Physics 140: Principles of Physics *Spring 2011*

URLs in the PDF version of this syllabus are clickable links

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	Room	Time
Recitation	Eaton 111	11:15-12:10 MWF
Laboratory	Eaton B13	1:30-5:00 M
Laboratory	Eaton B13	1:30-5:00 T

Required Texts & Materials (available at the College Store)
- Andrew Rex and Richard Wolfson, *Essential College Physics*, 1st Edition (Addison-Wesley)
- Physics 140 Laboratory Manual
- 5 $\times$ 5 Quad Ruled Composition book as a Laboratory Notebook

Recommended Texts & Materials
- Frederick J. Bueche and Eugene Hecht, *Schaum's Outline of College Physics*, Tenth Edition
- Prof. Walter Lewin's 1999 MIT OpenCourseWare physics 8.01 lectures at http://ocw.mit.edu/OcwWeb/Physics/8-01Physics-IFall1999/CourseHome/
- Prof. Walter Lewin's 2002 MIT OpenCourseWare physics 8.02 lectures
- Benjamin Crowell's free texts at http://www.lightandmatter.com/

Course Objectives
Physics is the fundamental study of the behavior of matter and energy. It is a quantitative and mathematical science. By the end of the course, students should have a working knowledge of the elementary principles of mechanics, sound, and heat, and their expression in mathematical form. Students should be able to apply these principles to solve simple problems stated in plain English.

About Physics 140
Architectural studies students are required to take a course in physics. This course was designed for them. Not only will we learn principles of physics, but we will also cover engineering oriented material that is not fundamental, but approximate and useful. Unlike many other science courses, physics is primarily a problem-solving course. There are only a few principles a week that we will learn, however there are many ways to use those principles. Learning to use the principles is best accomplished through solving lots of problems. I suggest that you work together in groups because that is a good way to learn this material. Explain to yourself and your study partners the ideas you are learning, how they apply to various situations, and how they translate into problems. ***It is most important to keep up with the material. New ideas build on old ones, so if you get behind, you will be lost.***

About T.J. Allen
I am a theoretical physicist working on particle physics and gravitation. I received my Ph.D. from Caltech in 1988 for work I did in string theory. I have been teaching since 1980, at the University of Wisconsin, the California Institute of Technology, SUNY Utica/Rome, and HWS. Besides physics, some other interests of mine are calligraphy, computers, electronics, mathematics, piano, yoga and the martial art Aikido.

Course Requirements

Laboratory
Class attendance and involvement
Homework problems, and other assignments
Quizzes
2 Hour Exams
Final Exam

Grading

The class will be graded on a straight percentage with the following breakdown:

A: 88% – 100% B: 75% – 87% C: 60% – 74%
D: 50% – 59% F: < 50%

I will not grade on a "curve," unless I feel that my exams were inappropriately difficult. In that case, I will add points to each exam to bring the grades up to where I feel they should have been. In other words, an exam score of 80% is guaranteed to be at least a "B–." The final grade will be composed of five elements, three of which are the quizzes and exams. The other two elements are the laboratory and homework/participation. The numerical grade will be computed using two schemes and your final grade will determined by the higher of the two.

α	β	Element
10%	10%	homework/participation
20%	20%	laboratory
30%	15%	hour exams
10%	5%	quizzes
30%	50%	final exam

Late Policy

Late homeworks will not be accepted. If you miss a quiz and you have a valid excuse, you may take a quiz the next day for 80% credit. If you miss an hour exam and have a valid excuse (a note from your physician or an acceptable alternative), you will be allowed to count the other hour exam for twice the weight. You must check with me ***before*** you miss the exam unless you fall ill suddenly before the exam, in which case you should contact me as soon as you are well. ***There will be no makeup for the final exam.***

Homework

It is very important that you do the homework. Doing the homework thoroughly and correctly is the most important and valuable part of the course, at least insofar as learning the material is concerned. It is also quite helpful if you do additional problems of your own choosing from the course text or any other source. Your grade is more a reflection of how much useful work you did outside of class than of how "mentally quick" you are. Homework may be irregularly collected, inspected, and marked. No advance warning of homework collection will be given. The contribution of the homework to your participation grade will be based more on the number of problems you did and less on how well you did them.

Quizzes

There will be short quizzes in recitation every so often, announced in advance. They will be on the current material, usually a single problem, sometimes two or three very short problems.

Exams
There will be two hour exams and a final exam. The hour exams will be in recitation on February 23 and April 6. The final exam will be during the period set by the Registrar's office, which should be Sunday May 8 at 7:00 p.m.

Recitations
Recitation is a place to get your questions answered, to see if you did the homework correctly, to learn how to approach problem solving, and to discuss the reading. I expect students to attend recitation and to be interactive. Just sitting quietly and writing down what I write on the board is not very helpful to your understanding!

