work that is illegible or so disorganized that it is difficult for the Instructor to follow. Your work must flow sequentially from left to right across the page and from top to bottom down the page. No credit will be given for work if the sequence of steps is difficult to determine. These rules will be enforced even if your final answer is correct. It is your responsibility, and your responsibility only, to present your work in a manner that is clear, well-organized, and legible.

Textbook

Mathematical Methods for Physics and Engineering 3rd Ed., by Riley, Hobson, and Bence is the required book for this course. Many of the homework problems will be taken from this textbook. Moreover, this text provides either solutions or hints to the odd-numbered problems. Consequently, you will have a large reservoir of problems that you may use for practice.

Academic Integrity

Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity without exception. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

Students with Disabilities

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 140 William Pitt Union, (412) 648-7890, drsrecep@pitt.edu, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Accessibility

Blackboard is ADA Compliant and has fully implemented the final accessibility standards for electronic and information technology covered by Section 508 of the Rehabilitation Act Amendments of 1998. Please note that, due to the flexibility provided in this product, it is possible for some material to inadvertently fall outside of these guidelines.

Copyright Notice

The materials used in this course may be protected by copyright. United States copyright law, 17 USC section 101, et seq., in addition to University policy and procedures, prohibit unauthorized duplication or retransmission of course materials. See Library of Congress Copyright Office and the University Copyright Policy.

Statement on Classroom Recording

To ensure the free and open discussion of ideas, students may not record classroom

lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use. The instructor may be more likely to grant permission if the student intends to autotune the lectures.