Syllabus Spring 2013 - Physics 152Q Dr. Frosso Seitaridou

Physics is a fundamental science. A good understanding of introductory physics will help you a) understand most technology (e.g., hydraulic brakes, the mechanics of bridges, MRI machines, photocopiers, etc.), b) better appreciate how physics concepts are constantly being used in other sciences (i.e., chemistry, biology, geology, etc.), c) hone your thinking and engineering skills, d) recognize the close connection between physics and history, politics, culture and the arts! By taking Physics 151 and 152 you will learn the concepts needed for understanding how a big part of the Universe works! I hope you are getting excited!

Goals of the Course

At the end of this course, we will be able to:

1. Explain the basic concepts, theorems, and principles of physics and when and where they apply.
2. Recognize the limitations of the concepts/theories/principles.
3. Apply these concepts in order to solve both simple and advanced (i.e., multiple-step or multiple-concept) physics problems by learning how to
    a. Deconstruct (i.e., break down) a problem to its component "mini" problems.
    b. Analyze which concept should be used for each "mini" problem.
    c. Integrate "mini" problems to move toward the solution of the problem.
    d. Correctly apply the concept and check the validity of the answer.
    e. Develop an organized and methodical solution to a problem.
4. Use calculus in order to solve advanced problems and gain insight into the concept/principle.
5. Integrate multiple concepts when analyzing a complex phenomenon.
6. Recognize the physics concepts behind our day-to-day experiences.
7. Begin to develop the quantitative and modeling skills used by engineers and physicists.
8. Understand the questions physicists ask and the tools they use in order to discover knowledge in this filed. This is the Ways of Inquiry approach that is outlined in detail below.

Remember that **knowing how to use calculus and using calculus is NOT the same as understanding the underlying concept. In this class you will be asked to do both!**

To achieve these goals, we will solve many problems, use laboratory exercises, and discuss real-world applications while employing the mathematical tools of algebra and calculus in the process. We will be covering a lot of important concepts during this semester. For this reason, you will have daily and weekly assignments and frequent quizzes.

Student work submitted as part of this course may be reviewed by Oxford and Emory faculty/staff for the purposes of improving instruction and enhancing Emory education.

Ways of Inquiry

This course has been designated as an Inquiry course. Since you have taken Physics 151 or the equivalent, you have been exposed to the science of physics and have developed a basic understanding of some fundamental physics concepts. Therefore, in Physics 152 you will be able to explore at a deeper level what makes physics a unique and distinct science. Through this course and the homework assignments, you will be learning what questions physicists ask, what tools they use, and how they discover knowledge. By reflecting on and thinking critically about what and how you are learning, you will be able to become independent learners in this field. You will also appreciate the insight into nature that physics can give you and the connection between physics and other disciplines. For more details on

how the "Ways of Inquiry" approach will be applied to this course, please see the last three pages of this syllabus.

Important Information

Instructor and Contact Information: Dr. Frosso Seitaridou. You can reach me by emailing at eseitar@emory.edu or by calling my office at 4-8344.

Office Hours: My office is at Pierce 209. I have an open door policy: if I am in the office and the door is open, feel free to come in. We can talk about physics and homework assignments, your student life, and anything else you would like to chat about. You can also email me to make individual appointments.

Tutor/SI: Unfortunately, there is no physics tutor/SI this semester. Therefore, it will be even more important to do your work on time so you can come and see me with questions early.

Prerequisite: Math 112 and Physics 141 or 151.

Textbook: Serway and Jewett, *Physics for Scientists and Engineers with Modern Physics*, Eighth Edition.

Homework: All homework assignments and other announcements and handouts will be posted on Blackboard. Therefore, you are expected to check Blackboard frequently. Omission on your part to do so will not be regarded as a valid excuse for not completing an assignment. Homework assignments will be of three different kinds:

