PHYS 122: General Physics II: Electricity and Magnetism

January 14, 2013 – Slighted Updated Jan 15, 2013

Content: Electrostatics, Electric Fields,
Potentials, Magnetic Fields, Circuits,
Electromagnetic Induction, Capacitance,
Electromagnetic Waves, Optics

Prerequisites: Physics 121 or Instructor's Permission

Schedule: Lectures: M W F 9:30 to 10:20 AM, Strosacker Auditorium

Labs: *Required. every other week*
Student *must* register for labs. See Diana Driscoll: `did2@crwu.edu`

Instructor:
Corbin Covault
Rockefeller 207
Phone: 216-368-4006
Cell: 216-339-3861
E-mail: corbin.covault@cwru.edu

Course Web Page: `http://www.phys.cwru.edu/courses/p122`
Lab Web Page: `http://physicslabs.phys.cwru.edu`

"Required" Text: *Physics for Engineers and Scientists*, 3rd Ed., Vol. 2, by Ohanian and Markert

Recommended: *The Cartoon Guide to Physics* by Gonick and Hoffman.

Homework: Due weekly most *Mondays by 5:00 PM sharp*.
11 assignments, lowest score will be dropped.
No late homework will be accepted under any circumstances.

Workload:

Homework	15%
Laboratory*	25%*
1st hour exam Fri Feb 08	5%
2nd hour exam Fri Mar 01	10%
3rd hour exam Fri Mar 29	10%
Final exam Mon May 06	35%

*Note: Lab are administered and graded separately

Syllabus Schedule:

Here is an *approximate* syllabus (schedule) for the course (subject to modification in the reading assignment). Depending on the interests of students in the class and the tenor of discussions, we may spend more or less time on any of these topics. For this table, I count fifteen weeks in the class and label each week by the date of the Monday on that week. **Note the dates indicated for the exams are fixed**. Note that every Monday you have a homework due *unless* you took an exam the previous Friday. Also dates where no class will be held are also indicated:

	Wk	Mon Date	Monday Homework Due?	Content Topics	Important Dates
Cycle 1	1	Jan 14	none	Charges, Fields, Voltage	
	2	Jan 21*	HW#01*	Circuits	**No Classes: Mon Jan 21**
	3	Jan 28	HW#02	Magnetism, Faraday's Law	
	4	Feb 04	HW#03	E-M Waves	**Hour Exam: Feb 08**
Cycle 2	5	Feb 11	none†	Gauss' Law	
	6	Feb 18	HW#04	Ampere' Law, B-fields	
	7	Feb 25	HW#05	Waves, Interference	**Hour Exam: Mar 01**
Cycle 3	8	Mar 04	HW#06‡	Fields and Energy	
		Mar 11		**SPRING BREAK**	**Mar 11-15 No Labs, No Classes**
	9	Mar 18	HW#07	Conductors, etc.	
	10	Mar 25	HW#08	Capacitor, Inductors	**Hour Exam: Mar 29**
Cycle 4	11	Apr 01	none†	Faraday, Lenz	
	12	Apr 08	HW#09	Maxwell's Equations	
	13	Apr 15	HW#10	Polarization, Optics	
	14	Apr 22	HW#11	Quantum Theory	
	15	Apr 29	none††	**Apr 29 last day of class**	**Reading Days Apr 30, May 1**
		May 04		Final Exam Review	1 PM to 5 PM Sat May 04♯
		May 06		**Final Exam**	**4 PM to 7 PM Mon May 06****

* First homework is due **Wed** Jan 23 due to MLK holiday.

† For weeks with no homework due, Optional Practice Problems will be offered.

‡ Homework #06 is a special assignment, and can be submitted any time before Wednesday, March 20.

†† A "practice homework" will be passed out but will not be collected or graded.

♯ Review session is tentatively scheduled for this time.

** All students **must** sit for the final exam to earn a passing grade.

For summary descriptions of Cycles, details on Lectures, Homeworks, Exams. Labs, Office hours, etc. see following pages....

