PHYS122 Fundamentals of Physics II

MWF 9–9:50am in PHY 1410 and 10–10:50am in PHY 1412

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Textbooks

The primary textbook for this course is *Collge Physics: A Strategic Approach*, 2nd Edition by Knight, Jones, and Field (Addison-Wesley publishers, ISBN 978-0-321-59549-2). I will not be assigning readings or required homework problems from this text, but it is invaluable for gaining a different perspective on the material that I present in class. Other perspectives can be gained online, but remember that I cannot and will not vouch for the veracity of every webpage out there. Read what you find online critically and always ask yourself if the source is trustworthy before using material found online in this course. Please note that this book is sold in two forms: a two-volume paperback and a one-volume hardback. The ISBN above is for the single volume hardback, which you probably still have from 121. If you don't have the hardback version from last semester, I still recommend you get it because we will be covering material from both halves of the book this semester (*i.e.*, you would need both volumes of the paperback set if you got it). The book also comes in a variety of packages which bundle different supplements with the textbook. You will not need any of these supplements in this course, so I suggest avoiding the bundles to save money.

For tutorials and labs you will need *Physics 122: Tutorials and Laboratories*, Fall 2006 Edition (ISBN 978-0-470-56674-9). This is a custom book published by Wiley & Sons specifically for use in this course. Because you will be writing in this book for the tutorials, you will need a **new** copy of this book.

You will also need a RF Clicker from Turning Point Technologies. This is the campus standard clicker and thus you may already have one from previous courses. You can also use the ResponseWare software from Turning Point Technologies to turn your smartphone or laptop into a clicker (it's actually cheaper this way). Don't forget that you will need to register your clicker (be it a stand-alone unit, an app simulating one, or the web interface) in order to use it. If you are using a stand-alone clicker you will need to ensure that it is set to channel 6 for each class in order to get participation credit. If you are using an app or the web interface which simulates a clicker then you need to login to session ID Springuel121. You can learn more about clickers, including how to register it, change channels, or set your session ID, at http://clickers.umd.edu/.

Class Participation

You are expected to attend all classes—lectures, discussions (tutorials), and labs. Each will involve your participation, including lecture. Most of these activities will result in participation points. Taken altogether participation is a full 20% of your grade.

Lecture

Lectures will be non-traditional and you will be expected to participate. Through the use of informal discussions with your neighbors, coordinated whole class discussions, clickers, and interactive lecture demonstrations I hope to create an environment in which you can express your opinion and contribute to the direction of the course.

Clickers

When clickers are used in class, you only get participation credit (1 point) for answers which are submitted at the appropriate time by using your clicker. You get points for participation only, not for simply attending lecture. If you forget your clicker, it doesn't work, or you fail to submit an answer on time, you won't get participation credit for that question. It is thus essential that you get any problems you have with your clicker fixed as soon as they occur. While you are encouraged to give your best answer whenever submitting an answer via clicker, your answers will **not** be graded for correctness. Any submitted answer will get you the participation point. Based on past semesters, there will be approximately 150 questions during the course (on average 3 to 4 each day, but likely more when we're going over examples and less when we're introducing new ideas).

Interactive Lecture Demonstrations (ILDs)

ILDs are worksheets which use a combination of clicker questions, small group work, and whole class discussions to go over a topic in more depth. We will be doing five of these during the course of the semester and you will get 5 points of participation credit for each one (this is on top of the points you get for any clicker questions included in the ILD). Worksheets are to be handed in at the end of class so that I can verify your participation.

Lecture participation points are easy to earn in principle, but also subject to the possibility of technical problems. As a result, I will make the determinations for the letter grade cut-offs when grades are calculated, after I've had the chance to see if how many points are actually being accumulated.

Tutorial

Based on past experience with other courses and instructors, many students find tutorials to be the most valuable element in the class for learning to do exam questions and homework problems. To encourage your participation, therefore, you can earn up to 5 points for your participation in each tutorial.

All discussion sessions are run as group tutorials. — The discussion sessions will be run as group activities using the tutorial worksheets in the Tutorial and Lab Manual. The tutorials have two goals:

1. to help you develop your conceptual understanding of the basic ideas underlying the physics,
2. to help you learn to think about how you know what you know.