a) **Daily reading:** After each class, I will assign the reading that you are REQUIRED to do BEFORE coming to class the next time. The reading will consist of sections from the textbook and my class notes that are already posted on Blackboard. You will be asked to reflect on that reading by answering some questions posted on Blackboard. **I will be asking for your oral responses during class. I will also be asking you to present examples and concepts during class. So, during class you will be doing a lot of the teaching!** By doing the reading before coming to class, you will be better prepared to present the material and follow the discussion that will take place in class.
b) **Daily practice problems and review questions:** At every lecture, you will be assigned a couple of problems and questions from the handout "Review Questions and Practice Problems". These problems will be much simpler than the Advanced Problems described in part (c) below (remember that these practice problems were written for the Physics 142 students). Thus, you should be able to do these problems before attempting the Advanced Problems described in (c) below. Use sheets of paper for the problems and keep them in a binder. You will be handing in the solutions to the assigned practice problems (not the answer to the review questions) when asked. Handing in the solutions to the assigned problems will count towards your Practice problems grade (see section on Grading below).
c) **Advanced problems:** Each week I will also be assigning a set of five advanced problems. The due date of each set will be announced under the "Assignments" tab on Blackboard. I will be collecting one or more of the problems in each set on the due date. Understanding how to do these problems will help you in preparation for the tests, as the tests will have problems of the same level of difficulty as these advanced problems. Submission of these problems will count towards your Advanced Problems grade (see section on Grading below).

Quizzes: There will be frequent quizzes on the material that was discussed in the lectures and homework assignments. I will not be giving out warnings for the quizzes. Also, quizzes cannot be made up: If you miss class the day when a quiz is taken, then you will not receive a grade for that quiz. Just as with the

homework assignments, my goal is to ensure that you review the material frequently. You cannot possibly learn a concept if you see it only once.

Tests and Exams: There will be three tests and one final exam (for dates, see below). The tests will be on the material discussed up until that point (the second test will cover the material after the first test and, similarly, the third test will be on the material after the second test). The final exam will be cumulative. There is no such thing as a make-up test/exam!

Re-grading Assignments: I am very careful when I grade assignments. However, I might make mistakes when I grade. If you would like me to re-grade a test/quiz/assignment, your request should be submitted to me **in writing within 24 hours** from the time I give back the graded assignment. Note that such a request will result in me re-grading the whole assignment/test/quiz (not just the specific problem you requested).

Attendance: I find attendance and class participation to be vital for this course. You will find the homework to be really easy to do, if you come to class and you actively participate by asking and answering questions. You are allowed **3 absences regardless of whether you have a valid reason for them or not.** Therefore, I recommend that you save those for when you really need them (e.g., you get sick) instead of skipping class. If you are absent from class on a day when there is an Organic Chemistry or a Math test, 10 points will be taken off of your next Physics test. If you exceed the 3 absences, there will be a 5% deduction off of your final grade for every additional absence. **ATTENDANCE IS MANDATORY FOR LAB SESSIONS**.

Tardiness and Cell Phones: Being late for a class, or having your cell phone ring in the middle of one, is distracting not only for you but also for me and for your classmates. Students who are late for class for more than 5 min will generally not be allowed to attend that day's lecture and will be considered absent. Students whose cell phone rings during class will be asked to leave the classroom and will be considered absent. For the same reason, **I will not allow food or drink during class**, with the exception of a bottle of water.

Grading: Grades are assigned on the plus-minus scale. The final grade will be determined based on the following weighting. **Grades to the following assignments will be given based on correctness, not completion.** So, especially for the homework (practice problems and advanced problems), make sure that you solve the problems correctly!

Practice problems and review questions: 10%
Advanced problems 10%
Quizzes: 10%
Exams: 10% each test (30% total), 20% for the final
Labs (pre-lab and post-lab quizzes, lab questions, report, project): 20%

Course Content: Electricity, Magnetism, and Optics

Important dates: Make sure you include these important dates in your planner/calendar. The actual times for the tests will be determined during class.

Date	Description
Feb. 15, 2013	Test 1
Feb. 18, 2013	Draft for first full lab report due in class

March 4, 2013	First full lab reports due in class
March 8, 2013	Test 2
April 12, 2013	Test 3
April 24-25, 2013	Second full lab report or final project presentation during lab session
Tuesday, May 7, 2013, 2pm-5pm	Final exam: Cumulative

Working with the Honor Code: The Oxford College Honor Code applies to this course as follows:

Quizzes, tests, and final exam: The work presented in these assignments should be your own. No collaboration permitted. You are expected to follow the instructions given by me and abide by the Honor Code. Sharing calculators, pencils, etc., is not allowed.

Lab report, lab project: On these assignments you can only collaborate with your lab partner.

Advanced Problems and Practice problems and review questions: You are encouraged to work on the assignments **by yourselves first, before consulting others (classmates, tutor, me, etc.) for help.**

Study groups: Even though you cannot work together on quizzes, tests, and exams, you are definitely encouraged to form study groups and study concepts together and explain to each other things that you were not clear about from class or from your reading assignments. However, as mentioned above, you are strongly encouraged to work on the homework assignments by yourself first, before consulting your classmates for help.