Goals of the Course:

Introductory physics courses are "historical beasts". This is to say that their content and design are largely dictated by tradition and precedent. The content of any introductory course in electromagnetism will not vary much from place to place. But the emphasis and approach to the content may vary considerably, and the whole enterprise is complicated by the fact that there is really a very wide range of topics that might be included in this class. Therefore it is worth considering the purpose and philosophy and goals of the course. As instructor, I will design the course so that the students can achieve these goals. This will give more focus and direction to the course than simply trying to "cover the material".

The main goals of Physics 122: General Physics: Electricity and Magnetism are as follows:

- To reinforce in students the formal method of investigating the world through physical sciences, and in particular, to have students learn for themselves how physics as a discipline can be used to obtain a deep understanding of how the world works.
- To have students understand the basic concepts of electric charge, electric current, and electric and magnetic fields,
- To have students understand how charges and currents respond to electric and magnetic fields and also how charges and current generate electric and magnetic fields,
- To have students learn practical fundamentals of linear electric circuit components and how their operation is governed by the fundamental laws of electricity and magnetism both in static and time-varying scenarios,
- To have students comprehend how all of the individual laws and observations regarding electricity and magnetism were unified by Maxwell into a theoretical framework and that this framework also precisely describes visible light and all other forms of electromagnetic radiation, and
- To have students learn a range of methods for applying these understandings and problems toward solving a broad range of physical problems with precision.

In addition the laboratory component of the course has the following overall goals:

- Students should be able to perform introductory physics experiments (verify experimentally physics concepts learned in lecture, operate and troubleshoot some experimental equipment, collect experimental data using computer interfaces, analyze data and interpret results, propagate errors and understand differences between random and systematic errors, standard deviation and standard error)
- Students should be able to write lab reports in a professional self-contained, publication-like format (independently write up a report after having collaborated with lab partners in performing the experiment and the analysis).

Physicss 122: Using a "Cyclic" Approach:

The topic of introductory physics has been taught in more-or-less the same manner in colleges and universities across the country for decades. Specifically, for Electricity and Magnetism, the material is traditionally presented in a *linear* fashion, starting with Coulomb's Law, defining a field, etc. Each topic is introduced and then expanded upon fully before moving onto the next topic.

Pedagogically, the difficulty with the traditional approach is that students will generally cover a given topic only *once* in a semester, and – without re-visiting the topic – even students who do well on exams tend to *lose comprehension* later in the semester or even in future courses. In a nutshell: the material does not "stick".

This pattern is not surprising when we consider what is known about how most people learn. The human mind is not a "blank slate", and people generally do not learn any any level of depth through a single exposure to a topic. Rather, material is learned through repeated exposure to ideas, re-visiting and expanding at several different points and different times. Generally speaking, we need to see it, reflect on it, act on it, and then see it all over again before we really learn it.

To help students deepen learning in the course we are using a *semi-cyclic syllabus* to Physics 122. The basic idea is that the course is divided into two *cycles* divided into two halves. During each half-cycle we will cover the content of the entire course, from charge to optics, followed by an exam. However, during each subsequent cycle we will look more deeply into the content topics.

For example, during the *Cycle 1* we will introduce the idea of point charges and we will consider simple fields that result from simple charge and current configurations. We will barely allude to the concept of electric potential, before moving into applications in circuits. During *Cycle 2* we will look in more detail at the mathematics of charge and current distribution, developing a formalism for surface flux and integrals. During *Cycle 3* we will take these idea further with a complete description of Maxwell's Laws and consideration of time-varying currents and physical optics. In other words, we will see the same topic three times, each time revisiting what we learned previously before adding further details to increase the depth of our understanding. For *Cycle 4* we will synthesize what we have learned an apply it to the concepts of both geometric and physical optics and will use this to set the stage for the first major pillar of modern physics: quantum mechanics.

This approach has many advantages, but one disadvantage is that the presentation of materials is *not* closely linked to the content and organization of *any* commercially available textbook. We will be using the text *Physics for Engineers and Scientists (3rd Edition) Volume II: Electromagnetism* by Ohanian and Markert for reading. But the reading assignments will "jump around the textbook" so as to match the presentation of materials in class. For those of you who are used to moving linearly through an assigned text, this will be a rather different experience.