Tutorials are where you learn to talk the talk! — The tutorial is about a lot more than just filling in the "right" answers in the worksheet. In the tutorial the most important thing for you to do is to try to understand what the physics principles are saying, and how they don't actually contradict what you know from living your life (though at first, they may seem to). You accomplish this by discussing the issues with your peers, learning what they think and clarifying for them what you think. You may be surprised to find that many of your colleagues don't actually agree with things that you think are obvious! And a critical part of learning to do science (any science) is not just learning the facts and

procedures, but learning to discuss the issues intelligently — and to work out things that may not be obvious at first.

Get problem help in the Course Center! — Since we will not be answering questions about HW in the discussion sections, we have set up a Course Center in room Toll 0208. You can come there to check other texts for ideas, to work with other students, and to ask the course center monitor (me or one of the TAs) some questions. Don't expect the monitors to show you how to do the problems, however. The problems are designed so that you learn by thinking about them, not by memorizing them or watching someone else show you how to do them. Monitors are encouraged to ask you questions first, to find out where you are coming from, and then to give you suggestions and hints for what you might try to solve them. Your colleagues are free to tell you anything, but you have to decide if they are right or wrong!

At the end of each tutorial, you will be given a short worksheet to complete at home. This worksheet is designed to review important concepts from the tutorial and/or prepare you for the next one. It is due at the beginning of your next tutorial but will not be graded. In order to gain full participation points for the tutorial, you must complete and turn in this homework. **Exception:** There will be no homework for the 13^{th} and last tutorial since you won't have a class after it where you can turn it in.

Letter grade cut-offs for the contribution of tutorial participation to your final grade will be 95-90-85-*etc.* These are more stringent than normal because these points are participation based and because it is that participation that is so important to developing the habits of mind that will help you in this course and beyond.

Laboratory

Ya gotta do the labs! — There will be an introductory lab plus 5 two-week labs during the semester. You must complete all of these labs in order to pass this course. This is a requirement in order to meet professional school criteria. If you miss 3 or more labs you automatically fail the course. If you miss several labs for reasons outside your control, then you should talk to your advisor about whether a Withdrawal or an Incomplete is more appropriate to your situation.

These are non-traditional labs! — Laboratories in this class will involve both exploration and creativity. Instead of being given a long step-by-step procedure, you will be given a question in a sentence or two. You will work in groups of 4 to plan and carry out your own experiment. In a second week you will analyze and model your data mathematically using Excel (a spreadsheet).

Each lab is graded out of 25 points but the introductory lab only counts for half of a normal lab. The contribution towards your final grade will most likely be the percentage of points earned with 90-80-70-*etc.* cut-offs applied for letter grades, but since there will be different TAs grading different sections, I reserve the right to adjust things, on a section by section basis if necessary, to keep things consistent across sections.

Homework

Homework is easily the most important part of this course, both because it carries a full 20% of your grade, and because it is in doing the homework problems that I expect you to do the most learning. Learning physics is like learning to play a musical instrument. I can show you the tools and techniques in class, but unless you practice using them, you won't learn them. The homework is designed to give you this practice. There won't be very many homework problems in each assignment, but you should expect every problem to be challenging, so plan ahead and don't leave it to the last minute.

Work together! — Since the problems will be difficult, it may not be easy to do them entirely on your own. You are encouraged to work together, but each member of the group must fully understand how

to solve each problem on their own. ("Oh, I see." is not good enough!) Each person must write up his or her own solution. The best way to be sure to not produce cloned solutions even when you work together is to agree on a solution, then each write up the work independently. Do not all copy from a solution you worked out together on the board. Do not write down what another person tells you to. Do not copy from notes (either your own or another students) which were taken while you were working with the group. Instead, recreate the solution on your own paper and include discussion and explanations of what you have done. If two or more write-ups are found to be essentially identical, both will be reported to the honor council and the grade in the course of the involved students will be subject to the outcome of their proceedings. As a word of advice, never email your finished solution to another student. Those guilty of facilitation (helping another student cheat) are subject to the same penalties as those actually cheating. Likewise, any solution which appears to be a close copy of a solution from a previous year will be submitted to the honor council.

Explanations are essential. — On homework (and on most exam problems) you will be expected to include explanations as to what principles you are using and how you know they are relevant. An answer which only includes equations will not get full credit (indeed, it isn't likely to get any credit).

