Syllabus for Physics 142L: General Physics II
Duke University, Spring 2015 (Revised Mar. 23, 2015)

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1. Introduction

Welcome to Physics 142L, General Physics II, which is the second part of the Physics Department's two-semester introductory survey of the fundamental concepts needed for understanding the physical world. This course covers electromagnetic phenomena (E&M for short), including electrical and magnetic forces, and light, which can be understood as an E&M wave. The science of E&M has had an enormous impact on our society, finding numerous applications in modern technology, from basic electrical systems and motors to electronic devices for communications and medical imaging. The course is intended for life-science students, but is also appropriate for anyone interested in a quantitative approach to the subject. Algebra, trigonometry, vectors, and multi-dimensional calculus are used throughout the course.

During the semester, you will be provided with many opportunities to master fundamental concepts and apply your knowledge to the relevant problems in both in-class and out-of-class learning activities. We will be using an active, student-centered learning pedagogy, emphasizing pre-class activities (reading the textbook, watching videos, testing your initial understanding with pre-class on-line activities), team-based problem solving in the class, homework, quizzes, laboratories, and discussion sections. The essential components of this teaching pedagogy are described in Section 7 below. If you feel that this pedagogy is not a good match to your learning style, you should consider to take PHY142L in the Fall or the Summer, which use a more traditional lecture format, but still use team-based learning in recitations)..

We look forward to interacting with you this semester – we are here to help you be successful!

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2. Instructors

A team of instructors (faculty, staff, and graduate students) teach PHY 142L and, collectively, they have many years of experience teaching this course. You should feel free to talk to Prof. Gauthier, the other co-instructors, and the graduate Teaching Assistants, whose contact information is given in the next section. You can also meet with the class instructors during Help Room (see Sec. 6 below) or schedule an appointment, preferably by email or after class.

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3. Prerequisites

To enroll, you must have received a grade of C^{--} or better in Physics 141L or an approved equivalent. Please contact Prof. Gauthier as soon as possible if you are not sure whether you satisfy this prerequisite or whether Physics 142 is the best introductory physics course for you.

In order to receive a grade for Physics 142L, you must also register for a laboratory section. During these times, there will be either a laboratory activity or a discussion section and a quiz. (Over the course of the semester, there will be 6 labs and 6 discussion sections. See the detailed schedule in Sec. 13).

If you have not recently taken Physics 141L, or need some extra help reviewing the material, there are two optional assignments on a review of vectors and Newton's laws, which you should complete in the first week of the course. See the *MasteringPhysics* eLearning site after you register as discussed in the next section.

4. Teaching Pedagogy, Typical Work Schedule

As discussed above, we will be using an active, student-centered teaching pedagogy that we believe will help you best learn and retain the topics covered in this course. Please note that many post-graduate programs are using this teaching pedagogy, including many Medical, Business, and Law programs (including the Duke programs). The reason that this teaching approach is being used is because it work – several studies have shown that active, student-centered teaching pedagogies results in better retention of material, higher scores on exams, and lower drop-out rates.

The elements of this teaching approach include:

- You will be required to read the assigned sections of the text before each learning unit. (**Estimated time: 1.5 hours**)
- Brief videos will be available that summarize the material of the learning unit. You are not required to view these videos, but we hope you find them useful. (**Estimated time: 0.5 hours**)

