Physics 142 – Electricity and Magnetism
Fall term 2014, University of Rochester
Information, Syllabus, and Schedule

P142 is a physics survey course in electricity and magnetism designed for physics majors. Students with other majors in the physical sciences or engineering who desire more depth than would be seen in P122 are welcome. The topics to be covered in P142 include electrostatics, electrical potential, magnetostatics, electric and magnetic fields in matter, current, capacitors, DC and AC circuits, induction, Maxwell's equations and, electromagnetic waves, and a bit of relativity and geometrical optics. Students are expected to have knowledge of basic calculus. It is also assumed that students have taken a strong, calculus-based introductory course in mechanics in preparation for P142.

Course instructor:

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

Office hours: **Tuesday 2:00-3:00 pm *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 time slots do not work for you, speak to me or send e-mail to find a mutually suitable time. Workshop leader office hours TBA.

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/P142_2014/
If you have problems reaching this site (and you've verified it is not your problem), please contact me. Also, I will make extensive use of Blackboard for this course.

Course e-mail:

I will use Blackboard to send emails to the class and to report grades to you and possibly a few other things. Time-critical announcements, hints for problem sets, corrections for problem sets, exam location changes, etc. will be sent to you via e-mail.

Lectures:

Hoyt Hall, Tuesday/Thursday 1105-1220

Textbook:

- H. C. Ohanian and J. T. Markert, **Physics for Engineers and Scientists**, Volume 2, 3rd edition, W.W. Norton & Company, New York, 2007

Books on reserve in Physics and Astronomy (PAS) library:

- Douglas Giancoli, **Physics for Scientists and Engineers**
- Young and Freedman, **University Physics**
- Halliday, Resnick and Walker, **Fundamentals of Physics**
- Tipler, **Physics**

Philosophy and goals:

I have several 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 an appreciation of the importance of these principles to your world and the rest of physics. Another goal is to develop in you the ability and confidence to attack analytical problems. (Note: I did NOT say memorize equations!) Finally, I plan to spend some effort developing your repertoire of analytical skills and tricks that will serve you well in more advanced physics courses. This is an honors course. So, I will expect you to be spending significant time working on this course outside of class by yourself and with others. If that isn't happening, one or both of us is not doing our job.

Workshops:

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

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 questions each week. 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 function well.

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 collaborative learning 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 courses I teach. The workshops are the best way I know to help you understand physics concepts and learn to solve analytical problems. More importantly, I can tell you from personal experience that most successful physics majors work frequently with a study group of some sort. It's something you might as well get used to doing.

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 hairline grades. I also use this information as part of my assessment of the educational effectiveness of the workshops as compared to other support systems that are frequently used in university physics courses.

Workshop leaders:

- Ingrid Koch, ikoch@u.rochester.edu
- Mehr Un Nisa, mehr@pas.rochester.edu

Laboratory:

Currently, the laboratory is conducted independently of lecture. The only contact between the two is one statistics lecture and the lab grade contribution to the 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). The physlabs e-mail address is appropriate for the majority of your questions, and is more likely to yield a timely response. It is only necessary to bring laboratory issues to my attention if you do not get a satisfactory response from physlabs.

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. P142 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. I reserve the right to switch the system from grading a single problem to making a "scan for effort" throughout the problem set.

Your solutions to each week's problem set must be handed in before 7 am on Friday. To turn them in, deposit them in the "P142" locker in the hallway by B&L 106. I will ask that one of the TAs empty the locker when they come in on Friday mornings. If the problem set is not in that locker when the papers are picked up, it will count as a zero. Rather than negotiate or pass judgment about poor or good excuses, I will give you three problem set "drops", no questions asked. In other words I will only count 9 of the 12 (or so) assigned problem sets. In spite of that, you should do and come to closure on any problem sets you fail to hand in or your exam grades will suffer and that *will* affect your final grade.

Keep up with the class. *Physics does not cram easily*. Many concepts/techniques need time to gel.

Student-led presentations/discussions:

Once the semester is progressing smoothly, the class will be divided into roughly six to eight groups. 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. The only constraint is that it must have something to do with the topics covered in this course.

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.

Grades:

- To factor out unavoidable fluctuations in exam difficulty, all exam grades will be normalized such that the mean for each exam is 100%. For example, this means if the mean of the exam is 60%, I will scale each student's grade for that exam by 100/60 before I determine the overall grade as shown below.
- Your grade will be calculated via one of the three 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	Final exam	Lab	Prob sets	Presentation
1	20%	20%	21%	15%	9%	15%
2	0%	30%	31%	15%	9%	15%
3	30%	0%	31%	15%	9%	15%

- 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 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. It's a problem I would love to have!
- If you are one point below a grade boundary … 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.

