Physics 2210 General Information

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Course web page: http://physics.weber.edu/schroeder/phsx2210/
Office hours: 10:30–11:30 daily. I may be available at other times as well, but I will usually not be available immediately before class, and I teach other classes on MWF at 12:30 and 2:30. My full schedule is posted next to my office door. Feel free to make an appointment if you like.

Textbook: You will need a textbook to use as a reference for this class, but the choice of textbook is up to you and we will not follow any particular textbook at a detailed level. A very affordable option is the OpenStax *University Physics* text, which is free in electronic form from openstax.org and also available in hard copy from the WSU bookstore. For this semester you will need volumes 1 and 2. Some good commercially published textbooks include: *Fundamentals of Physics* by Halliday, Resnick, and Walker; *Physics for Scientists and Engineers* by Knight; *University Physics* by Sears, Zemansky, Young, Freedman, and Ford; *Physics for Scientists and Engineers* by Serway and Jewett; and *Physics for Scientists and Engineers* by Tipler and Mosca. Any edition of these books published in the last 20 years or so should be fine, and non-current editions can be obtained over the internet at rock-bottom prices. There are other good books as well, so if you are wondering whether a particular book might be suitable, please ask. (All of the textbooks, I'm afraid, are badly bloated.)

Required materials: Everyone will need a scientific calculator; good ones can be purchased for as little as $15. You will also need a ruler and a protractor.

Course Outline

1. **Describing Motion**. In physics we describe an object's motion using precise mathematical ideas, like velocity and acceleration. This part of the course introduces these terms, postponing the question of *why* things move as they do.
2. **Forces Cause Acceleration**. We now take up the reasons why objects move in various ways, as first given by Isaac Newton. Surprisingly, we find that *motion*, in and of itself, has no known cause: things naturally continue to move when left alone. It is the *acceleration* of an object that is caused by forces from surrounding objects. Whenever two objects interact, they exert forces on each other.
3. **Interactions Conserve Momentum and Energy**. Often it is easier to understand motion in terms of momentum and energy instead of force and acceleration. All interactions between objects are constrained by the rules that the total momentum and energy of an isolated system never change.
4. **Miscellaneous Applications**. Wielding the powerful tools of Newton's laws and conservation of momentum and energy, we now study more complicated types of motion. In rotating systems we discover a third great conservation law, that of angular momentum. We also study gravitational forces, fluids, oscillations, and waves.
5. **Thermodynamics**. When a system contains a *large* number of particles, we don't bother to apply Newton's laws to every detail of their motions. Instead we take appropriate averages, and discover that the new concepts of "heat" and "temperature" emerge.

If I had to summarize the content of this course in one sentence, it would be this: *The universe is a mechanism.* Newton's laws give us a mechanistic explanation of motion, allowing us to predict

how objects will move in the future. The metaphor of clockwork—gears and springs all moving according to plan—is often used to characterize the Newtonian view of the world. Furthermore, Newton's laws are *universal*: they apply equally well to familiar earthly objects and to the stars and planets of the heavens.

Goals of the Course

The most obvious goal of this course is that you learn all the specific physics concepts and principles listed above.

But physics not just a collection of specific ideas. It is also a *way* of understanding the world: Strip away the complexity and focus on the underlying mathematical laws! Naturally this approach works better in some situations (Will the ball make it over the fence?) than others (Will it snow this Christmas?). The hardest part of physics is figuring out which *questions* we can feasibly try to answer. In any case, another goal of this course is to help you develop the habit of looking for the underlying physics in as many places as possible, and to give you the confidence that comes understanding the mathematical laws that the universe obeys.

Along the way, you'll need to practice a number of more specific *skills*: careful thinking and visualizing, making rough numerical estimates, carrying out step-by-step algebraic and numerical calculations, judging whether an answer is physically reasonable, and clearly explaining your reasoning and results. Improving all of these skills is another goal of the course. Whether or not you choose to become a professional physicist, they will serve you well for the rest of your life.

Policies and Procedures

Class sessions will be spent on lecture, demonstrations, example problems, and discussion. *Please interrupt me with your questions at any time.* Attendance is not required but is strongly recommended. Please make sure your cell phone remains silent during class, and refrain from any other activities that your classmates might find disruptive.

Problem sets will be assigned once a week, as indicated on the schedule. The purpose of the problem sets is *not* to test you; rather they are an opportunity for you to practice and learn. I *strongly* encourage you to work with classmates on problem sets. In this way you can learn from each other, prevent careless errors, practice putting ideas into words, and work in an environment more like the "real world". Of course, in the end each of you will be tested individually, so it's best not to rely on classmates *too* much.

I will also make official **solutions** to the problem sets available on the course web site. You are free to consult these solutions at any time as you prepare your own. However, I recommend that you use them only to *check* your own solutions, and when you are truly stuck. In any case, all work that you turn in must be in your own handwriting.

I will not take the time to read your problem solutions in any detail. Grading will be based mostly on the amount of work completed and the apparent effort expended. It is important that you turn in full solutions, with verbal explanations wherever appropriate (see the official solutions for examples). I will not simply count the number of correct answers.

Late homework will not be accepted. However, your homework grade will be based only on the highest 13 (out of 15) problem set scores, so you may miss two problem sets without penalty. This policy should give you enough flexibility to deal with most scheduled absences, illnesses, family emergencies, term papers, unexpected romances, and the like; exceptions will be granted only in the case of very serious illness or other long-term crisis, and then only if you contact me as soon as possible.