- After these preparation activities, you will be required to complete a pre-class activity on *MasteringPhysics*, due by Monday at Noon (12:00 PM) for each learning unit and made available to you by Noon of the previous Friday. These activities included guided tutorials and concept questions. You will see whether you have the problem correct in real time and are allowed multiple submissions, although you will receive the highest score if you get the problem correct on the first submission. If you find you are still having difficulty with the questions asked during this activity, you should attend the Monday evening Help Room so that you are prepared for Tuesday's class. Calculators are allowed for the pre-class assignments. (**Estimated time: 1.5 hours**)
- For the Tuesday primary class, we will start by a brief mini-lecture on a topic voted on by the class (you will enter your vote as the last question of each pre-class assignment). This will be followed by a question-and-answer session, and then an individual Readiness Assurance (iRA) that will test whether you have prepared for the learning unit and are ready to move on to more challenging topics. The iRA will consist of five brief problems with at least 4 out of the 5 problems being multiple choice concept/reading questions and the other a short worked problem. You will complete the iRA as an individual using the *Learning Catalytics* platform with your computer/tablet/smart phone. You will not see whether you completed the question correctly. Immediately after completing the iRA, you will work with your permanently assigned learning team to complete the SAME assignment, called the team Readiness Assurance (tRA) where only one team member will enter the responses for the team. The team will see whether the answer is correct after each submission and submissions will continue until you obtain the correct answer to the problem. More credit is given for a correct response on the first attempt. After the tRA, you will work challenging problems with your team, where responses will be discussed in class and some work will be assessed hrough *Leaning Catalytics*. No calculators are allowed during the iRA and tRA. Mini-lectures will be interspersed with this material as needed. The problems covered in class will be drawn from a pool of questions posted on *Sakai*. (**Estimated time: 75 minutes**)
- For the Thursday primary class, we will continue working challenging problems in teams, using the Learning Catalytics platform for some problems. In some weeks, we will also have a demonstration that illustrates a physics concept. Mini-lectures and discussion will be interspersed as needed. The problems covered in class will be drawn from a pool of questions posted on Sakai (**Estimated time: 75 minutes**)
- You will be required to complete a homework assignment each week using the *MasteringPhysics* platform. These will include some tutorial problems as well as end-of-chapter problems. You will see whether you answered the question correctly after each attempt, although you will get the most credit if you answer the question correctly after the first attempt. You will have access to the homework set by Noon of each Monday and the homework will be due by Noon each Saturday. Calculators are allowed during these assignments. (**Estimated time: 2 hours**)
- You are required to attend one laboratory or discussion section each week. On some weeks, we will have a laboratory activity and in others we will have a discussion session.(These meet at the same time and in the same room regardless of whether it is a laboratory or a discussion activity). In each laboratory activity, you will undertake an experiment that illustrates concepts related to the current learning unit. You will work in teams on these activities (these will be different from the in-class teams). There will be a laboratory write up required for each lab, turned in to your laboratory TA the following week. In the discussion activities, you will work with your lab team on additional problems related to the topics of the PREVIOUS week, plus a few problems from the current learning unit. These problems will be drawn from a pool posted on *Sakai*. There will be a paper-and-pencil quiz the last half-hour of the discussion section, which will be graded by the Teaching Assistant and handed back to you at a later time. No electronic devices will be allowed during the quizzes, including calculators. (**Estimated time: 2.5 hours**)

In summary, the flow of a typical week will be as follows:

Noon Friday (of the previous week) – Noon Monday: Carefully go over the assigned readings in the textbook, view the (optional) videos, complete the pre-class assignment on Mastering Physics. Attend the Monday Help Room as needed (see schedule posted on *Sakai*).

Tuesday: In-class – mini-lectures, iRA, tRA, team problem solving. We will use *Learning Catalytics* for the iRA and tRA, and some of the team problems.

Noon Monday – Noon Saturday – Complete the assigned homework on *MasteringPhysics*. Attend Help Room as needed.

Thursday: In-class – mini-lectures, team problem solving, occasional demonstrations. We will use *Learning Catalytics* for some of the team problems.

Tuesday – Friday: laboratory or discussion section activities. Attend Help Room as needed.

Note that the learning units before the mid-term exam and the final learning unit of the semester will span 1.5 weeks. There will not be an iRA or tRA on the second week of the learning unit. Specifically, you will not have an iRA or tRA on the week of a midterm exam or in the final week of the semester.

5. Textbook, Electronic Learning Resources, and In-Class Computers

Textbook: The official text for the class is Young and Freedman, *University Physics, 13th edition*. Most of the material for the semester is covered in Volume II of this text, with the exception of the learning unit on Mechanical Waves and a special handout on E&M waves, both in the middle of the semester. There are several options for obtaining the textbook; see below.

