

## Physics 13: General Physics II

*Spring Semester 2022*

### SYLLABUS

Please read carefully!

#### **Initial Competences Required for this course (what you should know already)**

PHY 13, or General Physics II, follows PHY 10 and is the second part of General Physics. Like PHY 10, PHY 13 is a calculus-based introductory course to physics, and it is meant mainly for students oriented towards the biological and environmental sciences, or pre-med students. PHY 10 is a requirement for PHY 13, and the knowledge acquired during PHY 10 – in particular the application of Newton's Laws, as well as the laws of energy and momentum conservation – is a prerequisite. The mathematical skills required are: Simple operations with vectors (including adding and subtracting vectors, scalar product, and vector product) and use of basics calculus (derivatives and integrals). Physics 13 requires a little less use of calculus compared to the course taken by engineering and physics majors (PHY 21), but you will still need to use integrals and derivatives in some simple applications. If you did not take PHY 10 or PHY 11 last semester, you may also need to get back in shape with writing and solving algebraic equations: Do not worry if you will struggle the first couple of weeks with algebra, by seriously working at the homework you will automatically gain back your skills!

#### **Course contents (what will be taught in this course)**

Subjects covered in Physics 13 include electromagnetism, waves, ray optics, interference and diffraction, and an introduction to quantum-mechanics and nuclear physics (a few special relativity concepts are briefly introduced, too). The purpose of this course is to discuss these topics, and teach how to apply their underlying principles to the solution of concrete problems. A student's performance will not only depend on how well she is able to acquire new physics concepts, but also on her ability to solve more and more structured problems, and combine new knowledge with some of the ideas learned in PHY 10. This will be achieved through homework and practice; starting with simple situations, you will develop strategies for solving more and more complex problems.

#### **Competences expected after this course (what you will be able to do when done)**

After this course, students should be able to analyze both conceptually and quantitatively various situations encountered in physics. At a minimum, they will be able to:

- work with point charges: Forces, electric field, electric potential, electric potential energy, electric dipole moment.
- work with magnetic fields: Moving point charges, current-carrying wires or loops, magnetic dipole moments.
- work with circuits, including capacitors, inductors, RC-circuits, and LR-circuits
- understand the ideas of magnetic flux and magnetic induction, and be able to quantitatively analyze the effects of either a changing area, or a changing magnetic field, or a changing orientation between the area vector and the magnetic field. Apply Lenz's Law to correctly determine the direction of the induced current.
- work with waves, including standing waves on strings, and Doppler's effect .
- work with optical elements such as mirrors and lenses
- work with interference and diffraction.
- understand the ideas of quantization and wave particle duality (de Broglie), as well as analyze quantitatively the photoelectric effect and the Compton effect.

- understand emission and absorption of photons and quantitatively analyze some quantum energy transitions in the atomic model of Bohr.
- understand basic ideas about nuclear physics: Mass defect, binding energy, different radioactive decays.

Your performance will not only depend on how well you are able to acquire new physics concepts, but also on your ability to solve more and more complex problems.

PHY 13  
INSTRUCTION MANUAL



### S.1. Instructor

Prof. Paola M. Cereghetti  
cereghetti@lehigh.edu

Office: LL 410

Office hours: Office hours will start the second week of the semester. In person office hour times will be announced the second week of the semester. Please e-mail me if those times conflict with your academic schedule, thank you. Office hour times may change, in that case students will be notified on course site.

### S.2. Class Meetings

Lectures attended by all students together take place on Mondays and Wednesdays from 7:55am to 8:45am in LL270. Meetings in smaller sections take place on Thursdays in LL316:

- Recitation #1: PHY 010-111: 7:55am-8:45am
- Recitation #2: PHY 010-112: 9:20am-10:10am
- Recitation #3: PHY 010-113: 10:45am-11:35am
- Recitation #4: PHY 010-114: 12:10pm-1:00pm

### S.3. Tutoring

Walk-in tutoring and group tutoring times are offered by the tutoring center. For more information and to sign up for tutoring please go to <https://studentaffairs.lehigh.edu/content/tutoring>.

### S.4. Textbook and Class Notes

*College Physics* by Openstax College is downloadable for free at <https://openstax.org/details/books/college-physics>. We will cover about half of the book. Class notes will be available on course site. These notes are my calculus-based addition to the College Physics textbook.

### S.5. Work outside the classroom

PHY 13 is a challenging 3-credit class. It is standard practice that for every credit hour at least 3 more hours are spent studying or doing homework. Reading the textbook and reviewing your notes is important; what is even more important is working on homework independently and doing extra practice exercises independently (see S.9. below).

### S.6. Attendance

Because physics is an intensive subject, keeping up-to-date with the material is essential. Consequently, you are expected to come to class on time and attend all lectures and recitations.

