Physics 114 – General Physics II
Spring term 2010, University of Rochester
Information, Syllabus, and Schedule

Physics 114 is the continuation of Physics 113. This is an introductory course in electromagnetism and modern physics. Topics covered include electromagnetism, light, optics, relativity, quantum mechanics, atomic physics, nuclear physics, and a little bit of particle physics and cosmology. Students are assumed to have a working knowledge of basic calculus and the material covered in Physics 113. The course is designed for science majors who are not majoring in physics or engineering.

Course instructor:

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Office hours: Tuesday 2-3 or by appointment**.** With my travel and your variable needs/schedules fixed office hours are not terribly practical. If I am out of town or the Tuesday time slot does not work for you, speak to me or send me an e-mail to find a mutually suitable time. Walk-in office visits (no appointment) are welcome with the understanding that if I'm in the middle of something else we might have to put off our discussion to a mutually acceptable time.

Course web sites:

Extensive use will be made of the web for distributing course materials, making announcements, etc. The class website URL is http://www.pas.rochester.edu/~manly/class/P114_2010/. If you have problems reaching this site (and you've verified it is not your problem), please contact me. Additional material, including your grades, will be distributed via BlackBoard http://bb.urmc.rochester.edu/webapps/portal/frameset.jsp .

Course e-mail:

I will use BlackBoard to email the class time-critical announcements, hints for problem sets, corrections for problem sets, exam location changes, etc. You will need to be registered formally for the course to receive these emails. Also, once registered for the course I advise you to check the appropriate email account with reasonable frequency, particularly if you miss the beginning of lecture when I will make general announcements.

Lectures:

Hoyt Auditorium, Tuesday/Thursday 1230-1345

Textbook:

- Douglas Giancoli, **Physics for Scientists and Engineers**, Volumes II and III, 4th edition (2009), Prentice-Hall.
- You may find this textbook as a single volume or as a large single volume that includes mechanics. Whatever form you use, make sure it includes chapters 21-44. In previous editions I have seen a single volume format that does not include the modern physics chapters at the end.
- You are welcome to use previous editions of the text. Just be aware that the problem assignments will be referring to the problems in the 4th edition. Copies of the 4th edition will be on reserve in the Physics and Astronomy Library located on the 3rd floor of Bausch and Lomb Hall.

Some useful books on reserve in Physics and Astronomy (PAS) library:

- Douglas Giancoli, **Physics for Scientists and Engineers**
- Instructor's Solution Manual for Giancoli (Use with great care. If you start looking at solutions in this book without first trying the problems on your own, I ***absolutely guarantee I will toast your tail*** on the exams!)
- Young and Freedman, **University Physics**
- Halliday, Resnick and Walker, **Fundamentals of Physics**
- Tipler, **Physics**

Philosophy and goals and warnings:

I have two major goals in this course as far as each of you is concerned. One goal is to provide you with a basic survey of the principles of electromagnetism and modern physics and an appreciation of the importance of these principles to your world. The other goal is to develop in you the ability and confidence to attack analytical problems. (Note: I did NOT say memorize equations!)

Unfortunately, I cannot open your skull and shove this knowledge/ability in your head. I will provide a systematic program of study and assignments at the appropriate level for this course. I have chosen an appropriate textbook. I will give lectures that I think are relevant and useful and even entertaining in spots (have mercy, it's physics after all). I will provide a support system manned by well-trained graduate and undergraduate teaching assistants. ***THE REST IS UP TO YOU!*** I will treat you as professional, adult students. I expect you to treat the course accordingly.

Plug-and-chuggers beware! I rarely give a problem on an exam that is exactly like something you have seen. I will give some problems that are very similar to what you have seen in order to check for basic brain activity. However, I am much more interested in testing your understanding of the concepts/techniques and your ability to use them when facing uncharted territory. Often my exam problems are almost trivial if you understand the concepts and have practiced using them by doing problems and quite difficult if you don't have this understanding. Typically, they are not hard technically (I'm not testing your ability to do math). We do give substantial partial credit for good attempts. Often the mean on my exams is around 65/100. If the class and the exam are "normal",

the mean is roughly a B. In the past, some students have found the low numerical means somewhat frustrating. C'est la vie. I find the low mean comes about naturally if I give exams that allow me to evaluate students at the upper end of the curve as well as those at the lower end.

