Syllabus for PHYS 180.002
Fall 2010

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Course Website: www.physics.unlv.edu/~lenz/
Texts: **Physics for Scientists and Engineers Second Edition: A Strategic Approach,** by Randall D. Knight and the **Student Solutions Manual, Vol. 1, Chapters 1-19** by Randall D. Knight, Scott Nutter, and Larry K. Smith

Tuesday	Thursday
August 24, Introduction and Chapter 1	August 26, Chapter 2, ***Chap 1 Quiz***
August 31, Chapter 2	September 2, Chapter 3, ***Chap 2 Quiz***
September 7, Chapter 4	September 9, Chapter 4, ***Chap 3 Quiz***
September 14, Chapters 5	September 16, Chapter 5, ***Chap 4 Quiz***
September 21, Review	September 23, ***Exam over Chapters 1 - 5***
September 28, Return Test & Chapter 6	September 30, Chapter 6
October 5, Chapter 7, ***Chap 6 Quiz***	October 7, Chapter 8
October 12, Chapters 8 & 9, ***Chap 7 Quiz***	October 14, Chapter 9, ***Chap 8 Quiz***
October 19, Chapter 10	October 21, Chapter 10, ***Chap 9 Quiz***
October 26, Review	October 28, ***Exam over Chapters 6 - 10***
November 2, Return test & Chapter 11	November 4, Chapter 11
November 9, Chapter 12, ***Chap 11 Quiz***	November 11, Chapter 12
November 16, Chapters 13, ***Chap 12 Quiz***	November 18, Chapter 13
November 23, Chapter 14, ***Chap 13 Quiz***	November 25, Thanksgiving Break
November 30, Chapter 14	December 2, Chapter 14 and Review
December 7, Final Exam, 1:00 p.m., BPB-106	

Material in the Course

The material covered in the three semester engineering physics sequence is the culmination of literally thousands of years of observation, experimentation, and codification. During this semester we will cover the topics dealing with Newton's Laws

and their application to mechanical problems. It is important to keep in mind that the laws presented in this book, the laws that describe the motion of simple objects, were not and are not obvious. But instead they represent the end point of a long and difficult process that began with casual observations, followed by more careful experimentation, until finally, some very smart person was able to find a way to describe a range of phenomena with a "simple" mathematical statement leading to a new "law" of physics. Oftentimes the "simple" statement requires learning the more precise definition of a term that is a common part of the English language. Some examples of colloquial words with precise scientific meanings are mass, weight, force, energy, and momentum.

The challenges of this course are multidimensional. The basic question is "how does an object respond when acted upon by one or more forces?" To answer this question, you have to be able to quantify the words "respond" and "forces." By respond, we mean what is the effect of the force on the state of motion of the object. This leads naturally to the concepts of position, velocity, and acceleration which are best described by using vectors. The study of motion is called kinematics. Newton's Laws quantify the way forces impact the motion of an object. The study of forces and related topics like energy and momentum is called dynamics. Kinematics and dynamics are the central themes of this semester's course but also show up in other physics courses.

I will attempt to convince you that there are very, very few equations to learn this semester. The beauty of physics is that a handful of Laws and concepts when combined with problem solving skills can be used to solve a wide array of problems. The key to learning physics is to discover the connection between topics and to resist the urge to treat each topic as unconnected to others topics. The worst way of trying to learn physics is by attempting to memorize a morass of equations many of which only apply to a restricted set of problems. Instead, you want to be able to connect the widest possible range of problems to the smallest possible set of equations!

MIT Open Course work on the Web

The following link http://ocw.mit.edu/OcwWeb/Physics/8-01Physics-IFall1999/VideoLectures/index.htm will take you to the webpage of the physics course 8.01 that was taught at MIT by Professor Walter Lewin. His lectures have made him something of a cyber-space physics guru. The lectures cover the material in PHYS 180 and some of the material covered in PHYS 182. They are built around a different but similar textbook. Professor Lewin has some very entertaining demonstrations which typically occur at the end of his lectures that ought to help you visualize concepts covered in our class. My suggestion is to view one of Professor Lewin's lectures before you read the corresponding chapter in Knight's textbook. And both ought to be done before I cover the material in class! Professor Lewin, Knight, and I will all cover the topics a little differently. I have not viewed all of Professor Lewin's lectures but lectures 1 – 22 plus 24 and 25 appear to be his lectures that are relevant for our class.