### S.7. Homework

All homework must be handed in at the due date. No homework will be accepted after that.

Homework is an essential component of this course, it will be assigned weekly, and it will be due in lecture every Wednesday. **No electronic submission allowed.**

New homework assignments and their solutions will be posted on course site together. However, it is important that you are disciplined enough to first do problems without looking at solutions. It is only through struggling on a problem that you will be able to learn the material and skills taught in this course, and thoroughly familiarize yourself with each new concept. Remember that even if you may at first fail to successfully complete a problem, the experience itself will be valuable. Each problem is constructed in such a way that you are made to practice more and more complex techniques. Once you are done with a problem, you can look at its solution. It is very important that you make sure you understand any differences between your work and the online solution.

Homework assignments will be graded for effort and completion. To make sure students are seriously doing homework and keeping up with the material, there will be quizzes in recitation every week. The quizzes will cover topics of previous HW assignments. If you just copy the solutions instead of doing the homework yourself, you will do badly in the quizzes, and even more so in the exams.

Some homework problems will be partially solved in class, making class attendance critical for the student who wishes to be successful.

**DO NOT START WORKING ON A HOMEWORK ASSIGNMENT THE NIGHT BEFORE IT IS DUE. IT IS A VERY BAD IDEA, AND THEREFORE HIGHLY DISCOURAGED!**

### S.8. Quizzes

To test your understanding of previous homework, there will be a quiz every week. So as not to disrupt the flow of the class, students arriving late will still have to hand-in the quiz together with the rest of the class. Students with a special accommodation should discuss other possibilities in a meeting with the instructor.

You are allowed to miss up to 2 quizzes *with or without an official excuse*. Quizzes often count for a maximum of 4 points; however, note that such numbers do not correspond to letter grades, but they are used to compute the contribution of quizzes to the final course grade. If you are present for a quiz, you will receive 1 point even if you answer wrong to all questions.

### S.9. Homework solutions and extra practice exercises

Solutions to past homework problems will be posted online at the beginning of the week to help you understand the material. Make sure that you understand each problem that you have not been able to complete correctly, because quizzes will cover any one of the topics in the previous homework. Additional practice packets (exercises with solutions) will be provided; working on them will be an essential component of preparing for the hour exams and the final exam. Each packet will be available in a blank copy and in a solution copy; to learn and study effectively, you should first try to solve the problems alone on the blank copy, and only after having struggled on them a good amount of time, look at the solution. If you do this you will see that initially you will spend a lot of time on one problem, but things will become easier and easier as you continue to practice. The longer you had initially struggled, the quicker this process will be. Remember that each student is different in their approach to and facility with a subject; **it may happen that to obtain good results you need to study considerably more than your friends**; do not be discouraged by that, just keep going, put a lot of time into practicing, never delay things to the last minute, and ask questions in recitations or during office hours.

### S.10. Instructional Videos

Links to several instructional videos covering the material of this course will be made available on course site. These videos will help you review in detail some of the most important material covered. They are also an important resource to develop problem-solving skills, and to review for exams.

**If a video comes with an assignment to watch it, it is mandatory that you do so.** Some videos cover material that will not be presented in lecture or recitation, but that will be essential to understand later material.



### S.11. Exams

There will be 3 hour exams (“mid-term” exams): On Monday February 21, 2022, on Wednesday March 23, 2022, and on Wednesday April 20, 2022, as well as one final exam (TBD). The hour exams and the final exam are closed book; an equation sheet will be provided stapled to each exam.

**No personal equation sheets of any kind are allowed.**

The hour exams will cover the new material taught until the date of the exam.

The final exam is cumulative, the material from the entire semester will be tested.

You are expected to follow the Student Senate Statement on Academic Integrity (see S.20 later). Specific rules for every exam will be printed on the exam’s front page. In particular, for hour exams #1, #2, and #3 students can only leave the room after having handed in the completed exam. If you want to wear a cap during an exam, wear it with the visor pointing backwards so that your eyes remain visible. No electronic devices that contain or allow to access information are allowed.

### S.12. Absences during exams:

There are no make-up quizzes or make-up hour exams.