Quizzes will be given at the end of class on the same dates that problem sets are due. Each quiz will consist of one or more problems covering the same topics as that day's problem set. Before each quiz we will have a half-hour question-and-answer session to discuss the homework and prepare for the quiz. No make-up quizzes will be given, but again I will drop the two lowest scores in computing your final grade. All quizzes will be closed-book with no notes allowed. Calculators will sometimes be permitted for doing arithmetic, but may not be used to store any information. Cell phones, tablets, laptops, and similar devices may not be used as calculators or for any other purpose during quizzes.

We will have four **midterm tests**, given in class. Like the quizzes, they will be closed-book with calculators (not including cell phones, etc.) permitted only for doing arithmetic.

The **final exam** will be like the midterms but longer (110 minutes), covering all the material of the course but with an emphasis on the last three weeks. It will be given in our usual classroom on Monday, December 10, starting at 9:30 am.

No make-up exams will be given without advance permission.

Laboratory exercises will also be an integral part of this course. You should already be registered for a weekly 3-hour lab section. During these sessions you will complete 12 lab exercises, turning in reports on each. You must purchase the lab manual at the WSU bookstore and bring it to your first lab session. Most lab policies are at the discretion of your lab instructor, who will grade your lab reports and then report each of your weekly lab scores to me. I will then drop the lowest score (allowing you to miss one lab without penalty) when I add up the scores and incorporate them into your final course grade. I may adjust lab scores upward or downward to compensate for inconsistencies in the grading standards of different lab instructors.

You will also take a **lab practical exam** as part of the lab program for this course. Although the exam will be administered by a lab instructor, for the sake of consistency I will grade these exams myself. Please note that the lab practical exam will be given during finals week, and it will be your responsibility to find a time to take it that does not conflict with your other final exams or other commitments. If your regular lab session is on Friday, you must take the lab practical exam on a different day (preferably Monday). Please consult with your lab instructor early in the semester if you have any concerns about scheduling.

If you are retaking this course and have already completed all of the lab exercises within the last year, you may ask to be excused from repeating the lab exercises and to instead have your earlier lab report scores applied toward your final grade. You must make this request in writing (email is preferred) within the first three weeks of the semester, providing the name of your former lab instructor and the date (semester) when you completed the labs before. Permission to use earlier lab scores is not granted automatically, so you should attend labs this semester while your request is pending. Even if your request is granted, you must still take the lab practical exam at the end of the semester, and it is your responsibility to schedule a time to take it.

Grades will be computed according to the following weights:

Problems sets (highest 13)	13%
Quizzes (highest 13)	13%
Lab reports (highest 11)	11%
Lab practical exam	3%
Four midterms @10%	40%
Final exam	20%

In deciding borderline grades I may also consider class attendance and participation. (It is your *effort* at participation that matters; how much knowledge you demonstrate makes no difference at all.)

Miscellaneous Rules

You are responsible for reading, understanding, and following the **WSU Student Code**, including its prohibition on all forms of cheating. Cheating on a homework assignment or quiz will result in a zero grade for that item on the first occurrence and failure in the course thereafter. Cheating in any way on a test will result in automatic failure in the course. Cheating (including falsification) in the lab will be handled according to the policies of your lab instructor, with penalties that may also be as great as failure in the course. Evidence of Student Code violations may also be presented to the appropriate hearing committee or the Dean of Students for possible further sanctions.

All written materials for this course, including quizzes and tests, are covered by copyright law and may not be reproduced, in printed or electronic form, without written permission.

In the event of a **campus emergency** (e.g., a power outage or unsafe weather conditions) that interrupts the schedule of this class, please check your WSU email promptly for any special instructions.

Special notice: Any student requiring accommodations or services due to a disability must contact Services for Students with Disabilities (SSD) in room 181 of the Student Service Center. SSD can also arrange to provide course materials (including this syllabus) in alternative formats if necessary.

Hints and Suggestions

The ideas of physics are the most fundamental and universal in science, but they are also the most abstract. Learning physics is therefore unlike learning most other subjects, even in science. Rote memorization might be necessary for a few basic definitions, but it won't help you learn to solve physics problems. Looking things up on the internet won't get you far either, even if it's occasionally convenient as a quick reference for the meaning of a word or the mass of a planet.

So what ways of studying are there, other than rote memorization and looking stuff up? The answer is *problem solving*: wrestling with how to apply the principles of physics to a new, unfamiliar situation; trying approaches that turn out to be dead ends; getting stuck and frustrated; explaining your frustration to a friend or classmate or in writing to yourself; putting the problem aside for a while so you can make a fresh attempt later; and finally, after enough effort, seeing the way ahead and carrying out the solution. There is no shortcut for this process, and you'll need to set aside plenty of time for it, week after week.

Each idea in this course will build on the earlier ones, so you'll want to make every effort not to fall behind. Don't skip class. If you don't understand something I say in class, ask immediately. Start working on each problem set as soon as we've begun covering the required material.

Finally, try to enjoy the course. Although you may not particularly care how long it takes a block to slide down a frictionless inclined plane, there are sure to be other applications that do interest you. Even those sterile inclined-plane problems can be fun if you think of them as puzzles to challenge your intellect. To me, the universal principles of physics are truly awe-inspiring, and the conceptual tools that physics develops are immensely powerful. I hope that, as you learn the principles and develop the tools yourself, you will find physics to be as enjoyable, useful, and liberating as I have found it to be.

Welcome to physics!