Be aware that you'll benefit from working to understand the concepts behind the problems. If you spend time plugging numbers into whatever equation seems to work without putting much thought as to why that is the correct equation, you'll have a long and miserable semester in this course. Sadly, there is no easy way out. The concepts will seem rather opaque at first, but once grasped, life is easy … sort of like riding a bike.

Finally, most of you will find Physics 114 a bit harder to grasp than Physics 113, particularly during the first half of the course. Among the reasons for this are that the material is less amenable to mechanical mental models and the need to get your head around the use of the calculus in the analytical work is greater than in Physics 113. That said, consistent hard work will pay off and the concepts and ability to solve the problems will come. This material requires time to bounce around your skull for a while before it begins to make sense. ***A word of warning: the first half of this course will wipe you out if you ignore it along the way and cram for the exams.***

Workshops:

An integral part of this course will be "physics workshop". You will meet once a week, for two hours, with a group of other students and a leader. During this time, you will work on a set of analytical and conceptual problems/questions that I prepare. The questions and problems will be relevant to the material covered the week before or the same week in lecture. Much of this will be review and practice. Some of it will be new and relevant material.

It is sometimes difficult to maintain the synchronization of the material in the lectures, workshops and problem sets. In the end, it really doesn't matter so much where you encounter the material for the first time. The hope is that having experiences all three ways of looking at the material, it will make sense to you.

The basic idea of the workshop concept is to institutionalize the study group with some leadership and supervision from the professor. The students in the workshop are expected to work through the module. The workshop leader will act as a facilitator, not a lecturer … and not an answer-giver. I *know* my workshop leaders can do the problems. Our job is to help you find it within yourself to do them! It is up to *you* to make your workshop section work.

No attempt will be made to sort out students in the workshop sections according to mathematical ability, gender, date of birth, tattoo color, pierced appendage, etc. Students who are rather challenged by this course will find the support available in workshop very helpful. Those of you who find this material easier may be surprised to hear that research on workshops tells us that *you* will benefit even more. It turns out you learn a great deal when you try to teach something. I urge you all, regardless of capability, to participate in, and enjoy, the workshops.

I have data from past courses that show consistent attendance of workshops *strongly* correlates with a better grade in the course. The workshops are the best way I know to help you understand physics concepts and learn to solve analytical problems.

Workshop leaders will keep track of workshop attendance. This will be one of my gauges as to the level of effort you put into the course. This will be taken into account during the final letter grade assignment and will be the deciding factor for grades within one point of a grade boundary.

Workshop leaders:

To be announced. The information is unavailable at this writing. It will be posted on the website when I know who they are.

Laboratory:

Currently, the laboratory is conducted independent of lecture. However, the lab grade contributes to your final course grade. **You must do (and hand in) all the labs get a grade for this course.** The laboratory grade will be averaged in as 15% of the course grade. All questions regarding the laboratory should be sent to the laboratory e-mail address (physlabs@pas.rochester.edu) or addressed to Professor McFarland. The physlabs e-mail address is appropriate for the majority of your questions, and is more likely to yield a timely response. There is no reason to contact me concerning lab issues unless your problem has not been resolved by the professor and staff running the laboratories.

Problem sets:

I will ask you to do a set of problems each week that illustrate and/or enhance what we've discussed in the lecture. P114 is a quantitative, problem-driven course. I will work mostly on concepts and mathematical techniques in lecture … but the exams will consist of quantitative problems. It is absolutely ***critical*** to your survival in this course that you work on these problems each week! ***For the vast majority of students, it is not possible to do well in this course without struggling with most of the homework problems throughout the semester.***

A week after each problem set is assigned, I will release a solution set. Your job is to study these solutions, understand your mistakes, and correct any misperceptions or holes in your understanding.