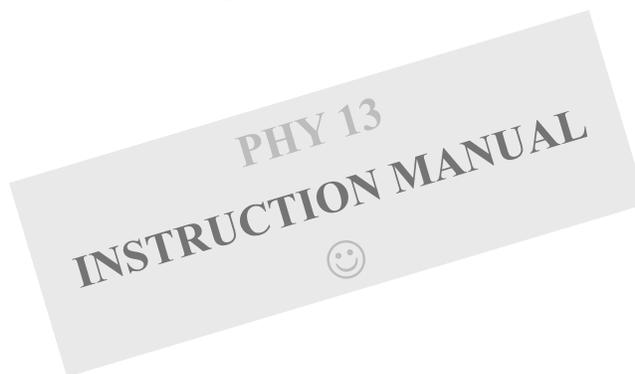
- ☞ No make-up quizzes. This applies to all students. You are allowed to miss up to 2 quizzes.
- ☞ No make-up hour exams. This applies to all students. All hour exams must be taken on the specified date and time. For students who miss an exam and have an official written excuse, the grade for a missed hour exam will be taken from the corresponding section in the final exam. An official written excuse requires documentation on-file, the legitimacy of which has been established by the office of the Dean of Students. Such specific documentation is also required from students who have a special accommodation from Disability Support Services. Please contact the appropriate Dean such as Dean McClaind (lob3@lehigh.edu) or, for students with accommodation, Dean Zullo (maz317@lehigh.edu).
- ☞ The final exam must be taken on the specified date and time. Students who foresee any kind of problems with attending the final exam, or miss the final exam because of accident or sudden illness, must contact the office of the Dean of Students as soon as possible, and obtain an official written excuse. The dean of students will then possibly allow such students to take the final exam at the official make up date. Note that your Professor is not part of the approval process, and of the decision making that will determine dates and circumstances of a possible make-up final exam.

Attention: Any excuse from the Dean of Students Office without documents on file is not acceptable.

### S.13. Grading

Your numerical grade in the course will be determined based on your performance in various activities, as detailed in the following table:

Attendance	10
Homework	10
Quizzes	10
3 Hour Exams	20
Final Exam	20
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<b>Total</b>	<b>70</b>





#### S.14. No Extra Credit

There are no extra credits beyond what is listed above (S.13.). Please do not ask for alternative ways to get additional credit and increase your grade. The break-down above is set in advance, and must be the same for all students.

#### S.15. Mistakes to avoid in quizzes and exams

Failure to apply what is listed in the following points will result in credit loss during quizzes and exams. Start to follow these guidelines as early as possible. This list is not exhaustive.

- ☞ **Write Clearly!** If there is any room left for interpretation by the grader, the answer will be considered wrong. No a posteriori explanation will be accepted.
- ☞ **When using vectors, use column notation**, otherwise the problem will not be graded.
- ☞ “Yes,” or “no” answers alone, or any short answer without explanation, are not accepted.
- ☞ Always show your calculations, and **clearly erase calculations you thought were wrong**. No credit for double answers will be given, you are responsible to choose the correct answer among your calculations.
- ☞ All algebraic expressions in a result have to be simplified as much as possible. Algebraic expressions where obvious simplifications have been omitted will be considered wrong at the discretion of the grader.
- ☞ Numerical results without correct units are always considered wrong.
- ☞ Results of numerical calculations not given as decimal numbers are always considered wrong.

#### S.16. Recommendation letters

Due to high demand, I generally only write recommendation letters for students who have also taken at least 3 credits of *Physics of Medical Imaging* courses with me (look for PHY 120, 121, 122, 123 in the Lehigh catalog). For all recommendations, I need at least a 3 weeks notice.

#### S.17. Accommodations for Students with Disabilities:

Lehigh University is committed to maintaining an equitable and inclusive community and welcomes students with disabilities into all of the University’s educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact Disability Support Services (DSS), provide documentation, and participate in an interactive review process. If the documentation supports a request for reasonable accommodations, DSS will provide students with a Letter of Accommodations. Students who are approved for accommodations at Lehigh should share this letter and discuss their accommodations and learning needs with instructors as early in the semester as possible. For more information or to request services, please contact Disability Support Services in person in Williams Hall, Suite 301, via phone at 610-758-4152, via email at [indss@lehigh.edu](mailto:indss@lehigh.edu), or online at <https://studentaffairs.lehigh.edu/disabilities> .

#### S.18. The Principles of Our Equitable Community:

Lehigh University endorses The Principles of Our Equitable Community [ [http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity\\_Sheet\\_v2\\_032212.pdf](http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf)]. We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.

### **S.19. Student Senate Statement on Academic Integrity**

We, the Lehigh University Student Senate, as the standing representative body of all undergraduates, reaffirm the duty and obligation of students to meet and uphold the highest principles and values of personal, moral and ethical conduct. As partners in our educational community, both students and faculty share the responsibility for promoting and helping to ensure an environment of academic integrity. As such, each student is expected to complete all academic course work in accordance to the standards set forth by the faculty and in compliance with the University's Code of Conduct.

## PHY 13 INSTRUCTION MANUAL



## APPENDIX

😊 Below you can find precious additional information, make sure to read it!