HW is on the web. — Homework will be assigned every Friday and will be due at noon one week later. Homework will be posted on ELMS and you will be turning it in via ELMS as well. Solutions will be posted there soon after they are due. As a result, late homework will not be accepted. Likewise, because homework is turned in online no excuse will be accepted for not turning it in.[1]

All HW must be typed! — Any homework that you turn in must be typed up to ensure legibility. We can't (and won't) grade what we can't read. If you need to include an equation, you may leave space for it and fill it in by hand, but you do so at your own risk. Make sure it is legible. If you know how, I strongly suggest using an equation editor. If you need to include a sketch, you may add that in by hand as well, but remember to make it large enough and neat enough that the grader can clearly read and understand what you are trying to depict. Please note that just because you want to add something to your homework by hand, doesn't change the fact that you will be turning it in electronically. If you do parts of your homework by hand, you will need to scan that piece and attach it to your homework so that it can be submitted via ELMS. If you don't have a personal scanner, then you have a couple of options:

- Several of the computer labs on campus have scanners in them. Consult with the OIT website (http://www.oit.umd.edu/wheretogo/seeTable.cfm) to figure out the places and times they are available and plan ahead. These computers being unavailable at the last minute when you go to turn in your homework is not an acceptable excuse for late homework.
- If you have a smartphone with a built-in camera, then you can get an app which will allow you to use that camera as a scanner (*e.g.*, http://www.docscannerapp.com/). These apps will automatically process a picture of a page taken with the camera to square it up and crop it properly. Without this sort of processing, a simple picture of a page is likely to end up distorted and difficult to read. Submit such pages at your own risk.

Homework will be substantial. — You should expect to spend between 4–6 hours each week on homework. Do not save it for the last minute as not completing the problems will adversely affect your grade (though it's not as bad as not doing anything at all).

Since the TAs are only paid for enough time to spend about 5 minutes on each of your assignments (probably less), only one problem per week on the Friday homework will be graded in detail on a basis of 1–6 and will provide you feedback. The rest will be scanned for reasonableness and given a grade of 1 (the

[1]Exception: If you are medically unable to do homework for an extended period of time (at least 4 days out of the week during which the homework was assigned) then an exemption will be granted with the appropriate medical documentation showing that you could not do the work.

ideas present are unrelated to the question being asked), 2 (the right ideas are present), or 3 (done correctly, the method used can get the correct answer).[2] Problems which are incomplete will receive a grade of 1 point lower than their quality would indicate (*e.g.*, a 3-point problem which starts with a viable method but which ends before arriving at an answer would receive a 2). On these "lightly graded" problems, you could get full credit and still have all the problems wrong! It is essential that you read over the solutions carefully in order to understand whether you had the right idea or not.

The contribution to your grade from homework is calculated as a percentage of the points earned with the traditional 90-80-70-*etc.* cut-offs applied.

Extra Credit

Each Friday homework assignment will have 9 problems on it which you can do for extra credit: 3 relatively easy (1 point each), 3 medium (2 points each), and 3 hard (3 points each). These problems will be taken mostly from the textbook, but may include similar problems derived from other sources. They will be graded on a pass/fail basis. Either you did the problem right and get full credit, or either your explanations or work is incorrect and you get nothing. The problems are turned in via ELMS (following the same rules as a regular homework assignment) and must follow the format demonstrated in the example problems in your textbook. Problems which do not include explanations (even if the problem didn't explicitly ask for them) or which do not follow the correct format will not get any credit.

You can earn a maximum of 100 extra credit points in this course. Earning all 100 points will raise your grade by 1 full letter grade (*i.e.*, a B− would become a A−, a C+ would become a B+, *etc.*). Earning less than the full 100 points will be prorated accordingly.

Exams

There will be 3 exams in this course: 2 in-class exams and the final. **All** exams are cumulative (and may include material from 121), but will concentrate most heavily on the material since the last exam. All exams will be scanned immediately after they are administered so that if one (or a piece of one) disappears in the grading process, it can be recovered.

In-Class Exams

The in-class exams will be given on a Friday (tentatively scheduled for March 2$^{\text{nd}}$ and April 13$^{\text{th}}$) and returned on Monday when we will go over the answers in class. Make-up exams will be on the following Thursday in the late-afternoon/evening (time and place TBD). Anyone may take the make-up exam. If you elect to take a make-up exam, then your final grade for the exam will be the average of your original grade and the grade that you receive on the make-up. Students who carefully consider their errors and understand what they did wrong on the first exam almost always improve. Students who don't do this and just "take another shot" and "study some more" are as likely to go down as to go up.