Religious Holidays: You need to tell me immediately if any religious holidays will interfere with the course, especially the final exam and tests

How to Solve a Physics Problem

Your homework assignments will consist of pre-lecture reading assignments, review questions and practice problems, and advanced problems. In your solutions to all problems (tests, practice problems, etc.), I expect to see that you solve the problems following several important steps. Following these steps will ensure that you are learning how to develop an organized and methodical solution to a problem (see section **Goals of the Course**).

1. **Read the problem** carefully so that you know what is given and what is asked.
2. **Draw a picture**. I cannot think of any physics problems that can be solved without drawing a good picture.
3. **Label all the quantities** in the diagram, those that are given and those that you need to find. Also, **show your coordinate system and show which direction you have defined as positive!**
4. **State the Physics Laws** that apply to that problem and explain why. Here, I am not asking for an essay, a sentence is enough. For example: ``The system is isolated ➔ Conservation of Momentum applies."
5. **Write the law in equation(s) form**. To continue the example, at this point you will say: $\overrightarrow{P_{final}} = \overrightarrow{P_{initial}}$
6. **Solve** the equations and substitute the values. **Always include the units throughout the calculations!** Also, **show your work**! You cannot just write the initial equation and then the result. You have to show me the intermediate steps. This way, I can identify the wrong step and help you understand why what you did is not right.
7. **Check your answer**. Do the units match? Does the sign in front of your result make sense? Is the answer too big or too small compared to what you expected?

Requirements for the Lab portion of this course

As noted above, the lab portion of the course constitutes 20% of your grade. For the lab portion of the course the requirements are as follows:

1. Bring your lab handout: You will be given the lab manual at the beginning of the semester. You are expected to have read the lab handout for each week's lab BEFORE coming to the lab. To ensure that, you will take a **pre-lab quiz** before each lab section.
2. Answer all the questions in the lab handout: Some of these questions will require that you spend time at home analyzing the data and drawing graphs. ALWAYS bring the answers to those questions in next week's lab for me to check. This will count towards your lab grade.
3. Understand the lab: Experiments require repetition in order to ensure that your data is reproducible. Sometimes students regard this repetition as "busy work". However, remember that at all times you need to be thinking about what your data means, if this is what you expected and why (or why not) and, also, what the reproducibility (or lack of) means. Essentially you are expected to be thinking about what conclusions you can draw from your data. There will be **post-lab quizzes** to ensure that you have understood the data and the purpose of the experiment. Pre-lab and post-lab quizzes count towards your lab grade.
4. A full lab report (for due date, see the table above). For one lab experiment (I will announce which one) you will have to do one lab report. I will give more detailed handouts on what a proper scientific lab report should look like when the time comes. The lab report will be corrected and graded and detailed comments will be given. If you desire, you could resubmit the lab report (after addressing all the comments) and the lab report will be re-graded, erasing in this way the first grade. You can only resubmit the lab report once.
5. Towards the end of the semester you will have a choice of either doing another full lab report (on an experiment of your choice, this time) or doing a small final project. For the final project you will have to pick a topic and, using physics concepts you have learned throughout the semester, you will have to explain how something works during a 15min oral presentation. As an example, a topic can be "How do rockets fly?" Depending on your preference (how many people decide to do the presentations) we will have the last lab section of the semester devoted to the presentations. The final projects will be group projects.

Lab Schedule

The experiments we will be conducting this semester are on the following topics. Additional experiments might be added if time permits.

Lab 1: Class

Lab 2: Equipotential lines and the electric field

Lab 3: Measurement of capacitance

Lab 4: Basic electricity I

Lab 5: Basic electricity II

Lab 6: The oscilloscope – RC circuits

Lab 7: The earth's magnetic field

Lab 8: Faraday's law

Lab 9: Optics I

Lab 10: Optics II

Acceptable and unacceptable class/lab behavior

For our class and lab you are expected to

a) have done the reading and homework problems (i.e., you are expected to come prepared),
b) have all the things you will need during class and lab (your notebook, binder with the solved homework problems, calculator, lab manual, office supplies, etc.),
c) pay attention.

There are certain things that I have observed students do during class and lab that I find unacceptable. In those cases I ask the students to leave the classroom or laboratory and I count them as absent.

