Physics 150-01: Introductory Physics I *Fall 2014*

URLs in the PDF version of this syllabus are clickable links *Version 1*

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	Room	Time
Lecture	Geneva Room	10:10-11:05 MWF
Laboratory	Eaton B13	1:30-5:00 M,T,W, or R

Texts & Materials

- Hugh Young, Roger Freedman, and A. Lewis Ford, *University Physics*, 13th Edition
- Physics 150 Laboratory Manual, available at the College Store
- 5×5 Quad Ruled Composition book as a Laboratory Notebook
- Instructors' Solution Manual, on reserve in the library
- Simple scientific calculator with 1 variable statistics such as the CASIO *fx-260*

Course Objectives

Physics is the fundamental study of the behavior of matter, energy, space, and time. 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 and waves and their expression in mathematical form. Students should be able to apply these principles to simple problems stated in plain English.

About Your Professor

Prof. Allen is a theoretical physicist working on particle physics and gravitation. He received his Ph.D. from Caltech in 1988 for work in string theory. He has been teaching at the University of Wisconsin, the California Institute of Technology, SUNY Utica/Rome, and HWS since 1980. Besides physics, some of his other interests are calligraphy, computers, electronics, yoga, and the martial art Aikido.

About Physics 150

The subjects covered in this class relate to phenomena that are common and objects that are visible. Most of what we'll study was well understood before the 20th century; this is perhaps the last "common sense" physics course, though we will study a little relativity and quantum mechanics, some of the more exciting developments of the 20th century.

This course is primarily a problem-solving course. There are only a few principles a week that we will study, however there are many ways to use those principles. Learning to use the principles is best accomplished through solving lots of problems. Working together in groups is a good way to learn this material. Just having a numerical answer is usually not very useful for understanding; it is much better to spend time first trying figure out how to get to the answer from what you know and *then* calculating the answer. To do well in this course, most students will need to study at least ten hours per week outside of class. Going to office hours, at least occasionally, is also necessary for most students and strongly recommended.

This class satisfies both goal 3 (quantitative reasoning) and goal 4 (scientific inquiry).

Syllabus Revisions

Except for the grading policy, this syllabus is subject to revision. Any revised version will be distributed on my website and notice of revision will be given in class.

Course Requirements

- Laboratory
- Recitation
- Daily reading assignments in text
- Class attendance and involvement
- Homework
- 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%

The exams are not graded on a "curve," unless there is evidence that the exams were inappropriately difficult. In that case, extra points will be added to each exam to bring the average up to the appropriate level. 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 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%	participation
20%	20%	laboratory
30%	15%	hour exams
10%	5%	quizzes
30%	50%	final exam

Late Policy

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 helpful to 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.

Quizzes

There will be short quizzes in lecture or recitation every so often, announced in advance. They will usually be a single problem, sometimes two or three very short problems. You will be allowed to bring a ***handwritten*** 3″× 5″ card (one side) of notes to each quiz.

Exams

There will be two hour exams and a final exam. The hour exams will be in lecture on October 8 and November 12. The final exam will be during the period set by the Registrar's office, which should be Friday December 19, 2014 at 8:30 AM. The hour exams will each be at least three problem pages. You will be allowed to bring one ***handwritten*** 8.5″× 11″ page (one side) of notes to each hour exam and two ***handwritten*** 8.5″× 11″ pages (two sides total) to the final exam.

Laboratories
The laboratories and discussions are taught by Dr. Leon Webster. ***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.*** 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 studied the lab manual *before* entering the laboratory. All students in laboratory are expected 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 asking for help. 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! Laboratory reports are due the week following the lab.

Office Hours
Office hours initially are Tuesday 11:00 - noon, and Friday 2:00 - 4:00, and by appointment. Participation credit is given for office hour visits. Be sure to sign in.

Disability Accommodations
Students with a documented disability for which they may need accommodations should self-identify and register for services with Mr. David Silver (x3351), the Coordinator of Disability Services at the CTL. Accommodations and services will generally not be provided until the registration and documentation process is complete. See the guidelines for documenting disabilities.