Missing the Exam — If you miss an exam without a valid excuse (see Attendance, below) then you will receive a 0 for that exam. If you have a valid excuse for missing the exam, then you will not get a 0 for the original exam and your make-up exam score will be treated as your score for the exam.

Regrades — Neither the TAs, nor myself, are perfect when it comes to grading. With 200 exams to grade, we are likely to make a mistake now and then. If you think the grader misunderstood what you were saying, or failed to give you proper credit, you can submit a written (typed!) request for a regrade. This request must include a clear description of why you think you deserve more points and must be accompanied by the original exam. **Do not write on the exam itself.** If you alter a graded exam and request a regrade I will automatically reported it to the honor committee.

[2] In both cases a grade of 0 is reserved for those who do not turn a completed problem in.

Exams will consist of 5 parts worth 20 points each: 5 multiple-choice problems similar to what you would see on the MCAT (and like the Passage problems in your text book), and 4 longer problems. With the exception of the multiple-choice problems, exam problems will not be standard end-of-chapter problems. You will be expected to think, and to explain your reasoning to obtain full credit. Questions of the type found on the exams will be included in the homework problems.

The exams will be hard and the average score out of 100 will probably be around 60 (based on past experience). This is because the exam is meant to help you learn and you learn the most from mistakes (more specifically, from figuring out how to fix them). However, as a result, I will not be using the traditional 90-80-70-*etc.* cut-offs for determining letter grades. In the past an A has been a 75 or better and an F has been below a 40, however I will probably adjust these cutoffs for each exam slightly. The actual cutoffs applied will be announced when the exams are returned. *N.B.* This does not mean that I am curving the exams. Applying a curve would require that I give the same number of Fs as As (more, actually, since As are gradated into A+, A, and A−, while there is only F at the other end). The performance of your classmates on the exam will never determine your grade. If everyone does well on the exam, then you will all get As. The reverse also holds true, however, so do not expect to get a good grade just because everyone does poorly.

Final Exam

The final exam for this class is scheduled for May 16th at 8am if you are in section 03** (the 9:00am section) or May 18th at 8:00am if you are in section 01**(the 10:00am section). These are the slots assigned to the course by the University and thus should not conflict with your other exams. It will be twice as long as an in-class exam and thus carries twice the weight. While I will lengthen the multiple choice problem section by simply doubling the number of questions, I reserve the right to use longer problems rather than simply more of them for the rest of the exam. The same grading criteria will apply to the final as apply to the in-class exams.

Please keep in mind that talking to students in the other section between the two exams is a violation of the Honor Pledge.

Grading

The components of your grade break down as follows:

Lecture Participation	10%
Tutorial Participation	10%
Homework	20%
Labs	20%
Exams	20%
Final Exam	20%

Because the point scales for each of the components of this course are not related, after each of the exams I will release an advisory grade on ELMS which tells you how you are doing in the course thus far (the first advisory grade coincides with your Early Warning Grades and will also appear on Testudo).

Attendance

If you cannot attend a lecture, tutorial, or lab session for a valid reason, as defined by the University attendance policy (http://www.testudo.umd.edu/soc/atedasse.html), then you should inform me ahead of time so that alternative arrangements can be made. All excuses must be documented (though the University does allow you to self document for 1 absence due to illness). You **must** provide me with the documentation for the absence, preferably before it happens. TAs cannot excuse you from any class activity. Absences without a valid excuse will result in a 0 for any assignments missed as a result.

Honor Pledge

The University has a nationally recognized Honor Code, administered by the Student Honor Council. The Student Honor Council proposed and the University Senate approved an Honor Pledge. The University of Maryland Honor Pledge reads:

> *I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination.*

For homework assignments in this course, the Pledge statement should appear on the first page of all assignments and can be digitally signed (since the work is being turned in electronically). For exams, labs, and other assignments turned in on paper the Pledge statement should be handwritten and signed on the front cover (in the case of a lab, all group members should sign, but the statement itself need only be written once). Students who fail to write and sign the Pledge will be asked to confer with the instructor.

For more information on the Honor Pledge visit http://www.studenthonorcouncil.umd.edu/.

Please note that I take this very seriously on every assignment. I have referred students to the Honor Council for cheating on homework problems and extra credit in the past and they have been found responsible and received an XF grade for the course. I do not confront students I suspect of cheating and give them a chance to explain themselves to me. If I suspect you of cheating, the first you will hear of it will be when the Honor Council contacts you.