We will therefore provide several different mechanisms to help students keep track of "where we are" in the course, regarding the Cyclic Syllabus as follows:

- On an occasional basis, short documents, called *Review Sheets* will be presented to the class which delineate the scope and depth of key topic areas for students. These Review Sheets will be specifically designed to let students know which topics they are responsible for in advance of each exam.

- Every lecture will be *videotaped by Mediavision* and will be available for viewing online afterward by any student at any time during the course.
- Example *Practice Problems* that delineate the scope and level anticipated for exams will be presented for students online. Solutions will also be posted on the web page.
- During most lectures, student in class will be presented with one or more *Clicker problems*. These are short conceptual problems that interactively probe student understanding. Students will be asked to respond using the I-clicker system. Solutions to these problems will be presented in class and archived on the web page. Note: Participation with I-Clickers is optional but will allow students to earn optional bonus points. Students can obtain I-clicker transmitters at the bookstore. You are responsible for bringing your clicker to lecture each day.
- The instructor will post weekly *hints on homework* on the online Phorum Discussion Board. The instructor will also endeavor to respond promptly to student questions posted there.
- This year we will be trying something new. Students will be encouraged to try out a system of online practice problems that are assigned by the instructor called *Expert TA*. Students will get detailed feedback and hints on how to solve a variety of problems. Note: Participation with Expert TA is optional but will allow students to earn optional bonus points. Students will receive email instruction as to how to participate.

It is worth reviewing this list. All-in-all, in the context of the course, students have access to a large number of resources that are available to help gain mastery of the material. And this list does not even include the "extra-help" options offered by SI leaders and instructor's office hours. Students have many learning styles, no two students learn the material the same way. Our goal is to provide to the students a variety of resources that can be used to help them learn in accordance with their own learning styles.

Lectures:

The lectures define the scope and central content of the course. The textbook will be used to support and supplement the lectures. Lectures define the course, not the textbook.

As a study aid, I will on occasion hand out "Review Sheets" that will outline what I consider the most important topics and ideas for each section of the course. I also usually post scanned copies of my lecture notes if I think this would be helpful to students.

Lectures are Mondays, Wednesdays, and Fridays from 9:30 AM to 10:20 PM. I will try to start and end promptly. I very much recommend that you should attend the lectures faithfully, paying attention and taking notes when appropriate. There will be occasional lecture demonstrations and interactive activities that will take place during the lecture to reinforce conceptual understanding of the material.

Note that the lectures will be videotaped and archived for online access by the University ITAC Mediavision team. This is a great resource for students to use if they have to miss a lecture because of illness or if you want to see something again a second time. However, I believe that *students*

who rely heavily on viewing the Mediavision videos instead of personally attending lectures will not perform as well in the class. The lectures are designed to engage the participants, allow for interaction, and to give a "multimedia" experience applicable to a range of student learning styles. Independent research has shown this: *In classes where students have a choice of coming physically to lecture vs. watching the lecture on video, students who come to lecture perform better in the class.* **So I strongly advise all students to plan their lives so as to be able to get up and into class each MWF morning at 9:30 AM for physics lectures.**

By the way, although the class is medilarge (at least 45 students) I would very much like to encourage students participation in the lecture. Please feel very free to raise your hand to ask a question or clarify a point. If you are puzzled, then chances are your fellow students are puzzled too and will be grateful that you asked the question. If I cannot answer your question in class in a way that is relatively brief and helpful to the other students, then I'll promise to respond after class or in a subsequent lecture. If you see me doing something obviously wrong on the chalkboard, make a noise or something so I do not get too far before I correct myself (I do make mistakes!) Also during the class we will often break up the lectures with little "questions" or activities that the students will participate in – usually in groups.

Text:

The "highly recommended" text for the course are *Physics for Engineers and Scientists*, 3rd Ed., Vol. 2, by Ohanian and Markert.. I've checked and it looks like it is in at the bookstore.

Important: A reading assignment will be passed out with each homework. In the reading assignment I will try to highlight sections that are important and indicate which sections are less important as well. Since we are using a Cyclic Syllabus this year it will be very important that you follow the reading assignments as assigned. You will find the lectures *much* more helpful if you have read the assigned text in *advance* of the lectures.