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 hold sessions in Eaton 111. Their hours will be posted outside the door. The physics department encourages you to take full advantage of this program. Visits to the Teaching Fellows earn participation credit. Please be sure to sign in.

Academic Integrity
Work on an exam or quiz that is clearly not one's own will receive zero credit. I must mention any academic dishonesty in any recommendation letter I write. I consider such deceit to be worse than stealing and am personally highly offended by it. Exams often have several versions with small differences that make it very easy to spot who received help, and often who gave that help.

Syllabus: Topics and Laboratories

This is the schedule of the subjects to be discussed in lecture and the laboratories that will be done that week in your laboratory section, on Monday, Tuesday, Wednesday, or Thursday, depending on which laboratory section you are in. On a week in which your laboratory section does not meet, your section will meet me for a discussion section. Following this table, there is a table of homework assignments and reading, keyed by lecture number.

Date	**#**	**Lecture Topics**	**Laboratory**
Mon 1 Sep	1	Space, Time, Mass – Units – Uncertainty – Order of Magnitude – Scaling	*First*
Wed 3 Sep	2	Displacement – Velocity – Acceleration	*Meeting*
Fri 5 Sep	3	Motion with Constant Acceleration – Free Fall	
Mon 8 Sep	4	Vectors – Components – Algebra – Geometry	*Measurement &*
Wed 10 Sep	5	Vector Multiplication – Scalar & Vector Products	*Error*
Fri 12 Sep	6	2D & 3D Motion – Projectiles	
Mon 15 Sep	7	Circular Motion – Relative Motion – Frames of Reference	
Wed 17 Sep	8	Einsteinian Revolution – Simultaneity – Time Dilation	*Discussion*
Fri 19 Sep	9	Forces – Newton's Laws – Weight – Free Body Diagrams	
Mon 22 Sep	10	Using Newton's Laws	*Average &*
Wed 24 Sep	11	Friction	*Instantaneous*
Fri 26 Sep	12	Dynamics of Circular Motion – Fundamental Forces	*Velocity*
Mon 29 Sep	13	Work – Kinetic Energy – Work-Energy Theorem	*Exam*
Wed 1 Oct	14	Work & Energy in General – Power	*Discussion*
Fri 3 Oct	15	Gravitational Potential Energy – Elastic Potential Energy	*& Review*
Mon 6 Oct	16	Conservative Forces – Force & Potential Energy – Energy Diagrams	
Wed 8 Oct		**Exam 1**	*Force Table*
Fri 10 Oct	17	Momentum – Momentum Conservation	
Mon 13 Oct		**Fall Recess**	*W & R*
Wed 15 Oct	18	Inelastic & Elastic Collisions – Center of Mass	*Discussions*
Fri 17 Oct	19	Relativistic Energy & Momentum – Correspondence Principle – Collisions	*Meet*