The course is designed so that no one bad assignment can cause you to fail. You can even fail the final and still get an A- in the course (provided, of course, that the rest of your work is good enough to make up for it). As a result it's likely that cheating won't help your grade enough to make the risk of getting caught worth it.

Students with Disabilities

If you have a disability which would interfere with your performance in this course and would like to request accommodations, you must consult with Disability Support Services and obtain an Accommodation Letter from them. Once you present me with this letter, I will make every effort to follow the requested accommodations where doing so can be done without compromising the learning experience of the course.

Semester Calendar

This calendar is subject to change and is not considered to be part of the syllabus proper.

Lectures

Monday	Wednesday	Friday
Jan 23rd	25th **1** Introduction & Learning Goals	27th **2** Review of Physics 121
30th **3** ILD 1 — Seeking Consistency: Harmonic Oscillation	Feb 1st **4** Harmonic Motion	3rd **5** The Pendulum
6th **6** Wave Pulses	8th **7** Superposition	10th **8** Sinusoidal Waves
13th **9** The Ray Model of Light and Shadow	15th **10** Mirrors and Virtual Images	17th **11** Curved Mirrors and Real Images
20th **12** The Mirror Equations	22nd **13** Refraction and Total Internal Reflection	24th **14** Lenses
27th **15** ILD 2 — Working Out What a Model Implies: Images	29th **16** Examples and Review	Mar 2nd Exam I
5th Exam I Review	7th **17** Huygen's Principle: Waves	9th **18** Recovering the Ray Model Results
12th **19** The Wave Model and Two Slit Interference	14th **20** Diffraction	16th **21** Diffraction: Examples
19th **Spring Break** No Class	21st **Spring Break** No Class	23rd **Spring Break** No Class
26th **22** ILD 3 — Making a Model: Thinking About Electric Force	28th **23** Electric Charge, Electric Force, and Coulomb's Law	30th **24** ILD 4 — Representation as Communication: Fields

Monday	Wednesday	Friday
Apr 2nd **25** Fields: Examples	4th **26** Electrical Energy and Voltage	6th **27** ILD 5 — Electrostatic Potential and Analogies
9th **28** Understanding Currents: Analogies and Kirchhoff's Laws	11th **29** Examples and Review	13th Exam II
16th Exam II Review	18th **30** Currents	20th **31** Currents
23rd **32** Examples with Currents	25th **33** More Complex Examples with Currents	27th **34** Capacitance
30th **35** Magnetic Forces and Fields	May 2nd **36** Magnetism and Moving Charge	4th **37** Puzzles in the Structure of Matter: Interaction of Matter and Light
7th **38** A Third Model of Light: The Photon	9th **39** Review	11th

Final Exam

Section 03** (the 9:00am section) has its final exam on Wednesday, May 16th, 2011 from 8:00–10:00am. Section 01** (the 10:00am section) has its final exam on Friday, May 18th, 2011 from 8:00–10:00am.

Tutorials & Labs

January 30–February 3:
- Tutorial 1: Harmonic oscillation
- Lab 0: How to use Excel to Illustrate Data

February 6–10:
- Tutorial 2: Finding mechanism: Pulses
- Lab 1: Damped Oscillations I

February 13–17:
- Tutorial 3: A model for light
- Lab 2: Damped Oscillations II

February 20–24:
- Tutorial 4: How can you tell where things are by looking?
- Lab 3: Light Refraction I

February 27–March 2:
- Tutorial 5: Can an image float in empty space?
- Lab 4: Light Refraction II

March 5–9:

Tutorial 6: Two source interference

Lab 5: Double Slit Interference I

March 12–16:

Tutorial 7: Wave properties of light

Lab 6: Double Slit Interference II

March 26–30:

Tutorial 8: Working from a model: Static electricity

No Lab

April 2–6:

Tutorial 9: Abstract concepts: Fields

Lab 7: Ohmic Materials I

April 9–13:

Tutorial 10: Potentials

Lab 8: Ohmic Materials II

April 16–20:

Tutorial 11: Hidden assumptions: Electric circuits

Lab 9: Magnetic Force I

April 23–27:

Tutorial 12: Implications of a model: Electric circuits

Lab 10: Magnetic Force II

April 30–May 4:

Tutorial 13: Organizing observations: magnets and fields

No Lab