You are encouraged to discuss the problems with others both before and after you turn in your assignment. However, I urge you to struggle with each problem on your own first. Otherwise your colleagues will carry you and you won't get much out of it. Most of you will find it easy to follow someone else's work. If you follow others too much as you do the problem sets, you will find that you are unable to begin problems on your own.

A fraction of your grade (9%) comes from your solutions to the problem sets. Only one problem, chosen at random, will be graded each week. It is not necessary to have the correct solution to the selected problem in order to get credit. You must, however, have made an honest attempt to do the problem.

Your solutions to each week's problem set must be handed in by 1:50 pm on Thursday, i.e., the end of class on Thursday. If you can't make it to class, you can turn the problems in early by placing your solutions in my B&L mailbox or under my office door. We will usually release of the official class solutions roughly at the time you hand in your assignment. Solutions handed in late will not be accepted. In case that didn't sink in, let me say it again. ***Solutions handed in late will not be accepted.*** It is expected that most of you will miss handing in two or three assignments due to the need to prioritize your busy lives. I will only count 9 of 12 assignments toward your grade. That means you can fail to turn in up to three problem sets with no direct effect on your grade. ***You should do any problem sets you fail to hand in anyway or your exam grades will suffer and THAT will affect your final grade.***

The point of forcing you to turn in the problem sets is to promote the habit of keeping up with the course. ***Physics does not cram well***. Many concepts/techniques need time to gel.

Personal response system:

We will use a personal response system (PRS) during lecture this semester. You will need to purchase a PRS transmitter at the bookstore (something like a small remote control). If you still have the one you used in Physics 113, it will work for our class. Bring it to lecture regularly once we start using it. This is a tool that will enable me to get responses from you in real time during lecture. It helps me make the lectures more interactive and engaging (which is tough to do in an analytical course like physics).

If the majority of you bring the PRS transmitters to class and use them, the class as a whole will benefit substantially. Though it violates my teaching philosophy, if I find that very few of you are participating with the transmitters, I reserve the right to allocate a couple of percent of the course grade to PRS participation. The technical capability to do this is in place, but I'd rather not deal with it if I can avoid it. So, bring your PRS and participate.

Where's the prof?:

You are my priority. However, my research duties will force me to travel some this term. I will do all I can to schedule my travel so that it has a minimal impact on your class. However, I won't be able to completely avoid it. Typically, when this happens, I will cancel class at the regular time and post a PDF file of the lecture slides and an accompanying mp3 audio file. Upon return, I will make the assumption that you have covered the material and listened to the audio file. I will usually be in e-mail contact when out of town, though I might not be carrying my copy of the textbook.

Makeups/missing exams and problem sets:

If you miss one of the term exams *for any reason* (no matter how good or frivolous), that exam will count as your "drop". I do not want or need to hear about it. Makeup exams involve a huge amount of work for me and, quite honestly, cannot be done fairly in a course like this. So, please don't come ask

me to give you a makeup exam because you feel that you had a decent reason for missing the exam in the first place. The flexibility in the system is already there for you. If you have good reasons to miss two term exams, contact me.

I have provided flexibility in the structure of the course to allow you to miss an exam and a reasonable fraction of the problem sets with no penalty. Use this flexibility sparingly and in times of real need because I will not negotiate for additional flexibility.

Plan not to miss the final exam. If you request a makeup final exam because you mistakenly bought an expensive plane ticket for the incorrect date, I will laugh at you. Seriously. The date for the final exam is set. Plan around it.

Grades:

Because I have set up the syllabus such that you can drop a term exam, it is important that the exams all have the same approximate difficulty. This is hard to achieve consistently. To correct for (approximately) variations in difficulty for the exams, all exam grades will be rescaled so that the 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

Your grade will be calculated via one of the five schemes shown in the table below, taking the one that yields the highest average. The numbers represent the relative contribution of the item in that column to your final numerical grade.

Scheme	Exam 1	Exam 2	Exam 3	Final exam	Lab	Prob sets
1	---	20%	20%	36%	15%	9%
2	20%	---	20%	36%	15%	9%
3	20%	20%	---	36%	15%	9%
4	16%	16%	16%	28%	15%	9%

You will not receive a grade in the course until you have completed the required laboratory work.

