

Syllabus

MATH 425H / PHYS 407H Studio Calculus/Physics

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Instructors:

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Overview of the course:

This course is a combined Physics and Calculus course which satisfies both the General Physics I (PHYS 407) requirements and the Calculus I (MATH 425) requirements. You must be registered for both of these courses. This course is also offered through the honors program.

This course covers the same material as any typical college, freshman level calculus-based physics and calculus course. One overarching idea in both courses is change – how do we describe and work with values and manipulate quantities (position, for example) that are constantly changing? The other idea is that of superposition – we can describe complicated phenomena by subdividing it into smaller, simpler pieces, then summing the effect of those pieces to get the full effect. These two ideas are related in that we can obtain the total change by adding up the effect of smaller variations.

In particular, the topics we cover in this semester are the description of motion, forces, momentum and energy, inertia, torque and angular motion. For calculus, the topics covered this semester include functions, derivatives, anti-derivatives, Riemann sums and integrals, the fundamental theorem of calculus, differential equations, and optimization.

One major difference in this course from standard introductory courses in physics and calculus is that we will use differential equations – equations that contain derivatives and cannot be solved with simple algebra techniques. These equations naturally arise in physics because they describe how quantities (e.g., position) change in time. We will learn a few techniques to solve some important problems.

The format of this class is also quite different compared to the standard MATH 425H/PHYS 407 sequence. We meet five times a week for two hours each day. Each class is a mixture of short lecture, group activities, computer work and experiments (some short, some longer). There is no separate recitation or laboratory meeting. The class size is capped at 30 students.

Goals:

We have two main goals for this course:

1. Improving your ability to understand and use the concepts of change and superposition.
2. Improving your ability to solve complex, "real-world" problems.

In addition to these main goals, we have several secondary goals. At the end of the academic year you should have significantly improved your ability to:

1. carry out essential operations (e.g., taking derivatives and adding vectors),
2. reason logically and defend your ideas,
3. learn on your own,
4. work in groups, and
5. apply physics and calculus concepts to a wide range of situations.

Expectations:

We expect that you, the students, will:

1. spend at least 10 hours a week outside of class on these two courses. Throughout the course we will discuss ways to make the best use of these ten hours.
2. attend all classes (unless you are ill or dealing with an emergency). Class activities are much more than reviewing the book. The classroom experience will be difficult for you to duplicate on your own.
3. seek help when you need it. If you find you are having academic or personal problems, please seek help from us or other resources (e.g., your friends, the counseling center, other tutoring resources).
4. be as concerned with the method of finding a solution to a problem as with finding the answer. We will not give you full credit for simply a correct answer; you must provide a correct explanation as well.
5. begin to evaluate your own work. For example we will expect you to be able to decide if your answer to a problem is plausible and if your strategy to solve the problem is appropriate.

What can you expect from us?

1. Classroom activities that help you think deeply about calculus and physics.
2. Our guidance as you work through the material, which we will give by asking useful questions rather than by immediately giving answers.

Technical details:

1. **Prerequisites:** Successful completion of high school physics and pre-calculus.
2. **Calculus Textbook and Class Packet:** The textbook used in the calculus portion of the class is *University Calculus* by Hass, Weir, and Thomas. In addition you must purchase the MATH 425H Course Packet (#25) at the copy center in the MUB. You must do this before your first calculus class.
3. **Physics Textbook, Tutorial, and Class Packet:** The textbook is *Physics for Scientist and Engineers (with Modern Physics)*, by Knight, published by Addison Wesley. You are also

required to use *Tutorials in Introductory Physics*, and *Tutorials in Introductory Physics – Homework*, by McDermott *et al.*, published by Prentice Hall. In addition, the physics activities are in a Course Packet that you receive from the Physics Department office, DeMeritt Hall 105. You must do this before your first physics class.