### A.1. Physics is like musics or sports

To study physics requires a lot of practice, in the same way that learning to play an instrument does. Time spent working on the material without finding a solution to a problem is not time lost, in the same way that time passed playing a scale on a violin 100 times is not. Also, while a student may have to go through a lot of practice to play the scale well, another one may just be able to do so after playing it a few times. This doesn't mean that the student who initially needs a lot of practice will not end up being an excellent musician, maybe even a better one than the one who initially "could just do it."

There is also the aspect that practice has to occur over a long enough amount of time. If you need to study to play in a concert one month later, it is better to practice for an hour every day than for 30 hours during the few days before the concert. If you follow the second option, you will not be able to play well in the concert or you might even injure yourself. Practice has to occur over time.

Another example: A weight lifter needs to prepare for a competition where she hopes to win a medal. She has two months to do so: It will be more useful for her to practice everyday for a reasonable amount of time during the following two months than to practice without stops the few days before the competition. Although the total amount of time spent practicing those last few days may be exactly the same amount that she would have spent over the past two months had she practiced every day, this second option option will clearly deliver much worse results and be actually very counterproductive. Again, practice has to occur over time for the best results.

### A.2. For students who did not take any form of physics before, and for those who did

This course covers material beyond the usual high school material (including AP physics). If you already covered some physics material in high school or elsewhere, make sure to always keep track of new details even in topics you may have already worked on; pay special attention to **new techniques to solve and approach problems**, I expect you to be able to use them in tests and homework.

In my experience, I do not worry as much for students who never had physics before but who are serious and disciplined in learning the material, as I do for students who had physics before and who feel overconfident. Often, a number of weeks into the semester, many overconfident students suddenly may realize that they are dangerously behind with the material.

### A.3. What to do if you are studying a lot, but you are not getting the results you wish

As mentioned earlier, PHY 13 is a challenging 4-credit class, and it is standard practice that for every credit hour at least 3 hours are spent studying or doing homework. This is only an average, and there may be students who are successful studying less than 3 hours per credit, while other students may need to practice for more than 3 hours per credit. These hours need to be hours of focused work: No cell phone checking, no TV, no friends – unless you truly think your study habits are compatible – and no other distractions. Also, breaks cannot count as time passed studying.

If you have the impression that you work a lot but still have difficulties performing well, do not compare yourself to other students. Because skills are variable, there may be students who study less than you do and get grades higher than yours. This is a fact that you cannot change. What you can do is honestly evaluate how much time you put in the following activities, and make changes accordingly. You need to develop a studying strategy that works for you.

Be present to all lectures and recitations. Some students think that coming to class is a waste of time because they do not understand anything anyway. This is a bad choice: If you come to class and you do not understand the material presented, at least you are aware of what you do not understand, and you can work on that during your study time, go to tutoring, ask questions. If you do not come to class, you will

have to go through that step anyway and alone; therefore, time-wise, coming to class is the least time consuming option.

Every day, during your study time, make sure you understand everything that was covered in class, and redo the problems discussed. It is not enough to simply finish the problems discussed in class, you need to redo all problems from scratch and look at your notes or at the homework solution as little as possible. Struggling over the solution of problems is an essential component of learning physics.

Because the solutions to homework problems are available to you, make a special effort to not copy the solution. Before giving up and looking at the solutions, make sure you have struggled at least 20 minutes on each individual problem in the homework.

Watch all the instructional videos on course site as soon as they have been posted. Do not procrastinate and wait to do that until the days before the exam. During those days you could watch the videos again to review a topic, but this should not be at the expense of practice time.

To prepare for exams, do all problems in the practice packets at least one week before an exam. In order for your practice to be successful, you must print out the blank practice sheets, and do the problems on those sheets without looking at solutions. You may notice that, at the beginning, you might not be able to finish a problem without looking at the solution. Don't get discouraged, you will improve as you keep exercising by solving more and more problems, looking at the solution less and less. As you feel more and more confident solving problems, start timing yourself. Allow yourself about 15 minutes (no more than 20 minutes) to solve a problem. If the time is up and you are still working on the problem, use a pen of a different color to finish the problem. This will allow you to get an idea of your speed solving the problem, and get additional practice as you finish solving the problem. If your speed is not high enough, it is likely because you may still have gaps in your knowledge of the materials and techniques, or you still haven't practiced enough; that's why you should start working on the practice packets early enough.

Finally, be very honest with yourself: Are you putting as much time in studying physics as you need to, and are you disciplined, avoiding all possible distractions? This is something you need to evaluate with brutal honesty yourself. Unfortunately, it is one of the few aspects your professor cannot help you with, the only answer to that is to do more of the above. Keep working, many students did well in the class and you will too, especially if you read all the syllabus until here during the first week of the semester!