Homework:

The homework is a *very* important part of this course, and will count **15%** of your final grade. Homework will usually be posted online on Fridays (along with a reading assignment for the coming week. The completed problems will be 10 days later on a **Monday**. The homework may be turned in either Mondays lecture (look for the marked box at the front of the lecture hall) or in marked boxes that will appear outside my office Rock 207 on Mondays. The deadline for submitting homework for any given Monday is 4:00 PM sharp. **Once this deadline passes, the boxes will be closed and homework will no longer be accepted – no kidding here.** If you are someone who will be having a difficult time with this you should make arrangements with a classmate or something. Homework will be graded and returned to you in approximately one week via file folders outside of Rock 207.

Here is the deal on due dates for homework: Homework solutions will written by the instructor and scanned and posted on the course web page to students on the evening they are handed in. For this reason, and because the pace of the course is relatively fast, *and* because of the very large number of students **no late homework will be accepted under any circumstances.** There will be no exceptions. This sounds really hard-nosed but it is actually pretty straightforward so I hope that students can live with this arrangement.

Having said this, I know that sometimes things happen and there are serious and legitimate reasons why students might not be able to submit homework on time. If you anticipate a personal emergency that might prevent you from handing in your homework on time, then you need to contact me (the instructor) *in advance of the homework due date* to make special arrangements. Likewise, if you are too ill to complete the work, you should notify the instructor. I am open to working out arrangements for students with special problems provided that you come to me *before* homework is due. In this case, usually what I will do is ask the student to agree to complete the homework and then once the homework is completed I will *excuse* that student from that particular homework. If student is excused from an assignment because of a personal emergency then the grade from that assignment will not be counted and instead the total homework grade will be based on the scores of the *other* submitted homeworks. Note that because of the "drop your lowest homework" policy (see below) I will generally only excuse students from homeworks because of major emergencies or illnesses – events that are completely out of ones personal control. Generally speaking, requests for excuses will need to be made in advance of the due date (when possible) and documentation of the emergency or illness will need to be provided.

Note: you should always contact the instructor as soon as it seems possible that you might not be able to submit any given homework by the due date as required. There is no penalty for asking for special arrangements in advance and then subsequently turning in your homework on time. I would much rather handle a potential problem before the fact that turns out to be a false alarm than to deal with a problem after the due date because the student hesitated to contact me in advance. As a rule I am generally sympathetic to making arrangements with students who contact me about potential problems *before* the homework is due. As a rule I am very unsympathetic to students who come to me on the day that the homework is due or later.

Here is the deal on how homework will be graded: You will be asked to submit a total of *eleven* homework assignments during the semester. For your homework grade, we will use the top *ten* best homework scores for each student and will *drop* your lowest score. I figure that during the semester, a typical student has an unanticipated personal problem or maybe one unresolvable academic conflict that substantially negatively impacts the ability of the student to complete their given homework. By throwing out the lowest score, I can account for this and students in these situations do not need to make any special arrangements with me. Note that in any case if you have a genuine personal emergency – something out of your personal control that would prevent you from completing the homework on time – you should contact the instructor in advance as described above.

Note: During those weeks where there is an hour exam on a Friday there will be no homework due that following Monday. Instead we will pass out a set of *practice problems* with solutions. Practice problems are completely optional and will not be collected or graded for credit.

Here is the deal on working with others to get your homework done: You are allowed and encouraged to work together on your homework. Learning from peers is really one of the best ways to learn physics. Just *don't over-do it*. You can help each other figure out how to approach each problem, but **you must actually work each problem yourself on the submitted homework!**. Don't let other people do the work for you. You need to learn to do the problems on your own. You can be certain that at least one of the homework problems will appear (perhaps in modified form) on each of the exams. Please do not copy other people's homework. **It is not**

acceptable to copy another's homework. It is not acceptable to allow your homework to be copied by others. Copied homework will result in zero credit assigned to both copi*er* and copi*ee*. Last semester several students were brought in for copied homework. It's not a pleasant situation. Don't be tempted. Work together but do not copy.