Laboratories
All of the laboratories must be completed in order to pass the course. A laboratory is not complete until you have handed in a laboratory report, or have otherwise had your lab work evaluated. You must have a laboratory manual and you must bring the lab manual, your lab notebook, and a calculator to each laboratory. Be sure that the lab notebook that you purchase is a Composition Book that is ***bound*** and ***has quadrille (graph paper) lines.*** Laboratory sections do not meet every week, so you should pay attention to the meeting times in the syllabus. You must have read the lab manual *before* entering the laboratory. I expect all students in laboratory to contribute to their lab group's efforts and to solve any problems that may arise by thinking about what they should do to get the experiment to work and trying it before they find me and ask for help. I am more concerned that you learn something interesting from laboratory than that you finish the lab. Keeping a neat lab notebook is important (especially since concise, neat notebooks are generally much more helpful when you are writing your lab report.) If you cannot state what you are doing or what you learned simply and concisely, then you probably need to think more about it!

Office Hours
Initially office hours will be Monday 10:10 - 11:05 and Wednesday and Friday 2:00 p.m. - 3:00 p.m., and by appointment. You may stop by any time to see if I am free to discuss physics, life, the universe, or anything else. If my office door is closed, I am almost certainly busy.

Physics Teaching Fellows Program
Assistance with course concepts is available through the Teaching Fellows Program. The Teaching Fellows Program provides a collaborative approach to teaching and learning. The Fellows were nominated by the physics department and selected jointly by the Center for Teaching and Learning (CTL) and the department. The fellows have been trained by the CTL.

The Teaching Fellows act as learning facilitators, helping their peers adapt to a subject's discourse and promoting academic interaction between students and faculty as well as among students. Time spent working with a fellow is time well spent. Note that the Fellows are not meant to replace the one-on-one tutoring offered through CTL, which remains available, nor to replace faculty-student interaction.

The Physics Teaching Fellows may be found several evenings during the week in Eaton 105. The exact times are posted outside the room. The physics department encourages you to take full advantage of this program.

Revision Policy
Policies and schedules set forth in this syllabus are subject to revision with one exception; the grading policy will not become more strict.

Syllabus: Topics and Laboratories

This is a schedule of the subjects to be discussed in recitation section and the laboratories that will be done that week in your laboratory section, either on Monday or Tuesday, depending on which laboratory section you are in. Following this table, there is a table of homework assignments and reading, keyed by lecture number.

If we get significantly ahead of, or behind, this syllabus, as is quite possible, a revised version will be distributed.

Date	**Lec #**	**Lecture Topics**	**Laboratory**
Wed 19 Jan	1	Algebra & Trig Review – Measurements – Uncertainty	*No*
Fri 21 Jan	2	1D Kinematics – 1D Vectors – Ideas of Calculus	*Lab*
Mon 24 Jan	3	1D Motion with Constant Acceleration	*Random Error &*
Wed 26 Jan	4	Vectors – Addition – Components	*Experimental*
Fri 28 Jan	5	2D Motion – Projectiles	*Precision*
Mon 31 Jan	6	Uniform Circular Motion	*Addition*
Wed 2 Feb	7	Newton's Laws – Normal Force – Weight	*of*
Fri 4 Feb	8	Frictional Forces	*Forces*
Mon 7 Feb	9	Applying Newton's Laws – Force Diagrams – Statics	
Wed 9 Feb	10	Dynamics – Inclined Planes – Atwood's Machine	*No Lab*
Fri 11 Feb	11	Universal Gravitation – Satellites	
Mon 14 Feb	12	Extended Bodies – Center of Mass – Motion of CM	*Forces*
Wed 16 Feb	13	Torque – Lever arm – Center of Gravity – Equilibrium	*on a*
Fri 18 Feb	14	Beams and Posts – Tipping Stability – Arches	*Boom*
Mon 21 Feb		*Exam 1 Review*	
Wed 23 Feb		**Exam 1**	*No Lab*
Fri 25 Feb	15	Buttressing – Structures	
Mon 28 Feb	16	Deformations – Stress – Strain	*Stress &*
Wed 2 Mar	17	Bending of Beams – Enhancing Structural Rigidity	*Strain*
Fri 4 Mar	18	Hydrostatic Pressure – Buoyancy – Lateral Forces	*in Wires*

