Syllabus Physics 21, Fall Semester 2015

http://www.lehigh.edu/inphy21/

Instruction Personnel

INSTRUCTOR

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HOMEWORK AND RECITATIONS, TEACHING ASSISTANTS

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Student's primary contact should be their recitation leader, a.k.a their teaching assistant (TA). If you have questions or need more help with an assignment, don't hesitate to ask during recitations, don't delay contacting (email) or visiting your recitation leader. But do try something yourself before going to the TA, otherwise it will be inefficient. Office hours will be set independently.

Required Materials and equipment

Further details and instructions on how to sign up for all of the services below are at http://www. lehigh. edu/inphy21/.

TEXTBOOK

Randall D. Knight, "Physics for Scientists and Engineers: A Strategic Approach", 3d Edition, Volumes 3 and 4. Volumes 3 and 4 cover chapters 20 to 37 of Knight's book. We will cover the same material, but not in the same sequence.

CLICKERS

Required for lecture activities (and also useful to earn extra credit in the lecture).

MASTERING PHYSICS

Weekly homework assignments.

COURSESITE

Any other class material is made available there.

Time, location, and organization

It is important to realize that this is a fast-paced course which does require *a lot of work*. The rule of thumb when you take a course, is that for every credit hour you need to work *three* credit hours on your own. This course is a 4 credit hour course, and therefore it is totally normal and expected that you work 12 hours a week in order to learn all the required material and in general keep up with the coursework. It is critical that you digest and exercise the material presented during one week before the next week starts.

LECTURE

Tuesday and Thursday, 09:20-10:10 *and* 10:45-11:35, LL 270.

RECITATIONS

Wednesday and Friday, various times

Classes meet four times a week, Tuesday and Thursday all together for the lecture, Wednesday and Friday in small recitation classes. To accommodate everyone, the lecture is held twice (!), once starting at 9:20am, the other starting at 10:45am. The lectures will introduce new material and cover the most important principles, and in general highlight the fundamental ideas that must be understood. Recitation sections will discuss some more examples and ideas, and go into more details about problem-solving. Recitations will be a very important playground for exercising, discussing, and repeating the material, it's not just about the weekly homework. It is also very important to *read the textbook*, or any other material you might find, on-line or otherwise. Reading different explanations by different people of the same thing always helps understanding.

Reading Assignments

Reading assignments are an integral part of the course. Students will be expected to *know the material in the reading assignments even if it is not explicitly discussed in the lecture or the recitation sections!* It is worth stressing that with the time I have in the lecture, it is impossible for me alone to tell you everything that you need to learn, but I can guide you by highlighting the most important things.

You can go through the reading assignments both before and after the material is handled in the lecture. But everything will be easier if you prepare for each class by looking at the corresponding chapter(s) in the textbook *before* coming to class. It's important that you do so even if you don't understand everything at first, and even if you just skim through the material, because this will help you acquaint yourself with names and definitions, and you will then be able to follow the lecture much better. You can then go back and re-read the corresponding sections. Nobody understands something by just hearing or reading it once.

Scrupulously follow the reading assignments, and don't be a minimalist. You will do best if you read *more* than what is stated in the reading assignments. Read the textbook, but also read anything else you may find useful, like popular science or history of science in the 19th century (see suggestion at the very end of this text).

Course grading

The final grade of the course will be determined by a combination of the points obtained in the two hour tests, the final exam, homework, and quizzes. Here is a grade distribution table:.

Exams	300	(75 from mid-term 1, 75 from mid-term 2, and 150 from the final exam)
Homework	150	(accumulated by adding homework points up to a maximum of 150)
Quizzes	75	(obtained from the grades of the best 7 out of 10 quizzes)
Total	**525**	

An ***additional 50 extra credit points*** that can contribute to the above total will be given away during the lecture through clicker questions. You get extra points for every question answered, it doesn't matter if you answered correctly or not.

Homework assignments and quizzes

ON-LINE HOMEWORK

A new homework assignment will be made available on masteringphysics by each Tuesday (**MPa**) and each Thursday (**MPb**). With two weekly homework assignments you can earn up to *16 homework points* each week. Homework points can be collected towards the *200 homework points* that count for the final grade. Do the math: 16 points over 12 weeks gives 42 points more than what you need to maximize the homework contribution to the final grade using masteringphysics alone. Thus, it won't be an issue if you miss out on one homework because you are sick for a week or because of any other problems. And the "learning homework assignment" also counts towards the total homework points (see below)

Assignments will appear on masteringphysics at least one day before recitations take place. Thus, every homework assignment can start to be discussed in recitation the following day: you must have a look at it *before* you go to recitation!