Date	#	Lecture Topics	Laboratory
Mon 20 Oct	20	Angular Motion – Angular Kinematics	
Wed 22 Oct	21	Relating Linear & Angular Motion – Rotational Energy	*1D Collisions*
Fri 24 Oct	22	Torque – Newton's 2nd Law for Rotation	
Mon 27 Oct	23	Rotation about a moving axis – Angular Work & Power	
Wed 29 Oct	24	Angular Momentum – Gyroscopes & Precession	*Discussion*
Fri 31 Oct	25	Equilibrium – Center of Gravity	
Mon 3 Nov	26	Deformations – Stress – Strain – Elasticity	*Exam*
Wed 5 Nov	27	Fluids – Density & Pressure – Hydrostatic Pressure	*Discussion*
Fri 7 Nov	28	Buoyancy – Describing Fluid Flow	*& Review*
Mon 10 Nov	29	Bernoulli's Equation	*Simple*
Wed 12 Nov	**Exam 2**		*Harmonic*
Fri 14 Nov	30	Universal Gravitation – Potential Energy – Spherical Mass Distributions	*Motion*
Mon 17 Nov	31	Kepler's Laws – Satellites – Black Holes	
Wed 19 Nov	32	Simple Harmonic Motion – Governing Differential Equation – Energy	*Discussion*
Fri 21 Nov	33	Pendula – Damped Oscillations – Resonance	
Mon 24 Nov	34	Waves – Wave Equation & Solutions – Sinusoidal Waves	*M & T*
Wed 26 Nov	**Happy**		*Discussions*
Fri 28 Nov	**Thanksgiving!**		*Meet*
Mon 1 Dec	35	Waves on a String – Energy & Power in Waves	
Wed 3 Dec	36	Superposition – Interference – Boundary Conditions	*Waves*
Fri 5 Dec	37	Standing Waves – Normal Modes	
Mon 8 Dec	38	Quantum Revolution – Einstein – de Broglie – Energy Quantization	*Discussion*
Wed 10 Dec	39	Sound Waves – Sound Speed – Sound Intensity – Normal Modes of Pipes	*& Final Exam*
Fri 12 Dec	40	Resonance – Interference – Beats – Doppler Effect	*Review*
Fri 19 Dec	**Final Exam Section 01 8:30 AM**		

Syllabus: Reading and Homework Problems

The assigned readings and homework are in Young and Freedman. *The reading assignments are to be done before lecture* on the day in which they are assigned.

Homework assignments are to be *done* by the lecture following the one in the table in which they are assigned. Homework assignments should be *attempted* by the lecture before they are to be done. Problems that are daggered† require integral calculus, which is not a requirement of the course.

Prof. Walter Lewin's MIT lectures, while not required, are strongly recommended. Hearing his excellent explanation of the material is very helpful. These web-accessible resources are linked into the PDF version of this syllabus.

Lec #	Reading Assigned & Suggested Viewing	Homework Assigned
1	Ch 1; §*1-6*; Lewin's Lec 1	Q1.1, Q1.8, Q1.10, Q1.11; 1.1, 1.10, 1.14, 1.16, 1.21
2	Ch 2: §*1-3*; Lewin's Lec 2	Q2.3, Q2.5; 2.1, 2.3, 2.8, 2.9, 2.17. 2.65
3	Ch 2: §*4,5*	Q2.15, Q2.18; 2.19, 2.23, 2.31, 2.41, 2.88
4	Ch 1: §*7-9*; Lewin's Lec 3	Q1.13, Q1.19, Q1.22; 1.31, 1.35, 1.39, 1.40,
5	Ch 1: §*10*	1.45, 1.47, 1.51, 1.53, 1.91, 1.102
6	Ch 3: §*1-3*; Lewin's Lec 4	Q3.5, Q3.6; 3.4, 3.13, 3.19, 3.43, 3.59
7	Ch 3: §*4,5*	Q3.10, Q3.11, Q3.12; 3.28, 3.29, 3.34, 3.35, 3.71, 3.79
8	Ch 37: §*1-4*	Q37.2, Q37.5, Q37.7 ; 37.2, 37.3, 37.7, 37.9
9	Ch 4: §*1-6*; Lewin's Lec 7	Q4.4, Q4.28, Q4.31, Q4.40, Q4.41; 4.1, 4.4, 4.16, 4.25, 4.37, 4.43
10	Ch 5: §*1,2*; Lewin's Lec 6	Q5.1, Q5.3; 4.54, 5.6, 5.15, 5.56, 5.93
11	Ch 5: §*3*; Lewin's Lec 8	Q5.18; 5.25, 5.34, 5.35, 5.89, 5.97
12	Ch 5: §*4,5*; Lewin's Lec 5	Q5.23; 5.42, 5.44, 5.45, 5.47, 5.119
13	Ch 6: §*1,2*; Lewin's Lec 11	Q6.1, Q6.4, Q6.12; 6.3, 6.8, 6.16, 6.20, 6.18
14	Ch 6: §*3,4*	Q6.16, Q6.20, Q6.22; 6.34, 6.35, 6.37, 6.75, 6.86, 6.101
15	Ch 7: §*1-3*	Q7.1, Q7.5, Q7.17; 7.5, 7.9, 7.12, 7.15, 7.30, 7.55
16	Ch 7: §*4,5*; Lewin's Lecs 12 & 13	Q7.13, Q7.15, Q7.21; 7.34, 7.38, 7.39, 7.46, 7.63
17	Ch 8: §*1-3*; Lewin's Lec 15	Q8.2, Q8.9; 8.3, 8.7, 8.24, 8.31, 8.41
18	Ch 8: §*4,5*; Lewin's Lec 16	Q8.10, Q8.22, Q8.24; 8.24, 8.46, 8.49, 8.86, 8.106, 8.111
19	Ch 37: §*7-9*	Q37.9; 37.27, 37.28, 37.33

