

## Syllabus

### MATH 426H / PHYS 408H Studio Calculus/Physics II

Spring 2016

#### Instructors:

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#### Class Schedule:

Our class will meet in DeMeritt Hall 311 on Mondays and Wednesdays from 9:10 to 11:00 am (Calculus), on Tuesdays and Thursdays from 3:40 to 5:30 pm (Physics), and on Fridays from 9:10 to 11:00 am (joint calc/phys).

#### Overview of the course:

This course is a combined Physics and Calculus course and satisfies both the General Physics II (PHYS 408) and the Calculus II (MATH 426) 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.

We will use our concepts of conservation laws in the new domains of oscillations and waves, thermodynamics, and electricity & magnetism and circuits. For calculus, the topics covered this semester include complex numbers, series and tests for convergence, integration methods, and limits.

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 math426/phys408 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 45 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:

- a. carry out essential operations (e.g., taking derivatives and adding vectors),
- b. reason logically and defend your ideas,
- c. learn on your own,
- d. work in groups, and
- e. 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 each of these two courses. Throughout the course we will discuss ways to make the best use of these hours.
2. attend all classes (unless you are ill or dealing with an emergency). Class activities are much more than reviewing the book. Your participation in cooperative group activities is vital to your success and the success of your classmates. This classroom experience will be impossible 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, or 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 MATH425H / PHYS407H
2. **Calculus Textbook and Class Packet:** The textbook used in the calculus portion of the class is *University Calculus* by Hass, Weir, and Thomas. Course Notes, Assignments and Class Exercises will be available on our course websites at <http://mycourses.unh.edu>. You should check the site regularly for updates, and review all materials as they are posted.

3. **Physics Textbook, Tutorial, and Class Packet:** The textbook is *Physics for Scientist and Engineers*, by Knight, 3<sup>rd</sup> Ed. 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 237.
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 our course websites at <http://mycourses.unh.edu>. 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. When the University opens late, typically at 10 am, please attend the remainder of the class, i.e., 10-11 am. During this shortened class time the instructor will focus on the essentials so you will be able 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:** 45% of your grade is based on work you will be doing in collaboration with others: class work – including attendance (10%), homework (25%) and one semester project (10%). A consistent effort throughout the semester is essential for success. The remaining 55% of your grade is based on three semester exams (35% total) 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 physics homework each week. Calculus homework

will dovetail with class assignments and will have periodic due dates. (Usually 1-2 weeks between assignments.) Homework assignments will contain both conceptual and quantitative questions.

For Physics, you will be given homework assignments on MasteringPhysics ([www.masteringphysics.com](http://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 also be given homework assignments. The assignments will dovetail with class exercises and will help to both broaden and deepen your understanding of the material. These homework assignments will contain both procedural and conceptual problems, and will probably require more thought and effort than your previous math homework. Homework assignments will be posted on <http://mycourses.unh.edu> on a weekly basis, with due dates posted online. Individual homework problems will be graded correct/incorrect, so it is important to seek assistance before the due date if you are unsure of anything.

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:** Three semester exams will be given about every four weeks, three in Calculus and three in Physics. Each will take around two hours (see schedule for dates). In addition to the three semester exams, we will have two final exams, one in Calculus and one in Physics. The exam 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, about one quarter of the test is based on the conceptual tutorials that we will be doing in class.

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 the instructor 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 and put away. Desktop computers are for academic use only. Please adhere to this rule at all times during class – it will be strictly enforced.

### Resources:

- **Course Website:** Studio Calculus (MATH 426H) and Studio Physics (PHYS 408H) have two separate course websites at <http://mycourses.unh.edu> driven by Canvas. Use your [wildcats.unh.edu](http://wildcats.unh.edu) username and password to log in. We will use Canvas 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 Canvas. 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 Hall 237 (2-1950). The Administrative Manager is Katie Makem and the Administrative Assistant is Michelle Waltz (2-6054). 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 to 4:30 pm, but closed for lunch (12 noon to 1pm), Monday through Friday.
- The **Mathematics Department office** is in Kingsbury Hall W383 (2-2320). 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 to 4:30 pm, but closed for lunch (12 noon to 1pm), Monday through Friday.
- The **Physics Library** is located on the first floor in DeMeritt Hall 114 (2-2348). The librarian is Heather Gagnon. Solutions to all physics 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 – the latter 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 [www.library.unh.edu/](http://www.library.unh.edu/).
- The **Mathematics and Engineering Library** is located in Kingsbury Hall S236.
- **Tutors:** Several groups on campus offer tutoring services in physics and mathematics: Tau Beta Pi (2-3101), Society of Physics Students (SPS) in DeMeritt Hall 339

([www.physics.unh.edu/society](http://www.physics.unh.edu/society)), and Marston House. Once they announce weekly hours, we will pass them on to you. Also, check out the web site for the Center for Academic Resources ([www.cfar.unh.edu/](http://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 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 (Tower B) in room G33. The MaC is also open on some weekends, be sure to check hours at [www.ceps.unh.edu/mathematics-statistics/mathematics-center-mac](http://www.ceps.unh.edu/mathematics-statistics/mathematics-center-mac).
- **DSS:** The University is committed to providing students with documented disabilities equal access to all university programs and facilities. If you think you have a disability requiring accommodations, you must register with *Disability Services for Students* (DSS). If you have received Accommodation Letters for this course from DSS, please provide me with that information privately, in my office, so that we can review those accommodations. Contact DSS at [www.unh.edu/disabilityservices/clockwork](http://www.unh.edu/disabilityservices/clockwork), 2-2607 or [disability.office@unh.edu](mailto:disability.office@unh.edu).
- **Emotional or Mental Health Distress:** Your academic success in this course is very important to me. If, during the semester, you find emotional or mental health issues are affecting that success, please contact the University's [Counseling Center](#) (3<sup>rd</sup> fl, Smith Hall; 603 862-2090/TTY: 7-1-1), which provides [counseling appointments](#) and other [mental health services](#).