You cannot:

a) come to class/lab without having done the reading and homework problems,
b) come to class/lab without your notebook, binder with solved problems, calculator, lab manual, office supplies, etc.,
c) eat during class/lab,
d) drink during class and lab (except for water),
e) not pay attention by sleeping or being distracted,
f) have your cell phone ring in the middle of class/lab. Your cell phones should be turned off when you come to class/lab. It will be even better if you do not bring them with you at all, since you do not need them. See policy on "Tardiness and Cell Phones" outlined above,
g) text during class/lab. Again, your cell phones should be turned off when you come to class/lab. It will be even better if you do not bring them with you at all, since you do not need them. See policy on "Tardiness and Cell Phones" outlined above,
h) use your laptop during class. During lab, you can use your laptop after collecting data and only for the purpose of data analysis,
i) be late for class/lab more than 5 minutes. See policy on "Tardiness and Cell Phones" outlined above,
j) be disrespectful.

If you need to leave the classroom or laboratory for any reason, you should avoid being disruptive and distracting. Try to leave the class/lab quickly and with as little noise as possible. You should not have to leave the class/lab more than once, and that can only happen occasionally (not in every class/lab). Also, there is absolutely no reason why you will need to leave the class/lab at all! Leaving the class should be your last resort!

Ways of Inquiry

Physics 152Q: General Physics II

Physics 152 is the second semester of the calculus-based introductory physics series. It is a course that is required of all students interested in majoring in physics, engineering, and other sciences. This course explores fundamental concepts in electricity, magnetism, and optics. These concepts have many applications, especially with regards to technological innovations that define our modern way of life. For the laboratory portion of this course, you will conduct some fundamental experiments that intend to deepen your understanding of the concepts. At the end of the semester, you will have the choice of either describing an application of a concept that we learned in class, or writing a full lab report on an experiment that you have conducted during the semester.

Asking the "right" questions: What (fundamental) questions will you learn to ask when dealing with this discipline?

In introductory physics the main goal for us is to answer the question of "Why?": Why do things work the way they do? Through this course, you will realize that the answer to this question can come by learning about some fundamental physical concepts, theorems, and principles. Though the question of "Why?" is at the core of this course, there are other questions that are equally important. Some examples include: When and how can I apply this theorem/concept? What are the limitations of this concept/theorem and why? How is this concept similar and different to other concepts that we have learned (both in Physics 151 and in Physics 152)? What does this equation mean? How was this equation derived and why was it necessary to derive this equation? What assumptions are being made every time one uses this equation? By asking and answering these questions, you will develop a deeper understanding of the physical concepts discussed in this course and, in the process, you will also learn to think like a physicist.

Using the "right" tools: What methods of analysis and argument will you learn to help you investigate questions in this discipline?

For the lecture part of the course, you will be asked to solve physics problems as part of the homework assignments. The physics problems will be of two different levels of difficulty: intermediate (practice problems) and advanced. The intermediate problems will require that you use two different concepts to develop a complete solution, while the advanced problems will require more than two concepts and/or more abstract thought process. By solving these problems you will learn how to break down (i.e., deconstruct) a problem into its component "mini" problems and correctly identify and apply the concept associated with each "mini" problem. You will also be asked to combine (i.e., integrate) multiple concepts in order to analyze a complex phenomenon (as is the case for many complex technologies). In the laboratory portion of the course, you will be using the scientific method as you conduct the experiments that are outlined in the laboratory manual. You have already been exposed to the scientific method in Physics 151 or the equivalent. Therefore, in Physics 152 you will feel more comfortable in the laboratory and, thus, you will be expected to show a deeper level of understanding of your data, how the data should be analyzed, and how your data verifies or falsifies your hypothesis.

Actively practicing inquiry: How will you "discover" knowledge in this course? How will you actively practice the process of inquiry?

You will be discovering knowledge in this course both in the lecture and the laboratory components. You can get new insights into learned concepts when you solve physics problems. Each problem can provide you knowledge with regards to a new application of the concept and a new way of combining (i.e., integrating) concepts. In essence, by combining concepts and de-constructing problems you will be discovering knowledge through the homework assignments. In the laboratory, you will have the opportunity to actively discover the concepts that you have learned about in class on your own by using the scientific method. For example, by measuring the currents through and the voltages across the elements of a complicated circuit, you will be able to verify Kirchhoff's rules. Though the experiments are outlined in the laboratory manual, you will be expected, as mentioned above, to think more deeply and critically about your data and "discover" on your own the knowledge that you can obtain from your data. In addition, at the end of the semester you will be asked to either write a full lab report that encompasses all the sections of a journal paper, or give an oral presentation on an application of a concept that we have learned in class. For example, a group of students last year gave an excellent presentation on how touch-screens work, an application that we had not discussed in class but was based on learned concepts. These students, therefore, discovered this knowledge on their own by conducting literature search and using concepts that they had already learned.