Where's the prof?:

You are my priority. However, in spite of this, I must travel frequently for my research. I will do all I can to schedule my travel so that it has a minimal impact on P142. However, I won't be able to completely avoid it. Class will go on. I'll do my best to arrange a decent guest lecturer or I'll post lecture slides and an accompanying mp3 audio track. I will usually be in e-mail contact when out of town … though I may not have all my records, solution sets, etc. Please accept my apologies in advance.

Makeups/missing exams, problem sets:

If you miss one of the term exams *for any reason* (no matter how good or frivolous), that exam will be dropped and the grade calculated via scheme 2 or 3 above. I do not need or want to hear about it. If a good reason is forcing you to miss a second term exam, contact me and I will try to work something out with you. Please don't miss the final exam. That would likely mean you would need to take an incomplete in the course and finish it in December 2015.

I have provided flexibility in the structure of the course to allow you to miss 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. Bear in mind that part of the motivation for the problem sets is to keep you from falling behind in the course. To allow you to skip or do these assignments late defeats the intended purpose.

Schedule:

This course schedule is approximate. The exam dates are fixed.

1-Tuesday, Sept. 2, 2014 – Intro, Coulomb's law
Reading in text: Chapter 22
2-Thursday, Sept. 4, 2014 – Electric force calculations, Electric field
Reading in text: Chapter 23
3-Tuesday, Sept. 9, 2014 – Electric field
Reading in text: Chapters 23
4-Thursday, Sept. 11, 2014 – Electric flux, Gauss' law
Reading in text: Chapter 24
5-Tuesday, Sept. 16, 2014 – Gauss' law, curvilinear coordinates
Reading in text: Chapters 24
6-Thursday, Sept. 18, 2014 – Gauss' law, Electric potential (no lecture in Hoyt, online due to Prof. having to travel)
Reading in text: Chapter 25
7-Tuesday, Sept. 23, 2014 – Electric potential
Reading in text: Chapters 25 and 26
8-Thursday, Sept. 25, 2014 – Electric potential, capacitance
Reading in text: Chapter 26
9-Tuesday, Sept. 30, 2014 – Capacitance, energy in the electric field
Reading in text: Chapter 26
10 - Thursday, Oct. 2, 2014 – Dielectrics, resistance
Reading in text: Chapter 26, 27
Tuesday, Oct. 7 - *** Exam 1, takes place in Hoyt during lecture slot
11 -Thursday, Oct. 9, 2014 – Resistance, Kirchoff's laws (Tentative ***no lecture in Hoyt, online due to Prof. having to travel, may change)
Reading in text: Chapters 28
12 - Thursday, Oct. 16, 2014 – Kirchoff's laws, RC circuits
Reading in text: Chapters 28
13 - Tuesday, Oct. 21, 2014 – Relativity
Reading in text: Chapter 36
14 - Thursday, Oct. 23, 2014 – Relativity, Magnetostatics
Reading in text: Chapters 29 and 30
15 - Tuesday, Oct. 28, 2014 – Lorentz force law, law of Biot-Savart
Reading in text: Chapters 29 and 30
16 - Thursday, Oct. 30, 2014 – Biot-Savart, Ampere's law
Reading in text: Chapters 29 and 30
17 -Tuesday, Nov. 4, 2014 – Ampere's law, Induction
Reading in text: Chapter 31
Thursday, Nov. 6, 2014 – *** Exam 2 – 0800 (common exam time slot) loc TBA
18 - Thursday, Nov. 6, 2014 – Inductance, energy in the magnetic field
Reading in text: Chapters 31
19 - Tuesday, Nov. 11, 2014 – LR and LC circuits
Reading in text: Chapters 32 and 30

<u>20 - Thursday, Nov. 13, 2014</u> – AC circuits, magnetism in materials
Reading in text: Chapters 32
<u>21 - Tuesday, Nov. 18, 2014</u> – magnetism in materials, Maxwell's equations
Reading in text: Chapter 33
<u>22 - Thursday, Nov. 20, 2014</u> – Maxwell's equations
Reading in text: Chapter 33
<u>23 - Tuesday, Nov. 25, 2014</u> – Electromagnetic waves
Reading in text: Chapter 33
<u>24 - Tuesday, Dec. 2, 2014</u> – Electromagnetic waves, polarization
Reading in text: Chapter 34
<u>25 - Thursday, Dec. 4, 2014</u> – Geometric optics and student presentations
<u>26 - Tuesday, Dec. 9, 2014</u> – Student presentations
<u>27 - Thursday, Dec. 11, 2014</u> – Student presentations

***** Depending on the number of presentation groups we end up with and how efficiently the presentations run, we may need to schedule an additional meeting outside of our normal lecture slot in order to finish the presentations.*****

<u>Saturday, December 20, 2014</u> – *** Final exam, 1600-1900, location TBA