Exams:

There will be a four exams. Please note the dates which I do not anticipate changing:

- **First Hour Exam – Friday, Feb 08 – in class:** Worth 5% of your grade.
- **Second Hour Exam – Friday, Mar 01 – in class:** Worth 10% of your grade.
- **Third Hour Exam – Friday, Mar 29 – in class:** Worth 10% of your grade.
- **Final Exam – Monday, May 06 – 4:00 to 7:00 PM:** Worth 35% of your grade.

Exams will be "closed book" and you will be able to bring one sheet of $8\frac{1}{2} \times 11$ paper on which you may put any hand-written notes that you wish. You will generally be given the values of important physical constants, if you need them. The hour exams will be given in lecture. The final exam will three hours long. Note that all exams *together* will count for a total of 55% of your grade.

Note Regarding Missing Exams: Students are expected to make *every effort* to attend exams as scheduled. As a rule, there is no mechanism for rescheduling or arranging for a make-up exam for a missed exam. Students who incur a personal emergency (accident, illness, etc.) must contact the instructor directly *immediately* and – as a rule – this must be done prior to the exam time. Students who miss a regular hour exam during the semester, and who wish to avoid academic penalty must must document the nature of the personal emergency with the instructor. Again, as a rule this must be done in advance of the exam.

Note in particular for exam conflicts with athletic and/or intramural activities: These conflicts must be addressed and resolved at least two weeks prior to each exam.

Note: There is a special rule regarding absences for the Final Exam. In accordance with university policy, only the Office of the Dead of Undergraduate Studies can authorize an excused absence from the Final Exam of any course. If you believe you might miss the final exam for any reason you need to contact the Dean's office directly – *not* the instructor. Note that the Dean will *not* authorize make-up final exams to accommodate early departures from campus for the summer holidays. **The final exam for Physics 122 is on May 6 from 4 to 7 PM. All students must take the exam at that time. Any student who does not take the final at the proper time will not pass the course.** Plan your travel accordingly!

Laboratories:

For many of you the labs will be "something different". We take our intro labs seriously at Case Western and the level and quality of the labs here is, in my opinion, far superior to what you will find at peer institutions. You will get much more out of the lab experience if you understand the goals of the lab and invest yourself toward these goals. These goals are articulated in an article

entitled "A Sermon on the Labs" that Dan Schultz and I wrote and that you will find in the first section of your lab manual.

Important: Doing well in Physics 122 requires students to deal properly with labs. Note that the laboratory counts for 25 percent of your total score. This will make a difference. The labs are administered and graded separately on a fixed percentage scale and the lab policies are such that any student who misses more than one lab and/or fails to submit more than one lab report is not likely to earn a passing grade in the lab. Students not taking the lab seriously are the *number one reason for withdrawals and failing grades in Physics 122.* Grading policies for the labs are determined and applied by the Laboratory Director: Dr. Diana Driscoll: diana.driscoll@case.edu. In the past, a minimum raw score of 60% or higher has been required to pass the intro labs.

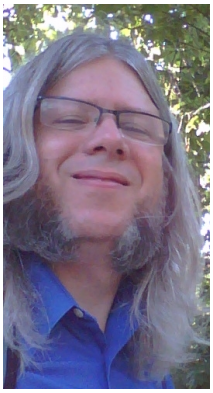
Important: Do not miss your lab assignment! Each student is assigned to a lab that meets every other week. Students can easily get confused about this. I suggest that you sort out any confusion about when your assigned lab slot is right away and make sure you mark on your calendar the specific times and dates for your lab so that you do not miss them. The bottom line on the labs is that you must do a decent job on them or your grade will suffer substantially. **You must not miss your assigned lab.** Several people got into serious grade trouble last year by not taking the labs seriously. **Several students who were earning decent grades in the class earned a D or an F because the did not deal properly with the labs!** If you fail to attend or complete even one or two lab reports you can quickly find yourself in serious danger of failing labs. It's worth repeating this because it is so critical: *The single most common reason that students to fail or are forced to withdraw from the class is because they do not properly attend lab and/or do not properly hand in their laboratory assignments*. You really don't want to have to explain to your parents that you had to withdraw from physics just because you forgot to mark your calendar to attend labs, do you?