4. **Physics Lab Fee:** You have been charged a \$30 lab fee for physics. This covers the cost of photocopying the physics course packet, the use of the web-based homework program, and the purchase of the lab equipment and computers.
5. **Schedule:** A tentative schedule of topics can be found on Blackboard. The exam dates have not been set yet but will be set this week, except for the final exam. We recommend that you have a calendar marked with all your major commitments and deadlines (e.g., tests from all classes, due dates for big projects, etc.) to help you budget your time. Do not make plans to leave town at the end of semester until we can establish a date for the final exam.
6. **Honors Credit:** This is an honors course that we are pleased to offer to students not in the honors program. If you join the honors program at a later date, you can petition for these two courses to be used to fulfill part of your honors requirements. Any student who takes this class and gets a grade of B– or better will get honors credit for this course, even if they are not in the Honors Program.
7. **Snow days:** When the University closes due to inclement weather and an entire class is missed, either calculus or physics, will be rescheduled, perhaps on an open Friday. If the weather is bad and the University will open late, typically at 10 am. Please attend the remainder of the class, i.e., 10-11 am. In this time the instructor can get the essentials across to you that you will need to do your homework.

Grades:

1. **Is this one course or two?** In terms of grades and credit, these are two courses. You will be given two different grades (a mathematics grade based on mathematics homework, mathematics content of tests and projects, class participation during mathematics classes; and a physics grade based similarly on physics work). It is possible to pass only one part of this course. Two classes during the week will focus on calculus and two will focus on physics; the Friday classes will emphasize both.
2. **Grading Schemes:** Half of your grade is based on work you will be doing in collaboration with others: class work (10%), homework (30%) and project(s) (10%). A consistent effort throughout the semester is essential for success. The other half is based on three semester exams (10% each) and the final exam (20%) where you show what you can do on your own.
3. **Class Attendance:** Class attendance is critical and mandatory. During class we will be doing many group projects to build conceptual understanding, facility with operations, and problem solving skills. Interacting with other students and with instructors is a powerful skill to develop, thus attendance is recorded and graded.
4. **Group Work:** Approximately once per week we will collect and grade work done in class by your group. This homework will be graded on a scale of 5, judged on how well your group meets the assignment goals.
5. **Homework:** In general there will be one calculus and one physics homework each week. This homework will contain both conceptual and quantitative questions. For physics, you will be given homework assignments on MasteringPhysics (www.masteringphysics.com – use the sign-on instruction that come with your textbook), a web-based homework system

that you will complete electronically and assignments to be done on paper to be handed in. The hand-in homework is especially important because it will be much like the questions on the exams and it will exercise your ability to solve a problem starting from a blank sheet of paper, where you will be expected to articulate the approach and method that you use and justify your answer, as well as compute the answer. Many of these problems will have algebraic rather than numerical answers. The MasteringPhysics homework is more in the form of drills and simpler exercises. MasteringPhysics will grade your homework and give you immediate feedback. The physics hand-in homework will be due on Thursdays in class, while the MasteringPhysics homework will be due at 11 pm on Wednesdays. For mathematics you will be given homework assignments on MyMathLab, a web-based homework system similar to MasteringPhysics, and in-class homework. MyMathLab homework will be due on Mondays and in-class homework will be due on Fridays at the beginning of class.

Late homework will not be accepted. This is necessary so that we can quickly grade and provide you feedback. If you do not have time to do the entire homework assignment, we recommend that you turn in what you have at the due date. It is far better (both for your grade and your understanding) to do part of the homework, rather than doing it all poorly or skipping it entirely. We advise that you begin to work on the homework assignment as soon as the material is covered in class.

The homework given in mathematics classes will only count toward the mathematics grade; the homework given in the physics classes will only count toward the physics grade.

6. **Exams** will be given about every four weeks and will take three hours (see the schedule for dates). There are three semester exams and a final exam. The final exam is comprised of two parts and counts as two exams. The test questions will be taken from homework, labs, and lectures. There will be roughly an equal weighting between conceptual and quantitative questions. Some of the questions will be straightforward applications of what we have been studying, others will require a deeper understanding of the material. For the physics part of the test, one quarter of the test is based on the conceptual tutorials that we will be doing in class.