Lec #	Reading Assigned& Suggested Viewing	Homework Assigned
20	Ch 9: §*1,2*	Q9.4, Q9.6, Q9.7; 9.5, 9.10, 9.14, 9.15
21	Ch 9: §*3,4*; Lewin's Lec 19	Q9.9, Q9.10, Q9.14; 9.25, 9.45, 9.71, 9.77
22	Ch 10: §*1,2*	Q10.1, Q10.3, Q10.10; 10.1, 10.5, 10.8, 10.9, 10.59, 10.73
23	Ch 10: §*3,4*	Q10.18, Q10.27; 10.20, 10.21, 10.32, 10.69
24	Ch 10: §*5-7*; Lewin's Lec 20	Q10.20, Q10.21, Q10.24, Q10.29; 10.42, 10.43, 10.67, 10.94
25	Ch 11: §*1-3*; Lewin's Lec 25	Q11.4, Q11.5, Q11.7; 11.5, 11.11, 11.14, 11.76
26	Ch 11: §*4,5*; Lewin's Lec 26	Q11.14, Q11.17, Q11.20; 11.25, 11.34, 11.41, 11.86, 11.96
27	Ch 12: §*1,2*	Q12.4, Q12.5, Q12.16; 12.5, 12.12, 12.50, 12.59
28	Ch 12: §*3,4*; Lewin's Lec 27	Q12.13, Q12.18, Q12.20; 12.31, 12.37, 12.74, 12.85†
29	Ch 12: §*5,6*; Lewin's Lec 28	Q12.23, Q12.25, Q12.29; 12.41, 12.42, 12.91, 12.94
30	Ch 13: §*1-4*; Lewin's Lec 14	Q13.1, Q13.7, Q13.9, Q13.10; 13.4, 13.5, 13.19, 13.72
31	Ch 13: §*5,6,8*; Lewin's Lecs 22 & 24	Q13.14, Q13.17, Q13.21; 13.24, 13.28, 13.37, 13.69, 13.82†, 13.84†
32	Ch 14: §*1-4*; Lewin's Lec 10	Q14.1, Q14.3; 14.4, 14.9, 14.16, 14.19, 14.30
33	Ch 14: §*5-8*; Lewin's Lecs 24 & 21	Q14.12; 14.41, 14.53, 14.72, 14.93, 14.97
34	Ch 15: §*1-3*	Q15.1, Q15.6; 15.2, 15.3, 15.8, 15.9, 15.12, 15.52
35	Ch 15: §*4,5*	Q15.4; 15.15, 15.22, 15.23, 15.26
36	Ch 15: §*6,7*	Q15.15; 15.37, 15.38, 15.70
37	Ch 15: §*8*; Lewin's Lec 31	15.40, 15.43, 15.72
38	Ch 39: §*1*; Ch 40: §*1,2*	Q39.1, Q40.1, Q40.2; 39.1, 39.7, 40.11
39	Ch 16: §*1-4*	Q16.1, Q16.5, Q16.8; 16.3, 16.8, 16.20, 16.26, 16.30
40	Ch 16: §*5-8*	Q16.11, Q16.18; 16.33, 16.35, 16.39, 16.41, 16.59, 16.70