MPa (the Tuesday homework) must be submitted on-line *two days* later by Thursday at midnight, so that its solution can be discussed on Friday. **MPb** (the Thursday homework) must be submitted on-line *five days* later by Tuesday at midnight, the following week, and its solution can be discussed in recitation the day after. The submission deadline is strict. The system does not allow for late submissions and late submissions won't be accepted.

LEARNING HOMEWORK

The "learning homework assignment" (**LHW**) will be posted on coursesite every Tuesday. It consists of a single problem that aims at discussing and teaching some aspects of the material in a different way than what can be done with the on-line homework. You must hand in each learning homework assignment in two stages. On Friday, you must hand in a *short preliminary narrative* describing the steps you intend to take towards solving each of the problems, but without any calculations. Then, next Wednesday, you must hand-in your *final solution*, as complete as possible. Both steps will be graded on a scale from 0 to 2, delivering *4 extra homework points* per week that will count towards the total homework points mentioned above. Late homework will not be accepted. Your learning homework will be returned to you by the next Wednesday, when you hand in your next LHW.

Solutions to the learning homework will be posted Wednesday evening (the day you hand in your final work) on coursesite, and you must read the solutions and compare them to what you did. I will provide full, detailed solutions, so it is not the responsibility of the grader to go through and find your mistakes for you. Going through the solutions yourself and comparing to what you did is a avery important and helpful way to learn the material.

QUIZZES

There will be one short quiz every week during Friday's recitation. Of all the quizzes, only the best 70% will count for the final grade. We plan to do about 10 quizzes and only the 7 best ones will count towards the 75 Quiz points that contribute to the final grade (see above). There won't be any make-up quizzes.

A TYPICAL WEEK

w i, day 1	Tuesday	Submit $\mathbf{MPb}_{i-1}$	$\mathbf{MPa}_i$ available	$\mathbf{LHW}_i$ available
w i, day 2	Wednesday	Hand in $\mathbf{LHW}_{i-1}$ in recitation	$\mathbf{LHW}_{i-1}$ solutions posted	$\mathbf{LHW}_{i-2}$ back to you
w i, day 3	Thursday	Submit $\mathbf{MPa}_i$	$\mathbf{MPb}_i$ available	
w i, day 4	Friday	Hand in $\mathbf{LHW}_i$ narrative in recitation		Quiz in recitation
w i+1, day 1	Tuesday	Submit $\mathbf{MPb}_i$	$\mathbf{MPa}_{i+1}$ available	$\mathbf{LHW}_{i+1}$ available
w i+1, day 2	Wednesday	Hand in $\mathbf{LHW}_i$ in recitation	$\mathbf{LHW}_i$ solutions posted	$\mathbf{LHW}_{i-1}$ back to you

The most important thing you need to know

Getting into the habit of obtaining hints and help on a homework assignment before trying to do it yourselves is *the absolute worst thing* you can do. The most difficult part of solving a problem is finding the right path to work through it. That's what you need to exercise (the *narrative* that is part of the weekly learning homework is meant to help with this).

In addition to the academic integrity issues, copying your homework is a guaranteed way to *not* learn the material and to get a bad final grade. A similar effect applies to tutoring. Ask a tutor if you need help, but try doing the problems alone first!! Going to a tutoring class where they tell you what to do, or getting hints for solving weekly homework that then leave only the math for you defeats the purpose of doing homework and will work against you in the tests and in anything else.

Exams

MID-TERM HOUR TESTS

There will be two hour tests that will take place according to the plan issued by the Registrar's office. The grade of the hour tests will contribute to the final grade only if it *improves* on the grade of the final exam. No make-up tests will be given.

FINAL EXAM

There will be one comprehensive final exam. The date and time of the final exam will be set by the Registrar.

Grades of all tests and exams will be merged into one total *exam grade*, which will contribute to the final grade as described by the grade distribution given earlier. This exam grade is either the final exam grade or the result of the weighted average

$$(m1 + m2 + 2 f)/4,$$

whichever is larger (in the formula, $m1$, $m2$, and f are the numeric grades of the mid-term tests and of the final exam, respectively). This is equivalent to each midterm contributing 75 points, and the final contributing 150 points. But the mid-term exams will contribute to the final exam grade only if they *improve* it. This means that you can do badly in the hour tests and not suffer any consequences provided that you do well in the final exam. On the other hand, a good hour test performance will allow you to build a floor for the total exam grade.

Exams are closed book, but a summary sheet with the most important facts and expressions will be provided. You don't need to memorize any formula.

Some final general advice

LECTURE PLAN AND TEXTBOOK

In regards to reading the textbook, a note of advice: do not just read it sequentially. Keep going back and forth and look at sections over and over again. Read the questions at the end of the chapter, and then go back to look for information based on what you can answer and what you can't. Reading sequentially is the worst way to digest the material. In this class I will follow an optimized path through the material, described in the plan made available on coursesite. This path has been designed to highlight the relationships that may not be seen just by following the textbook sequentially. A counterintuitive advantage that follows from this is also that the reading assignments will not be necessarily sequential, which will help you access the book in an efficient way, and get a feeling of the different ways each topic or physical effect can be associated together. This will in turn be very helpful for general understanding, and will make you better at solving problems because it trains you in seeing relationships. But in addition to the textbook, do also consider any other source material that you can find, from wikipedia to anything else that you might find useful (see the last section below).