Here are some of the key policy rules for the lab:

- Reports due: one week after you do the lab (For the spring break week, reports are due one week BEFORE you perform the next lab.)
- Written reports must be submitted hard copy *and* electronically. Failure to submit the electronic copy will result in a zero for the lab. Labs must be submitted electronically within 24 hours of the hard copy submission.
- Deadline for requesting an end-of-semester makeup: 2 weeks from the date of the missed experiment
- Deadline for resolution of *all* problems: First Reading Day before Finals (**April 28, 2011**)
- You may lose points for each instance of: wrong mailbox, missing report cover sheet, incomplete ID, forgetting your notebook (5 pts)
- If you miss a lab without valid reason you earn a zero (0) for that lab.
- If you know you have a conflict with a lab for a athletic activity or other pre-scheduled event you must make arrangements with your TA and/or Dr. Driscoll to reschedule your lab at least **two weeks in advance**.

- Late arrival or attending wrong lab section without valid reason: 5 percent of the points from your total lab grade, for the entire semester per occurrence.
- Late work: 10 percent (of total credit) per weekday until 1 week after due date, 0 credit afterwords. Penalty applies to *all* parts of the lab, even if some parts were submitted on time.
- Correctly Attributed Copying: 50-100 percent of value of copied work (depending on amount copied) with minimum loss of 6 points.
- Plagiarism: 100 percent of your grade for the report and forwarding of evidence to the Office of the Dean.

How to Contact the Instructor:



In the modern age of communications, there are several ways to reach me:

Corbin Covault
Office Phone: (216)-368-4006 (with voice mail)
Mobile Phone: (216)-339-3861 (with text messaging)
Internet Email: `corbin.covault@cwru.edu`
(**For Email Please always put "PHYS 122" in subject!**)

Office Hours: Rockefeller 207 **Mondays 1:00PM to 4:00PM**
Thursdays 1:30PM to 4:00PM
Fridays 1:30PM to 2:30PM
Other times: by appointment

The easiest and the best way to contact me is send me e-mail. *Please put the words "PHYS 122" in your subject line as I am much more likely to notice this sooner.* I check my e-mail frequently and I save everything. If you call and ask me something on the phone or ask me for something right after class, I am more likely to forget. If it is important, send e-mail, and include a header like: "Phys 122: Important: Need help on Homework Problem 3" or whatever. As an alternate to email, you should also feel free to send a **text message** to my mobile phone, but again it's very important that you make it clear from your text that you are a current student in Physics 122 when you do this. I generally do not respond to texts from anyone I don't recognize.

You should feel to try to reach me any time, day or night. However, follow these guidelines: From 7:00 AM to 9:30 PM please feel free to contact me at work or at home using my office or mobile phone, and/or my e-mail and/or text. If you leave a message on my voice mail, please *speak clearly and loudly* and be sure to state your *full name*, indicate when you are calling (time and date) and how I can reach you. **After 9:30 PM, please send me e-mail or text message only. Do not call me on the phone, as this will disturb my family.** But feel free to send email or a text, no matter how late it is. If you are up late working, chances are high that I am too. If I am awake, I will respond as quickly as possible. If I am asleep, then I will try to respond to you when I wake up.

This document has just told you everything you need to know to track me down. Please do so as soon as it is clear to you that you need to communicate with me about anything regarding this course, particularly if you have a concern or problem. If you leave a message I will try to get back to you as soon as I can.

Note also that I get email notification whenever someone leaves a message on the P122 Phorum Discussion Board. So if you have a question that you think might be of general interest post it there and I will reply so that everyone can benefit. I check the bulletin board on the web page most every day. Last year our Discussion Board outpaced every other similar site for postings on any other topic on campus.

Instructor's Office Hours:

I love to meet directly with students. My main office hours will be **Thursdays, Fridays and Mondays in my office, Rockefeller 207.** The times will be set during the first week and will be posted on the Phys 122 web page. If the posted times slots are bad for you, contact me directly to schedule an appointment at a more convenient time. I encourage you to approach me immediately after the lecture if you would like to clarify some point or discuss anything in the course material that is not clear to you.