Your initial relative position on the grading curve depends solely on the numerical grade as calculated above. I will calculate your grade using each of the four algorithms and keep the highest one. I will then assign letter grades to the numerical scale. There is no fixed curve to be assigned … no grade quotas. If you all do "A" work in my eyes, you ALL get A's and I get to deal with the dean and the chairman of the department … but so be it. It's a problem I would love to have! If your class is similar to most I've seen in the past it is likely that the mean in the final grade distribution will be near the center of a fairly wide B range.

If you are close to (but below) a grade boundary (within one point as the rounding is done to the nearest integer by my Excel spreadsheet) … and many of you will be … I will give you the higher grade near the boundary if you have attended more than half the workshops.

The way in which I calculate your grade using the four schemes above tends to compress the final grade distribution. In the end, the 9 percentage points

tied up in the problem sets can represent a very big swing in terms of letter grades. Because of that, I reserve the right to limit the letter-grade damage to one full letter grade for students who chronically fail to hand in their problem sets. In a sense, they are likely already penalized with lower exam grades. Do us both a favor and don't make it an issue.

If you are at the bottom of the grade distribution, it does not mean that you are failing the course necessarily. It means I have to look very carefully at your scores and effort. If you are living on bits of partial credit and are putting in little visible effort, then you may not pass the course. If you are making more mistakes than you should, but are putting in effort and show that you are learning something by taking a pretty good crack at a number of problems through the semester, then you will pass … you may not be in any danger of an A, but you'll get through the course.

Schedule for P114, Spring 2010:

This course schedule is tentative. The exam dates are fixed. Exam subject matter will change as appropriate for the material covered and will be announced in advance of the exam.

Lecture	Date	Topic	Chapter in text
1	Jan 14 (Th)	Intro to class, start of Coulomb's law	21
2	Jan 19 (Tu)	Coulomb's law, electric field	21
3	Jan 21 (Th)	Electric field	21
4	Jan 26 (Tu)	Electric flux, Gauss' law	22
5	Jan 28 (Th)	Gauss' law	22
6	Feb 2 (Tu)	Energy, electric potential	23
7	Feb 4 (Th)	Electric potential	23
8	Feb 9 (Tu)	Capacitance	24
Exam 1	**Feb 11 (Th)**	**Hoyt – during normal lecture time**	
9	Feb 16 (Tu)	Capacitance, energy in E field	24
10	Feb 18 (Th)	E fields in materials, electric current	25
11	Feb 23 (Tu)	Resistance, Kirchoff's laws	25, 26
12	Feb 25 (Th)	RC circuits, Lorenz force law	26, 27
13	Mar 2 (Tu)	Lorenz force law, Law of Biot-Savart	27, 28
14	Mar 4 (Th)	Biot-Savart, Ampere's law	28
SPRING !!!!!!!!!!!!	BREAK !!!!!!!!!!!!!!!!	Relax Get a tan	*But don't kill all your brain cells! You'll need'em*
15	Mar 16 (Tu)	Ampere's law, solenoids	28
16	Mar 18 (Th)	Magnetic induction	29
Exam 2	**Mar 23 (Tu)**	**0800-0920, Hoyt Auditorium**	
17	Mar 23 (Tu)	Energy in B field, B fields in matter	28, 30
18	Mar 25 (Th)	Maxwell's equations, EM waves	31
19	Mar 30 (Tu)	EM waves, polarization	31, 35
20	Apr 1 (Th)	Geometric optics	32, 33
21	Apr 6 (Tu)	Physical optics	34, 35
22	Apr 8 (Th)	Rise of quantum mech, Bohr atom	37
23	Apr 13 (Tu)	Atoms, quantum mechanics	38, 39
Exam 3	**Apr 15 (Th)**	**Hoyt – during normal lecture time**	
24	Apr 20 (Tu)	Magnetic resonance, nuclear physics	41, 42
25	Apr 22 (Th)	Nuclear physics, special relativity	41, 42, 36
26	Apr 27 (Tu)	Particle physics, cosmology	43, 44
Final exam	**May 5 (Wed)**	**7:15 pm – location TBA**	**cumulative**