Meta-level reflection: How will you be asked to reflect upon, question, and appreciate the ways of inquiry used in this discipline?

In the lecture part of the course, you will be asked to discuss and think critically about each learned principle and its limitations. Solving problems provides you with opportunities for reflection. For example, you will often come and ask me why it is that you can use this concept and not a closely related one to solve a problem. These assignments also allow you to question the applicability of the concept, which in turn causes you to wonder if a new, more encompassing concept needs to be developed. The process of deconstructing problems and integrating concepts will also help you appreciate this way of inquiry.

In the laboratory, the application of the scientific method provides opportunities for that kind of reflection, questioning and appreciation. In your lab reports, you will be asked to think about your experiment and your data. For example, when you describe the error associated with your data, you will have to discuss the limitations of your experimental setup and how you would improve it. You will also need to think about how your data verifies or falsifies your hypothesis. By consistently using the scientific method, you will be able to reflect on and appreciate its advantages and its general acceptance as *the* method of inquiry.

Increasingly independent investigation: How, specifically, will your investigations become more independent over the course of the semester?

Since you enrolled in Physics 152, you have already taken Physics 151 or the equivalent. Therefore, at this point you have developed some basic understanding of the way physical concepts are discovered and learned. In Physics 152 you will have the basic skills needed in order to be more independent investigators of the physical concepts. The assignments in Physics 152 will consist of problems that will require a higher level (when compared to the assignments in Physics 151) of deconstruction and integration of the concepts. For example, concepts that were learned in Physics 151 will be used for

solving problems in Physics 152. In the case where you do not remember how to use a concept learned in Physics 151, you will be asked to go back and remind yourselves. In other words, you will be encouraged and asked to answer your own questions in that regard, since you have had enough exposure to physics to be independent learners.

As explained above, in the laboratory you will be conducting experiments that are outlined in detail in the laboratory manual. However, as the semester progresses, you will be asked to address questions that arise from your acquired data but are not posed in the manual. Furthermore, as mentioned, at the end of the semester you will have the choice of either writing a full lab report or giving an oral presentation on an application of a concept or concepts that you have learned in class. With regards to these final projects, you will be working independently, using me only as a reference source.

Connections to something bigger: What specific "real-world" questions, interdisciplinary connections, or ethical issues will you explore in an attempt to deepen your understanding and appreciation of the class content?

One cannot really talk about physics without discussing "real-world" applications. Physics 152, since it deals with electricity, magnetism, and optics, involves many applications that you can readily experience in the "real-world." One example that will be brought up in class has to do with the equipment in the Williams gym and you will be asked to think why the treadmills, for example, need to be plugged into electrical outlets while some of the ellipticals do not. These "real-world" questions address the core question in physics of "why does this work the way it does." In addition, the concepts learned in this course readily allow for interdisciplinary applications. For example electrostatic forces between charges, one of the main concepts we will learn in Physics 152, are fundamental in biology and chemistry. Optics becomes relevant when one discusses how light affects an artist's painting, for example. In this course we will not explore any ethical issues.

Appropriate assessment for inquiry-based learning: What specific assignments will you be asked to do, to demonstrate your increased abilities in reading critically, writing, analyzing, or speaking with clarity?

As mentioned, you will be asked to solve physics problems throughout the semester. In your solutions you are expected to demonstrate your ability to deconstruct problems and integrate concepts. This is a fundamental part of demonstrating your ability to analyze a physics problem. You are expected to follow the solution format, which is described in the syllabus in detail, and guide the reader through your thought process as you develop the solution. In the laboratory portion of the course, you will be asked to write multiple (approximately 8) short lab reports, and one full lab report (which can be submitted in drafts), in addition to the final project (which, as explained above, can be either another full lab report or an oral presentation on an application of a concept). All of these assignments will require that you analyze your work (experiment, data, hypothesis, etc.) critically. The full lab reports will contain all the parts of a published research paper (abstract, introduction, materials and methods, results, discussion, and conclusion.) Via the short lab reports and the drafts of the full report(s) you can receive feedback not only on the quality of your writing but, also, on the depth of your critical analysis of your experiment and the acquired data.