The exams will be a mixture of mathematics and physics questions. Some questions will be purely mathematics or physics, will be marked as such, and will only count for that course grade. The more complex questions will be a mixture of mathematics and physics and will be marked accordingly. They will count toward both grades. Each test will therefore have both a mathematics and physics grade.

Makeup tests are only allowed in the most exceptional circumstances, and only for legitimate reasons (e.g., family emergency, illness). If possible, you must inform us beforehand.

7. **Questions about grading:** Questions about grading on either tests or homework should be submitted to us within three working days of the return of the work. It is best if you write down the question and attach it to your graded work, otherwise we are likely to forget the details of your question.
8. **We do not scale grades** in this class. It is possible, for example, for everyone to get an 'A'.
9. **Exceptions:** For legitimate reasons, such as illness, you may not be able to complete your work on time or take an exam. In that case, contact one of us as soon as possible. You can e-mail or call our work phones any time of day.
10. **Cell phones** must be turned off during class.

Resources:

Blackboard Course Website: Studio Calculus and Studio Physics has two course websites at <http://blackboard.unh.edu>. Use your `cisunix.unh.edu` username and password to log in. Details about accessing Blackboard are given on a separate sheet. We will use Blackboard for communication: we can post announcements, assignments, old tests, documents such as this syllabus and all your grades; we can e-mail the entire class or individuals, you can e-mail each other. There are also discussion boards and chat rooms that you may find useful. There is also a calendar to follow important dates.

Office Hours: Office hours will be arranged and announced the second week of class. They will be posted on Blackboard. Please feel free to come speak to us about any academic questions, to discuss how the class is working (or not working), or anything else of concern to you. You can always arrange a time to meet with us if you have difficulties finding time during office hours.

Work Sessions: We will also set up times and places where students and the teaching assistants can get together informally to work on homework.

The **Physics Department office** is in DeMeritt 105 (862-1950). The Administrative Manager is Katie Makem and the Administrative Assistant is Michelle Waltz (862-6054). The **Mathematics Department office** is in Kingsbury Hall W350 (862-2320). The Administrative Manager is Jan Jankowski. The office staff will handle add/drops, hand out grades at the end of the semester, and are generally helpful with any administrative part of the course. The offices are open from 8:00 am - 4:30 pm, but closed for lunch (12 noon-1pm), Monday through Friday.

The **Physics Library** is located in the basement of DeMeritt Hall (Room 19, 862-2348), the librarian is Erica Brown. Solutions to all homework, etc., will be held on reserve there. In addition, other physics texts are on reserve (e.g., *Physics for Scientists and Engineers* by Giancoli, *University Physics* by Young and Freedman, *Fundamentals of Physics* by Halliday, Resnick, and Walker, *Physics* by Serway, and *The Feynman Lectures on Physics* by Feynman [this is at a higher level than our text, but is very entertaining!]). The regular hours are Mon-Thurs 8 am to 10 pm, Friday 8 am to 4:30 pm, Saturday 1 pm to 5 pm, and Sunday 2 pm to 10 pm. The hours change on holidays, and will be posted outside the library door and on the library web page <http://www.library.unh.edu/>.

The **Mathematics and Engineering Library** is located in a temporary home in New Hampshire Hall (use back entrance from the parking lot).

Tutors: Several groups on campus offer tutoring services in physics and mathematics: Tau Beta Pi (phone 862-3101), Society of Physics Students (www.physics.unh.edu/sps), and Marston House. Once they announce hours, we will pass them on to you. Also, check out the web site for the Center for Academic Resources (www.cfar.unh.edu/) for other assistance provided by the University.

MaC - The Mathematics Center: The MaC is a place you can go to any time throughout your stay at UNH to get help with mathematics. If your calculus pre-test results show that you need to brush up on your skills, you can go to the center and you will be given worksheets to help you with your particular difficulties. You can also go to the MaC for general mathematics help, regardless of how you did on the pre-tests. The MaC is located on the bottom floor of Christensen Hall in room G33 (862-3576). The MaC is also open on some weekends, be sure to check hours at www.mathematics.unh.edu/cgi-bin/generatePage.cgi?mac/mac.