Electronic Learning Resources: We will be using two primary on-line eLearning resources, *MasteringPhysics* and *Learning Catalytics* (accessed through the *MasteringPhysics* web site). Access to this resources is REQUIRED for the course. *MasteringPhysics* is an on-line tutorial and homework program has a large range of tutorials to help you master the course concepts, and some of these will be assigned during the pre-class assignments and homework sets (both delivered through *MasteringPhysics*). Real-time grading of problems takes place in this system, extensive hints are available for many problems, both of which allows you to efficiently use your time – you will know immediately whether you are on the right path for a problem so that you can close the learning feedback loop without delay. *Learning Catalytics* will be used for the in-class quizzes at the beginning of each learning unit and for some in-class problems. It allows the instructors to see in real time your progress on problems so that we know when the class is ready to move on to the next part of the learning unit. It can be accessed using many mobile devices (smart phones, etc.) or with a laptop.

There is a baseline cost for accessing *MasteringPhysics*, and an additional cost for the electronic version of Young & Freedman *University Physics*, which is $10 when you also purchase access to *MasteringPhysics*. The additional cost for *Learning Catalytics* is $10 IF YOU DO NOT get the eText, and FREE if you do get the eText. Thus, we recommend that all students purchase access to *MasteringPhysics* for the semester, and elect access to both the eText and *Learning Catalytics*. The benefit of the eText is that you have access to all volumes of Young & Freedman, including the chapter on Mechanical Waves, and the instructors will put notes directly in the eText that point out topics of emphasis or to reinforce the reading list by pointing out sections that will not be covered in the course.

You have many options for gaining access to *MasteringPhysics*. One is to go directly to the *MasteringPhysics* web site (see instructions in the next section below). Another is to purchase a Student Access Code/Card Kit from the Duke Textbook Store, ISBN: 0321741250 (although you will have to pay more for *Learning Catalytics* when you first enter the eLearning site). Another is to purchase the print version of the text that is bundled with the Student Access Code/Card Kit from the Duke Textbook Store, ISBN: 0321928814 (although you will have to pay more for *Learning Catalytics* when you first enter the eLearning site).

In the first week of the course, you will be assigned a tutorial that will help you learn how to enter information correctly into *MasteringPhysics*.

We will also use *Sakai* for posting instructions for each learning unit, videos, and changes to the course schedule if needed.

Computer Requirements: You are REQUIRED to have access to computer for entering the *MasteringPhysics* web site, which you will need to do OUTSIDE the classroom for pre-lecture and homework assignments. A browser is required along with a few plug-ins. See the *MasteringPhysics* web site for requirements and validating your setup.

An electronic device (either a laptop, tablet, electronic pad, or smartphone) is REQUIRED to access *Learning Catalytics* for the in-class activities, including the individual Readiness Assurance (iRA) and team Readiness Assurance (tRA) that will take place every Tuesday, as well as some team problem solving sessions on Tuesdays and Thursdays. There are resources on the *MasteringPhysics*/*Learning Catlytics* web site to determine whether you device will work for this purpose.

6. Accessing *MasteringPhysics*, *Learning Catalytics*, and the eText

For previous *MasteringPhysics* users: If you have joined a *MasteringPhysics* course before and can still log in, save time by following the guide for joining another course (available from www.masteringphysics.com > Tours & Training > Getting Started) instead of this page. We request that you change your user name to be the same as your Duke NetID so that it is easier for us to import your grades into our gradebook.

For new MasteringPhysics users:

A) What You Need to Register:

- A valid email address (you should use your Duke email)
- A student access code
  (Comes in the Student Access Code Card/Kit that may have been packaged with your new textbook or that is available separately in the Duke Textbook store. **Otherwise, you can purchase access online at www.masteringphysics.com**.)
- The course ID: MPGAUTHIER08005

B) Register:

- Go to www.masteringphysics.com and click Students under Register.
- To register using the student access code inside the *MasteringPhysics* Student Access Code Card/Kit, select Yes, I have an access code. Click Continue.
- –OR– Purchase access online: Select No, I need to purchase access online now. Select the textbook University Physics with Modern Physics by Young and Freedman 13th edition. Select that you need access to *Learning Catalytics*. Decide if you want access to the eText, (highly recommended, required if you don't own the textbook) and click Continue. Follow the on-screen instructions to purchase access using a credit card.
- License Agreement and Privacy Policy: Click I Accept to indicate that you have read and agree to the license agreement and privacy policy.
- Select the appropriate option under "Do you have a Pearson Education account?" Continue to give the requested information until you complete the process. The Confirmation & Summary page confirms your registration. This information will also be emailed to you for your records. You can either click Log In Now or return to www.masteringphysics.com later.

C) Log In:

- Go to www.masteringphysics.com.
- Enter your Login Name and Password that you specified during registration and click Log In.

D) To Access *MasteringPhysics* Again Later

- Simply go to www.masteringphysics.com, enter your Login Name and Password, and click Log In. *After you have joined a course*: You can open any assignments from the Assignments Due Soon area or from the Assignments page. For self-study, click eText or Study Area,

E) Support

Access Customer Support at www.masteringphysics.com/support, where you will find:

- System Requirements
- Answers to Frequently Asked Questions
- Registration Tips & Tricks video
- Additional contact information for Customer Support, including Live Chat

Refund for *MasteringPhysics* if you drop the course: If you decide to drop the course by the Duke Add/Drop deadline (January 21), you may or may not be eligible for a full refund for the cost of accessing the *MasteringPhysics* eLearning site. The site will allow a refund up to two weeks after you initially sign up. Thus, if you register on the *MasteringPhysics* web site on January 7, you can still get a full refund if you drop on the last day. If you register for *MasertingPhysics* early than January 7, you will need to drop the course before the Duke Add/Drop deadline if you want a full refund.

7. Times and Places

You are required to sign-up for the primary course and one weekly laboratory section.

- The regular class (PHY 142L-001) will meet from 11:45 AM – 1:00 PM on Tuesdays and Thursdays in Gross Hall Room 107.
- The laboratories will meet during various 2-hour blocks between Tuesday and Friday each week in Room 147 Physics. The discussion sections will take place at the same time as your lab section and in the same room. As seen on the schedule in Sec. 12 below, some weeks you will have a laboratory activity and other weeks you will have a discussion section and quiz.
- Help Room will be from 7:00-9:00 PM on Mondays (Room 154 Physics), Wednesdays, and Thursdays in (Room 150 Physics W and Th). Instructors will be there to answer your questions on the course concepts and problems.

8. Teams

We will assign each of you to teams that you will work with during the primary class times. The group size will be approximately six. Your team will have an assigned space in Gross Hall (see the seating map and the spreadsheet of teams posted on *Sakai*), and each group will be given a small white board to foster group interactions. The groups will be permanent throughout the semester. Please note that we do not "curve" your grade for this course, so your team mates are not competing with you – your team is there to help foster your learning and everyone can succeed!

Each in-class team will be assigned to one of the co-instructors, who will be there to answer your questions and help you with the material during the in-class activities.

Please note that working in teams is increasingly important and valued in almost any career path you will follow after graduating from Duke. It is important for your learning in the course to have a high-functioning team, and this takes some time to develop. Work with your teammates to figure out how each member can contribute. Some team members might be very good at setting up a particular problem. Another might be good and making a drawing of the problem. Others might be good managing the group time, manipulating the mathematical expressions, playing devil's advocate, etc. Find your place on the team and contribute to the group learning!

On the first day of class, we will set aside time for you to get to know your teammates and to develop a Team Contract (typical discussion points posted on Sakai) that will put forth the ways in which you agree your group will function during the semester. At the end of the semester, you will complete a team evaluation that will highlight team members who were high contributors to the team, and perhaps indicate those who did not contribute as much. This evaluation will be used to assign "bonus" credit to your overall grade.