WHAT IS THIS REALLY ABOUT?

Many different students take this course. Some of you may be interested in physics. Some of you may have to take this course as a prerequisite and don't see the reason why. Some of you may hate the fact of having to take physics. Others may love it. Maybe you will encounter some problems (especially as part of the learning homework) that seems to be too esoteric or appear to be totally useless. Or you may find problems that seem too easy or boring. There may be some of you who will only be interested in their grade, or a few who don't care too much about the grade but just want to be done with this course and move on to other things. Some others will be happy to learn something about how the universe works, and others still will seriously love physics.

Because of the diversity of interests in the students taking the course, we need to cover all backgrounds. What I will try to do with this course is help everyone, no matter what their aim is: give something to the physics lovers to go beyond what's in the standard textbooks, while not bothering the other students too much. Provide a structure that allows to get a decent grade even if you are not a physics fan – if are willing to do the work. But most of all, the important question is what will remain after the course is over at the end of the semester.

Part of what is developed during this course is the ability to *calculate* and *solve problems*. This is a valuable skill that will be useful whatever you do in the future. Such a skill is built through *practice*. It is the same as in music or in athletics.

Practice is what allows you to master something, and developing problem-solving skills requires doing many problems, alone. We help you to do this by providing homework assignments and discussing them with you.

Another part of what is developed during this course is the *knowledge* of some things that happen in the universe and an *understanding* of how they work. Or how one can use them to do something new. This kind of understanding and knowledge is achieved only when one acquires the ability to see how the various things we will discuss are related to each other. Imagine that what we will learn is represented by some big photograph. It is possible to go through a course like this one and only do the equivalent of analyzing clusters of pixels and their color, or how they are arranged. But true understanding is only reached after you are able to take a step back, see the whole picture produced by all pixels together, and learn how different parts relate to each other. It is important to achieve this ability to see the whole picture, while at the same time we work on some details by zooming into it. This is what is very difficult to achieve by just reading a textbook sequentially, and where my role in the lectures comes in. By stressing the ***fundamental qualitative principles*** of the physics we are teaching I will take a spotlight and illuminate the various parts of the picture and guide you through it. Tell you how some physical effects are related to each other, highlight which parts of the textbook are really important, and help you distinguish them from the parts that are just additional descriptions or examples.

The ultimate aim is not just to be able to solve problems in a test. It is to obtain some background knowledge and some work habits and strategies that will be useful for you later on.

PROBLEM SOLVING

The basic trap many people fall into because of various reasons, including former training and the way people are tested in school, is the big bear trap of thinking that knowing the material is equivalent to solving the standard problems, with the associated belief that in order to solve a problem one needs to find the formula to do so.

This doesn't work. This has never worked. The very first thing you need to do to solve a problem is visualize it, make a sketch of what is going on, or what you think may happen, decide what basic principles can be understanding the issues, set up some basic relationships, *and then, once you have an idea about what to do*, start thinking about equations. Equations, not formulas. Because equations are the mathematical description of a *relationship*. Then, at the end, you will see that you need some formulas, and you will go get them and finish solving the problem.

ADDITIONAL WAYS TO HELP YOU LEARN

To develop the way of thinking that I describe in the paragraph above, it is necessary to develop an understanding of how things "work" in general terms, of how different effects are related to each other, or can be described in a similar way, etc. I will try to give an intuitive feeling in the lecture whenever I can, but you should also look for other sources beyond our classes or the textbook. You can find lots of things just on the web. Here I just want to suggest a little, cheap booklet that you can read on the side – like a series of good newspaper articles – and that should help you develop a good alternative explanation of the concepts we teach. You can get *"Understanding Physics: Volume 2: Light, Magnetism and Electricity" by Isaac Asimov* for $6 (check the usual on-line bookshops). Get it, read it. I am sure it will help.

A note on academic integrity, etc.

Academic integrity applies to all we do. Teamwork on tests is cheating. Doing homework as a team and especially copying the solutions of homework assignments are also against academic integrity: please see the links in the top-left corner when you enter coursesite. In any case, some nice discussions among friends are always a good way to learn and exercise the material, but do try to work on the assignments alone. Always relying on help from others will work against you because it will not allow you to identify the areas where you have more difficulties.

Accommodations for Students with Disabilities

If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, Williams Hall, Suite 301 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

The Principles of Our Equitable Community

Lehigh University endorses The Principles of Our Equitable Community. We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom. [http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf]