Physics 100 – Physics of the natural world
Fall term 2009, University of Rochester
Information, Syllabus, and Schedule

This is an introductory course designed especially for students in the humanities and other non-scientific fields who are interested in learning something about the physical world. Topics include the nature of science, the scale of the universe from galaxies to atoms and quarks, the fundamental forces of nature, motion and relativity, energy, electromagnetism and its everyday applications, the structure of matter, atoms, light and quantum mechanics. There are no prerequisites, no background knowledge is required and the material will be presented with very little mathematics. Substantial use will be made of demonstrations.

Course instructor:

Prof. Steven Manly e-mail: **Steven.Manly@rochester.edu**
Phone: 275-8473
Office: B+L 203E

Office hours: **Monday 3:30-4:30 pm and Wednesday 11 am-noon *or by appointment.*** With my travel and your variable needs/schedules, I find that fixed office hours are not terribly practical. If I am out of town or if the listed time slots do not work for you, speak to me or send e-mail and we will find a mutually suitable time to meet.

Course web site:

Extensive use will be made of the web for distributing course materials, making announcements, etc. The class URL is
http://www.pas.rochester.edu/~manly/class/P100_2009S/ .
If you have difficulty reaching this site (and you've verified it is not your problem), please contact me.

Blackboard:

I will make some use of the Blackboard course management system. In particular I will use that system to email the class, report grades, and distribute material that should not be openly accessible on the web. It is essential that you let me know if you are not receiving emails sent to the class.

Lectures:

Hoyt Auditorium, Monday and Wednesday from 2-3:15 pm

Textbook:

- Art Hobson, **Physics Concepts and Connections**, 4th edition (2007), Pearson Prentice Hall.
- I will give you some additional reading assignments as we go. Generally these will be relevant magazine articles that I will post on BlackBoard.

Philosophy and goals:

Physics 100 is meant to be fun and interesting. There is nothing as wacky as reality and it will be my pleasure to take you on a guided tour of some of the delightfully twisted parts of our universe. This is a conceptual course. The use of mathematics will be limited. We'll delve into the structure of matter, the nature of forces, the life cycles of stars and the evolution of the universe. We will explore how the very small and the very large in this universe are intimately related.

My main goal for this class is to expose you to the modern scientific view of the universe. I hope to do this in a way that you will find exciting and not intimidating. This class will help you understand the nature of science, from the basic scientific method and process of discovery to the reality of scientific politics. It is my hope that this experience will help you appreciate the degree to which science (and physics in particular) shapes the life you live.

I'm not one to require that you come to class. In this case, however, I want to warn you that the topics covered in this course consist of the things that I do for a living. In many parts of this class, I will not be basing my lectures from the textbook reading. The topics covered in the reading assignments will be similar to those covered during lecture, but in many sections of the course I will be giving you my own take on the subject. I will post what I write during lecture online, often with some degree of fleshing out with what was said during class. But - be warned - I think the online notes will often be a poor substitute for the discussions/lecture we have during class.

I hope that you will be willing to ask questions and participate in discussions during lecture. Again, this is not required, but it will lead to a vastly improved experience for us all if you participate.

Recitations and problem sets:

Each week you will meet for up to two hours in what we'll call a "recitation" section with a graduate teaching assistant. I consider this an integral part of the course. I will script out a series of exercises and discussions for you to participate in during this time. We will try to accomplish a few different things in these recitations. First, this will be a place for you to check that you understand the basic ideas discussed in class during the previous week. It's a place to get some of your questions ironed out in an environment that is a bit more intimate than the lecture hall. Second, you will work through selected analytical and conceptual problems together. (I don't intend to turn this into a math-intense physics course … it's just that doing simple analytical problems is a good path to a deeper conceptual understanding for many students.) Finally, I plan to have you do some hands-on or visual exercises to reinforce some of the physical concepts. Material and concepts covered in recitation is considered fair game for the exams. Solution sets for the problems done in recitation will not be released.

We will have around 9 recitations this semester. My intent is to make them a valuable part of the course. Because I hope to work on some of the goals of the course in recitation, I would like you to attend recitation. To encourage this, I will allocate 14% of your final grade to recitation attendance/participation.

For each recitation you attend, you will receive 1 percentage point. An additional percentage point will be given to you if you participate in the recitation discussions/calculations as determined by the recitation section leader. I encourage you to attend all recitations, but I will only count up to 7 of them in your grade. This scheme allows you to miss 2 recitations, no questions asked, without penalty.

Each week, I will assign a few analytical and conceptual problems for you to do outside of lecture and recitation (problem sets). These questions will help you focus on essential points and will give you a sense of the kinds of things I might ask on exams. Working on these problems after reading over the appropriate sections in Hobson (or other reading) will be the best way to prepare for recitation each week. Solutions to these problems will be released one week after the assignment is given out. There will be a total of ~10 problem sets assigned. You are to turn in your answers to each problem set at the end of class on the date specified on the assignment as posted on the web. We will check each problem set handed in for 'reasonable effort'. Not all problems have to be done and not all problems have to be done correctly to get credit for doing the assignment. Again, 14% of the final grade is allocated to problem sets. For each problem set handed in with 'reasonable effort' put forth, you will receive 2%. We will count up to 7 problem sets in the grade calculation. This gives you the freedom to miss up to 3 problem sets with no grade penalty.

Recitation leader:

- Amanda Neukirch, ajneuk@pas.rochester.edu

Student-led presentations:

Once the semester is progressing smoothly, the class will be divided into groups of ~5 students. Each group will select a topic from a supplied list and "teach" it to the class during a half-hour time slot toward the end of the semester. Each group can teach the topic using whatever format they feel works well. You can make use of written, video and audio sources, teach using conventional chalk on the board, PowerPoint, video, play, song, lecture, posters, etc. Whatever floats your boat. You can petition me to do a different topic.

I have allocated several class periods for groups to make presentations. Each student will grade the effort of each of the groups and this information will be used by me to determine the relative grade ranking of the different groups. I will act as a safety valve to make sure the grading is appropriate/fair. Each student will also give me a measure of effort supplied by each member of their group and this information might be used to modify individual grades with respect to the group grade.

I'll give you more information on the presentations soon.

Makeups/missing exams and problem sets:

I will evaluate your grade using two separate algorithms shown below. If you are present for each exam, this scheme will end up dropping your worst grade. If you miss an exam, that missed grade will count as your drop. I will not

give makeup exams in this course. If you miss two exams, contact me … preferably before you miss the second exam if you know about it in advance.

Grades:

- All exam grades will be rescaled so that the class mean of each exam is 75. For example, if the overall mean of exam 1 is 63, everyone's exam 1 grade will be rescaled by 75/63 before the grade calculations below are performed. This renormalization will (approximately) even out the variations in exam difficulty.
- Your grade will be calculated via one of the three schemes shown in the table below, taking the one that yields the highest numerical average. The numbers represent the relative contribution of the item in that column to your final numerical grade.

Scheme	Exam 1	Exam 2	Final exam	Present.	Prob. sets	Recitation
1	---	22%	30%	20%	14%	14%
2	22%	---	30%	20%	14%	14%
3	16%	16%	20%	20%	14%	14%

- Your initial relative position on the grading curve depends solely on the numerical grade as calculated above. I will then assign letter grades to the numerical scale.

Schedule:

This course syllabus is tentative. I may adjust the speed and/or topics a bit after I get to know you and your interests better. Other reading will be added as we go, particularly in areas where Hobson is weak. The exam dates are fixed.

Wednesday, Jan. 14, 2009 – Introduction to class, nature of science, scales in the universe
Reading in Hobson – Chapter 1 (p. 2-25) and sections 2.4 and 2.5 (p. 37-41)
Wednesday, Jan. 21, 2009 – Fundamental physical quantities and Newton's laws
Reading in Hobson – Chapters 3 and 4 (p. 52-84)
Monday, Jan. 26, 2009 – Newton's laws, gravitational and electrostatic forces, fields
Reading from Hobson – Sections 5.1-5.2 (p. 90-98), 8.4-8.5 (p.-171-174), 8.8 (p. 181-184)
Wednesday, Jan. 28, 2009 – Fields, relativity
Reading in Hobson – Sections 10.1-10.6 (p. 220-235)
Monday, Feb. 2, 2009 – Relativity *Reading in Hobson – Section 3.4 (p. 59-60), Sections 10.7-10.8 (p. 235-242), Section 11.1 (p.248-254)*
Wednesday, Feb. 4, 2009 – Magnetism, Maxwell's equations, light
Reading in Hobson – Section 8.8 (p. 181-184), Section 9.1 (p. 190-194)
Monday, Feb. 9, 2009 – Light, electromagnetic radiation, waves
Reading in Hobson – Sections 8.1-8.3 (p. 162-171), sections 9.2-9.4 (p. 195-200)
Wednesday, Feb. 11, 2009 – Blackbody radiation, photoelectric effect, quanta of light
Reading in Hobson – Sections 13.1 and 13.2 (p. 298-304)
Monday, Feb. 16, 2009 – DeBroglie matter waves, Bohr model of atom

Reading from Hobson - Chapter 13 (p. 298-316)
Wednesday, Feb. 18, 2009 – Bohr model, Schroedinger's equation, rise of quantum mechanics
Reading from Hobson – Sections 14.6-14.7 (p. 338-347)
Monday, Feb. 23, 2009 – multi-electron atoms, chemistry, periodic chart
Reading from Hobson – Sections 14.6-14.7 (p. 338-347)
Wednesday, Feb. 25, 2009 – Chemistry, quantum uncertainty
Reading from Hobson – Chapter 14 (p. 320-348)
Monday, March 2, 2009 – ** Exam 1 **
Wednesday, March 4, 2009 – Rutherford scattering, nuclear physics
Reading in Hobson – Chapter 2 (p.29-46), Sections 8.4-8.7 (p. 171-180), Chapter 15 (p. 354-376)
Monday, March 16, 2009 – Nuclear physics
Reading from Hobson – Chapter 16 (p.380-404)
Wednesday, March 18, 2007 – Stars
Reading from Hobson – Sections 5.1-5.6 (p. 90-110), section 11.1 (p. 248-254), review sections 16.1-16.4 (p. 380-387)
Monday, March 23, 2009 – Quantum fields and forces – particle physics
Reading from Hobson – Sections 18.1-18.3 (p. 439-449)
Wednesday, March 25, 2009 – Standard model of particle physics
Reading from Hobson – Sections 18.4-18.5 (p. 449-459)
Monday, March 30, 2009 – Particles, earth in cosmos, gravity
Reading from Hobson – Sections 11.2-11.7 (p. 254-268)
Wednesday, April 1, 2009 – Big bang cosmology
Reading from Hobson – Sections 11.2-11.7 (p. 254-268)
Monday, April 6, 2009 – Cosmology, inflation, dark matter, dark energy
Reading from Hobson – Sections 11.2-11.7 (p. 254-268)
Wednesday, April 8, 2009 – Current directions of exploration from the LHC to supersymmetry to SNAP to strings
Monday, April 13, 2009 – Topics TBA
Wednesday, April 15, 2009 – Student presentations
Monday, April 20, 2009 – Student presentations
Wednesday, April 22, 2009 – ** Exam 2 **
Monday, April 27, 2009 – Student presentations
Wednesday, April 29, 2009 – Student presentations
Tuesday, May 5, 2009 – ** Final exam **, 1600-1900, location TBA – cumulative