I want to be as accessible as possible during the semester. I am willing to meet with students on most any day if you make an appointment. I welcome students visits. Please come see me often. Call ahead if you are able, since I sometimes have lab meetings and so forth that take me out of the office. Sometimes there is a sign on my door if I am out indicating where I am and when I will return. But in any case I am always happy to schedule an appointment. **Note: I am generally not on campus on Saturdays, Sundays, and Wednesday afternoons, although I should be reachable by phone or email on any of these times.**

The P122 Web Page:

We are supporting the administration of this class on the web. The URL address of the Physics 122 Home Page is: `http://www.phys.cwru.edu/courses/p122`

The P122 Home page will support the following:

- A copy of every document generated for the class including syllabus, homework assignments, exams, announcements, etc.,
- Scanned homework solutions and exam solutions, and (on occasion) lecture notes,
- Special practice problems with solutions,
- On occasion, audio recordings of lectures,
- Links to Mediavision video archives of all lectures.
- Links to registration and support information for the PRS wireless Classroom Response System.
- A bulletin board for public/anonymous Q&A between students and instructor (very handy!), and
- Pointers to other resources that might be useful for P122.
- An (occasionally) updated anonymously indexed report of student point scores in the course.

There is also a web page which has all of the details on the physics labs:
`http://physicslabs.phys.cwru.edu`
Please check this out for any details concerning the lab.
Your feedback is welcome.

Grading policies:

I strive for a fair and impartial grading policy. You grade should reflect the degree to which you have demonstrated mastery of the material and central concepts of the course. The grading will be based *strictly* on a comparative total numerical score tallied at the end of the semester. Your scholarly attitude, diligence, and effort will only impact your grade insofar as they increase your ability to earn higher numerical scores on the assignments. Your numerical score alone will determine your assigned grade. This means that everyone with the same total numerical score will get the same letter grade. There is no mechanism for "extra credit".

The numerical grading system assigns a total of 1000 points, as follows:

Work:	**Points:**	**Percentage:**
First hour exam	50	5%
Second hour exam	100	10%
Third hour exam	100	10%
Final exam	350	35%
Homeworks (15 pts each)	150	15%
Laboratories	250	25%
Total:	1000	100%

In addition two the numerical score there is a further constraint: **Any student who is not present for and/or does not take the final exam will not earn a passing grade in P122.** Note that only the Dean of Undergraduate Studies has the authorization to excuse an absence from any regularly scheduled final exam.

Note that I do *not* assign letter grades to individual assignments or exams. Letter grades are assigned only in two instances: (1) provisionally at mid-terms and (2) at the very end of the course.

Letter grade assignments will correspond to numerical score ranges. The correspondence between numerical scores and letter grades will depend both upon the distribution of the scores and upon a reasonable expectation for performance in the course. Students who can demonstrate minimal understanding of the key concept of the course will receive a passing grade. Students who display deeper understanding will receive higher grades.

All of the time I have students ask me about my grading policy. The question usually boils down to *Do you grade on a curve or do you grade straight percentages?* The answer is *neither*, exactly. So here, in detail, is how I grade:

For any particular assignment or exam, I have an *apriori expectation* for how well students ought perform and I check my expectation by calibrating it against the actual performance of the students in the class. As a rule, the calibration corresponds to a typical student who is near the middle of the class earning a letter grade of "B". My expectation value will vary from assignment to assignment but I will generally target a median performance level of approximately 60 to 70 percent of the points on exams. But this will vary from exam to exam and it cannot be predicted or forecast by students or the instructor in advance. This means that if everything goes according to my *apriori expectation*, students who earn scores of very roughly 70% percent on exams and who keep up to class average on homeworks and labs can expect to earn a "B". Students who perform

at levels substantially higher or lower can expect to earn correspondingly better or worse letter grades. If student performance has a distribution that matches my expectations, then roughly half of the students will earn B's, and most of the rest will earn A's and the remaining a smaller group will earn C's or lower. In the past, the "A/B" cutoff percentage has been somewhere in the low to mid-80's. The C/B cutoff has been somewhere in the low to mid 50's, and student will almost certainly need to earn at least 40 percent of the points to pass. All of these numbers correspond to a very approximate "apriori expectation baseline" and are subject to change, but these are roughly my expectations.