Words of Advice

In my experience, one of the biggest challenges in a physics class is learning how to correctly apply the underlying physical laws to the particular situation defined by a specific problem. If this is done correctly, you are left with some equations that must be solved. The solution of those equations requires some facility with mathematics. If the equations are solved correctly, the answer will be right, that is agrees with some solution manual answer. A "wrong" answer can mean that you used the wrong physical law, for example conservation of kinetic energy instead of momentum, or that you applied the correct principle incorrectly, or that you set the problem up correctly but made a mistake in mathematics, or the answer in the manual is written in a different but equivalent way, or, perish the thought, the answer manual has the incorrect answer! Figuring out where you went astray is the biggest obstacle to learning physics.

Suggestions for Problem Solving

1. One of the easiest ways of checking an answer is to make sure your answer has the correct units. This presumes that you know what the correct units are and that your answer is in form that allows a simple check of units. To this end, I suggest starting a problem by defining quantities with letters. For example, a car comes to rest from an initial velocity of 60 mph after traveling 40 m. Let d = 40 m. Let $v_{initial}$ = 60 mph. Find the time it took for the car to stop. By using letters, your answer for the time will be in terms of d and $v_{initial}$ instead of numbers. Having letters makes it much, much easier to check to make sure the units of your answer have the units of time. A note of warning, the initial velocity is given in miles per hour and the distance in meters. My suggestion is to convert from mph to m/s as the first step in solving this problem, $v_{initial}$ = 27 m/s. It is possible to do this without using symbols as an intermediary if you are very, very careful about writing <u>every</u> number used in a calculation with its units. Then you can check the units at the end since they have been carried along step-by-step. I have never been able to do this in a consistent manner and find it much easier to solve the problem symbolically which makes it easier to keep track of units and then, as the last step, to substitute numbers.

2. My next suggestion is more of a strategy for doing the exercises and problems at the end of each chapter. In my experience, students have a tendency to do the problems by "fishing" for the correct formula in the chapter. That is, after a problem is read, the chapter is scanned for what looks like an appropriate equation. The definition of an appropriate equation is one that gives the "correct" answer. This is a seriously flawed strategy. Instead I suggest the following: <u>Xerox the problems at the end of the chapter</u>. Then put some physical distance between the Xeroxed problems and the textbook. Now sit down with the problems and attempt to do them without having the textbook at hand. If you can't, then it is time to re-read the text trying to focus on the material you

did not know that kept you from doing that particular problem. When you can do the exercises and problems at the end of the chapter without using the textbook as a crutch, you will have made great progress in learning the material. This is also great preparation for the examinations since the textbook is not available during tests!

3. I encourage you to attempt to evaluate the "correctness" of your answer before checking it against the solution manual. Are the units correct? Is the sign of the answer correct? If d is the distance covered by a car while stopping, d must be positive since distances are intrinsically positive numbers. Is the answer the correct mathematical entity? For example, is the answer a vector instead of a scalar. If a vector is called for and your answer is a scalar, your answer cannot be correct! If the answer is a numerical value, is it a "reasonable" value? For the stopping car problem, would you consider 0.5 meters as a reasonable answer? If the answer is in symbolic form, does it have the right dependence on the parameters that constitute the answer? I will give examples of these checks during the semester. Asking these questions helps you develop important problem solving skills.

4. ***Lastly, calculators will not be allowed during the two in-class exams and the final. The problems on the exams will either use "simple" numbers or not have numbers at all.*** The best way to practice for the exams, is to get in the habit of doing the problems at the end of each chapter without the aid of a calculator. For example, if an object has a mass of 1257 kg, you can approximate that by 1200 or even 1000 to get a ballpark answer without having to use a calculator. The other thing I would encourage you to do is to practice using scientific notation so that when you see 1200 you immediately think of that as 1.2×10^3! Scientific notation makes it much, much easier to keep track of the order of magnitude of an answer.