In the laboratories and discussion activities, separate teams will be formed on the first day of the first laboratory together with the laboratory/discussion Teaching Assistant.

9. Grading Scheme, Dropped/Replaced Work

Points	Work
10%	Pre-class assignments (via *MasteringPhysics*)
2.8%	iRA (via *Learning Catalytics*)
4.2%	tRA (via *Learning Catalytics*)
8%	Quizzes (written quizzes in the 6 discussion sections)
10%	Laboratories
15%	Homework (via *MasteringPhysics*)
15%	Midterm I
15%	Midterm II
20%	Final Exam
2%	Maximum bonus points for outstanding team participation
102%	**Total possible**

The lowest grade in the following components of the required work will be dropped for each student.

- 2 pre-class assignments
- 1 homework assignment
- 1 quiz
- 1 laboratory

In addition, we will have the following exam replacement rule:

- The grade on the final exam will replace your lowest in-class midterm exam provided that your final exam score is higher (on a percentage basis).

Because of these policies, there will be no make-up quizzes or laboratories if one of these activities is missed. Also, there will be no make-up midterm exam unless you have a serious illness supported by a short-term illness notification form (STINF) submitted before the exam.

10. Grading Scale

This course strongly promotes team-based learning and encourages each of you to succeed in learning. Therefore, the course is graded on an absolute scale. The table below is the default sale based on your cumulative score (including bonus points for outstanding team participation)

Score Range	Grade
97.00 – 100+	A+
93.00 – 96.99	A
90.00 – 92.99	A-
87.00 – 89.99	B+
83.00 – 86.99	B
80.00 – 82.99	B-
73.00 – 79.99	C+
67.00 – 72.99	C
60.00 – 66.99	C-
50.00 – 59.99	D
0 – 49.99	F

11. Exams

There will be two in-class exams during the semester in addition to a comprehensive final exam. These will be pencil-and-paper exams that will include some multiple-choice and short answer problems as well as a selection of longer worked problems. These problems will echo the types of problems you have seen in the pre-class assignments, iRAs, tRAs, in-class problems, homeworks and quizzes.

The exams will be held in Gross Hall Room 107, although we might split the class in half and have some of you take the exam in another nearby location. Review/study sessions will be scheduled in the evenings leading up to each exam.

The exams will be **closed book**: **no calculators are permitted**, and **accessing any electronic device is not permitted**. Any calculations will require symbolic manipulation of mathematical expression using algebra, trigonometry, and calculus, or simple arithmetic that you can do by hand.

The schedule is given in the table.

Midterm I	Thursday, February 12, 11:45 AM – 1:00 PM (in class)
Midterm II	Thursday, March 26, 11:45 AM – 1:00 PM (in class)
Final Exam	Monday, April 27, 7:00 – 10:00 PM

Formula sheets: A formula sheet will be provided for each exam that has the relevant topics for the associated learning units and can also be used the quizzes.

Example exams: Before each exam, at least one previous exam with solutions, and perhaps other old exams without solutions will be made available for you to prepare for the exam. The course content changes somewhat from year to year, so not all problems on the old exams will be relevant (and this will be indicated).

Instructor Hints: If you are completely stuck on a problem during a quiz or exam, make sure to ask an instructor. The instructor might choose to give you a hint to get you pointed in the right direction, but a note will be made on the exam and credit will be deducted from the problem based on the extensiveness of the hint.

Regrade requests: All regrade requests for any items, including exams, must be submitted **in writing no later than one week after the graded work is returned**. In your write up, you should indicate your thinking about the solution to the problem and why you think there was a mistake in grading. Regrade requests concerning quizzes or laboratory reports will be handled by your laboratory/discussion section Teaching Assistant. Regrade requests concerning exams will be handled by the Lead Course Instructor and the person who graded the problem (one of the Course Instructors or Teaching Assistant). Note that regrades will be done on complete problems, not on parts of problems, and thus can result in a lower overall score after regrade. There are no regrades for pre-class and homework assignments, as well as iRA and tRAs given that these are graded using the on-line systems. If you believe that the system is using the incorrect solution, please contact your assigned co-instructor or the lead instructor.