However, sometimes student scores to not match my expectations. In this case I *adjust* the grading system – but I only do this if this works to the advantage of students. Here's how this works in two possible cases.

First, if for the class *as a whole*, student performance is generally *better* than my expectations, then on average letter grades will be generally *higher* and *all* students who perform better than my expectations can expect at least a "B" and possibly a "A". In this case no "adjustment" is made. In other words, if exam averages are significantly higher than the expected value of 60 to 70 percent, the average grade can in fact be significantly higher than a "B". In principle this means that, every student in the course can earn an "A" by performing at a level that is significantly higher than my *apriori* expectations for a "B" performance level. Note: This means that you *cannot* raise your grade in the course by working actively to lower anyone else's grade. Your grade will depend upon your performance alone.

However, if for the class *as a whole* student performance is generally *worse* than my expectations, I usually attribute this to problems with the course (ineffective lectures, over-difficult or over-long exams, etc.) In this case I *adjust* (i.e. curve) the course grade so that the student who performs at an average level can still expect a grade of "B". In other words, if the class average on exams drops much below the apriori expected scores of 60 to 70 percent, then I curve the grades so that the average student can still expect a "B".

Basically, then, I curve the class if it helps the students. Note that the decision to adjust is made on an exam-by-exam basis and

Finally, since I do not grade on an fixed pre-set "absolute" scale, I cannot precisely predict in advance what final point total or what percentage points on any given assignment will correspond to what particular letter grade. If you ask me for this, I will tell you that I cannot do it. I know that for some students it is very important to know exactly what their letter grade standing is. Unfortunately, I can only determine this approximately until we reach the end of the semester. And in general this means that students who want to get an idea of where they stand will usually need to make an arrangement to meet with me to discuss this in office hours. However, I am very happy to meet with individual students who are interested in learning "where they stand" at any point in the course based on work completed. Please see me directly if you have any concerns or confusion as to how the grades for the course will be determined.

One final point: In evaluating the work we will strive to achieve the most fair and objective grading strategies. This means, for example, that all of each exam problem will be graded by a single grader, for consistency, etc. Exams will cover materials discussed within lecture or material in the texts referred to within lectures only. You will not be responsible for material outside the scope of the course as delineated in this syllabus.

Bonus Points:

Note that there is, in general, no mechanism for "extra credit" in Physics 122. Grades are based strictly on numerical point totals only. However, there will be several occasions during the semester for students to earn "Bonus Points." Students can earn bonus points two ways:

- By participating with I-Clickers during some lectures, or
- By participating with weekly practice homework problems on Expert TA.

Students who participate with the I-Clicker system during lecture will earn one or two bonus points per lecture. A maximum of 40 bonus points for clicker participation will be awarded over the whole semester. Bonus points earned from I-Clicker participation will be applied to raise a given student's score of any *one* problem on the final exam. The final exam will consist of nine problems, each worth between 30 and 50 points. Bonus points will be *automatically* applied to exactly *one* problem on the final exam so as to maximize the total score for the whole exam. Note that no matter how many bonus points a student has, these points can only be applied to only just one problem on the final exam.

Students who participate with the Expert TA online practice problem homework will receive one homework bonus point per assigned practice problem if the problem if the student earns a score of at least 50 percent for the problem. A maximum of 30 bonus points for Expert TA participation will be awarded over the whole semester. Bonus points earned from Expert TA participation will be applied to raise a given student's score on assigned homeworks by up to three points per homework. Bonus points will be *automatically* applied so as to maximize the student's overall homework score for the course.

Note that I-clicker bonus points and Expert TA bonus points are not interchangeable. Note that bonus points cannot be applied to hour exams or labs.

Note that all course grades will be initially determined prior to the application of bonus points. All bonus point activities are completely optional. Failure to participate cannot lower any students grade.

Note that all bonus points are experimental and are not guaranteed. They may not be traded or negotiated or appealed for in any way. *The entire Bonus Point program for Physics 122 may be completely canceled or withdrawn for any reason by the instructor for any and/or all students at any time during the semester before grades are assigned.* All decisions regarding the application of bonus points are completely at the discretion of the instructor and all decisions regarding bonus points are final.