Grading

Physics is learned by working problems and thinking about the problems and the answers. The number of problems that have to be worked by you to understand the material in a particular chapter is impossible for me to know. Each chapter in the text lists has a summary of the most important concepts for that chapter. Doing problems that help you learn those highlighted concepts is obviously a useful to study each chapter. It is your responsibility to manage your time efficiently and to learn the material in each chapter. I will also do some representative problems from each chapter to help you see how mathematics and physics work in unison to solve problems. Keep in mind that the goal of the homework problems is to help you learn the material. If you are having trouble with a particular type of problem, do more problems covering that topic! The course website has a set of hints for each of the assigned problems and also

has my solutions. Don't use either until after making a serious attempt at solving the problem yourself. Also, see if the hint helps before looking at the answer!

Chapter 1 – problems 16, 20, 23, 25, 27, 29, 32, 33, 48, 54
Chapter 2 – problems 17, 22, 25, 29, 32, 40, 51, 56, 59, 67
Chapter 3 – exercises and problems 11, 15, 20, 23, 25, 31, 39, 40, 42, 45
Chapter 4 – exercises and problems 25, 29, 34, 41, 43, 47, 55, 61, 63, 72
Chapter 5 – conceptual questions 4, 15, 17, exercises and problems 23, 31, 35, 37, 41, 43, 52
Chapter 6 – exercises and problems 15, 18, 23, 29, 31, 36, 43, 53, 56, 58
Chapter 7 – conceptual question 11, problems 10, 17, 24, 31, 33, 39, 41, 43, 44
Chapter 8 – exercises and problems 8, 13, 20, 23, 24, 31, 35, 36, 47, 51
Chapter 9 – exercises and problems 4, 25, 26, 28, 33, 36, 47, 50, 57, 60
Chapter 10 – exercises and problems 31, 35, 37, 39, 45, 49, 50, 53, 56, 59
Chapter 11 – exercises and problems 3, 5, 38, 41, 43, 49, 51, 60, 64, 66
Chapter 12 – exercises and problems 43, 58, 63, 69, 71, 80, 81, 85, 89, 91
Chapter 13 – exercises and problems 26, 29, 34, 39, 43, 49, 55, 56, 58, 59
Chapter 14 – exercises and problems 13, 16, 20, 33, 47, 51, 55, 63, 67, 73

1. There will be eleven chapter quizzes and the best ten scores will count for 20% of the course grade. The quiz questions will be selected from one of the assigned homework problems for that chapter. The numbers may be simplified so that the problem can be done without a calculator.
2. There will be two one hour exams. Each exam will count for 25% of your grade. The dates and chapters covered on those exams are listed on the course calendar. The final will be comprehensive but will emphasize the material covered after the second exam.
3. The final will count for 30% of your grade.

Remember, calculators will not be allowed for any of the examinations. The numbers on the examinations will either be simple enough to be calculated by hand or the answers will be symbolic, that is letters without numbers!

Disability Resource Center (DRC)

The DRC coordinates all academic accommodations for students with documented disabilities. The DRC is the official office to review and house disability documentation for students, and to provide them with an official Academic Accommodation Plan to present to the faculty if an accommodation is warranted. The DRC strongly encourages faculty to provide accommodations only if and when they are in receipt of said plan. Faculty should not provide students accommodations with being in receipt of this plan. UNLV complies with the provisions set forth in Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, offering reasonable

accommodations to qualified students with documented disabilities. If you have a doucmented disability that may require accommodations, you will need to contact the DRC for the coordination of services. The DRC is located in the Student Services Complex (SSC), Room 137, and the contact numbers are: VOICE (702) 895-0866, TTY (702) 895-0652, FAX (702) 895-0651. *For additional information, please visit:* <*http://studentlife.unlv.edu/disability/>* .

Missed Class(es)/Student

As a general rule, a student missing a class or laboratory assignment because of the observance of a religious holiday shall have the opportunity to make up class work. Students must notify the instructor of anticipated absences by the last day of registration, January 16, 2008, to be assured of this opportunity. NOTE: Students who represent UNLV at any official extracurricular activity shall also have the opportunity to make up assignments, but the student must provide official written notification to the instructor no less than one week prior to the missed class(es).