12. Grading Policies on *MasteringPhysics* (you can also have these displayed within MP)

Pre-class and Homework assignments:

- You can rework the assignment **after** the assignment due date for practice. Does not affect your grade.
- You always see the assignment score.
- You are penalized for late submission, 20% of the assignment score per hour (will never go below 0%).
- Limit of 6 attempts per question
- You will see the solution after you give up or exhaust all attempts.
- Deductions per incorrect answer = 100%/(# of answer options -1)
- Deductions for incorrectly answer any other type of question before the last attempt: 3% per incorrect answer.
- Given credit for correctly answering a question Hint.

- Bonus credit for no opening a Hint: 2% per Hint not opened.
- Credit is deducted for exhausting all attempts or giving up on a question in a Hint.

PHY 141 Review material: (There is no credit for these assignments and they do not affect your grade – other than helping you succeed in PHY 142.)

13. Duke Community Standard

We expect that you will abide by the Duke Community Standard.

Specific to this course, we expect that you will not use electronic resources on the web to find the answers to the problems in any assignment.

It is permissible to talk in general terms with instructors, team-mates, and tutors as long as the conversation is only about how to approach a particular problem, but not the specific solution to a problem.

Of course, during team-based assignments, you can talk to your teammates about all aspects of a problem.

During iRAs, tRAs, quizzes and exams, you will not access any electronic information outside of the assignments, you will not talk to others, nor will you copy work from others.

If in doubt, ask an instructor!

14. Detailed Schedule

Week #, Date of Week	Topics	Reading (from text, Young and Freedman)	Labs/Discussion
0 1/8	Introduction to General Physics II, Mastering Physics and Learning Catalytics Introduction, Active Learning Overview	*OPTIONAL*: Review of Vectors (1.7-1.10) and Newton's Laws (4.1-4.3, 4.5)	**No lab/discussion**
1 1/12	Electric Charge and Electric Field	Ch. 21.1-6	*Lab* – Electrostatics
2 1/19	Gauss' Law, electric potential energy	Ch. 22.1-22.4, 23.1	*Discussion* – electric charge and fields
3 1/26	Electric potential, equipotential surfaces, capacitance, energy in electric field	Ch. 23.2-23.4, 24.1, 24.3	*Discussion* – Gauss' Law, electric potential
4 2/2	Current, resistance, *emf*, power, Kirchhoff's rules, RC circuits, power distribution	Ch. 25.1-21.5, 26.2, 26.4, 26.5	*Lab* – DC circuits
5 2/9	1 class – continue with week 4 topics, **EXAM Thursday, Feb. 12**	See Week 4	**No lab/discussion**
6 2/16	Magnetism, source of magnetic field 1 class only because of snow, RA Thursday	Ch. 27.1-27.6, 28.1, 28.2	**No lab/discussion**
7 2/23	Magnetism, source of magnetic field	See week 6	*Lab* – Magnetic Force
8 3/2	Fields produced by different sources, induction, Faraday's Law, Lenz's Law	Ch. 28.3-28.5, 29.1-29.5	*Lab* – Faraday's Law
9 3/9	**SPRING BREAK**	**SPRING BREAK**	**SPRING BREAK**
10 3/16	E&M Waves, Nature & Propagation of Light	Handout on E&M Waves, Ch. 33.1-33.5	*Discussion* – sources of magnetic field, induction, Faraday's Law
11 3/23	1 class – continue with week 9 topics, **EXAM Thursday, Mar. 26**	See Week 9	**No lab/discussion**
12 3/30	Interference (including Huygen's principle)	Ch. 33.7, 35.1-33.5	*Lab* – Interference and polarization
13 4/6	Diffraction	Ch. 36.1-36.7	*Discussion* – Interference
14 4/13	Geometric Optics	Ch. 34.1-34.8	*Lab* – Geometric Optics
15 4/20	1 class – continue with week 13 topics	See Week 13	**No lab/discussion**