Date	Lec #	Lecture Topics	Laboratory
Mon 7 Mar	19	Kinetic Energy – Work – Power	
Mon 9 Mar	20	Gravitational & Elastic Potential Energy	*No Lab*
Fri 11 Mar	21	Non-conservative Forces – Work-Energy Theorem	
Spring Break March 12 – 20			
Mon 21 Mar	22	Using Energy Methods	*Beam*
Wed 23 Mar	23	Momentum – Collisions	*Deflection*
Fri 25 Mar	24	Temperature – Thermal response of materials	
Mon 28 Mar	25	Heat – Specific Heat – Latent Heat – Calorimetry	
Wed 30 Mar	26	Heat Conduction – R-values – Walls, Windows & Doors	*No Lab*
Fri 1 Apr	27	Convection – Radiation – Greenhouse Effect	
Mon 4 Apr		*Exam 2 Review*	
Wed 6 Apr		**Exam 2**	*No Lab*
Fri 8 Apr	28	Thermodynamics – Heat Engines & Pumps	
Mon 11 Apr	29	Entropy – Carnot Efficiency	*Simple*
Wed 13 Apr	30	Oscillations – Simple Harmonic Motion – Energy	*Harmonic*
Fri 15 Apr	31	Forced Oscillation – Damped Oscillation – Resonanace	*Motion*
Mon 18 Apr	32	Waves – Frequency – Wavelength – Superposition	
Wed 20 Apr	33	Interference – Beats	*No Lab*
Fri 22 Apr	34	Sound – Intensity – Decibel Scale	
Mon 25 Apr	35	Electric Charge – Electric Forces	
Wed 27 Apr	36	Voltage – Current – Resistance	*No Lab*
Fri 29 Apr	37	Power – Series and Parallel Circuits – House Wiring	
Mon 2 May	**Summary & Final Exam Review**		

Syllabus: Reading and Homework Problems

Unless otherwise noted, the readings are in Rex & Wolfson, *Essential College Physics*. In some cases videos of Prof. Walter Lewin's MIT lectures are also suggested. These free web-accessible resources are linked into the PDF version of this syllabus. Reading and viewing should be done before the recitation number listed in the table. Homework assignments are to be completed by the recitation number in the table. In some cases, you will be also be given assignments in class that are not in your text.

Lec #	**Assigned Reading or Viewing**	**Assigned Homework**
2	Ch 1; Lewin's Lec 1; Ch 2: §1-3; Lewin's Lec 2	Ch 1: 19, 27, 40, 43, 52
3	Ch 2: §4,5; Lewin's Lec 3	Ch 2: 1, 4, 30, 33, 43, 48
4	Ch 3: §1,2	Ch 2: 52, 59, 63, 66, 67
5	Ch 3: §3,4	Ch 3: 36, 38, 39, 43, 44
6	Ch 3: §5; Lewin's Lec 6	Ch 3: 48, 49, 65, 67, 71
7	Ch 4: §1,2; Lewin's Lec 8	Ch 3: 85, 87, 91, 105, 107
8	Ch 4: §3,4	Ch 4: 29, 30, 31, 33, 39, 41
9	Ch 4: §5	Ch 4: 71, 81, 78
10		Ch 4: 45, 95, 97, 99
11	Ch 9; Lewin's Lecs 5 & 22	Ch 4: 55, 56, 62, 63, 114
12	Ch 6: §5	Ch 9: 31, 33, 52, 63, 91
13	Ch 8: §6,7	Ch 6: 89, 91, 98, 101, 120
14	Arches	Ch 8: 74, 75, 80, 85
15	Structures	Arches: 2.1,2.2,3.2,3.3
16	Ch 10: §1,2; Lewin's Lec 26	Arches: 4.1; Structures: 1,2,4
17	Beam Bending	Ch 10: 27, 29, 30, 31, 35
18	Ch 10: §4; Lewin's Lec 28	Beams: 1,4,5

Lec #	Assigned Reading or Viewing	Assigned Homework
19	Ch 5: §1,2,3,6	Ch 10: 49, 52, 55, 39, 47
20	Ch 5: §4	Ch 5: 29, 33, 45, 49, 59, 67
21	Ch 5: §5	Ch 5: 73, 74, 77, 98, 99, 107
22	Lewin's Lec 11	Ch 5: 85, 87 93, 95
23	Ch 6: §1-4; Lewin's Lecs 15 & 16	Ch 5: 115, 121, 123, 125
24	Ch 12: §1-4; Lewin's Lec 32	Ch 6: 33, 39, 54, 57, 61, 65, 80
25	Ch 13: §1-3	Ch 12: 25, 37, 47, 53, 61, 77
26	Heat Conduction	Ch 13: 33, 40, 43, 45, 53, 61, 72
27	Ch 13: §4	Heat:
28	Ch 14: §1,2	Ch 13: 75, 77, 79, 82, 84
29	Ch 14: §3-5	Ch 14: 29, 34, 36
30	Ch 7: §1-4; Lewin's Lec 10	Ch 14: 55, 57, 63, 65, 67, 71
31	Ch 7: §5,6; Lewin's Lec 31	Ch 7: 33, 37, 53, 57, 61, 65
32	Ch 11: §1	Ch 7: 68, 75, 59, 94
33	Ch 11: §2	Ch 11: 27, 29, 31
34	Ch 11: §3,4	Ch 11: 35, 37, 41, 43
35	Ch 15: §1-3	Ch 11: 50, 53, 55, 65, 83
36	Ch 16: §1,2; Ch 17: §1	Ch 15: 27, 33, 41, 43
37	Ch 17: §2-4	Ch 16: 33, 39, 42, 45; Ch 17: 35, 37
'38'		Ch 17: 4, 45, 47, 53, 59, 65, 71