

Syllabus for Modern Physics

Physics 251, Spring, 2024

Lecture and Recitation Instructor

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Office hours: in B-145, Tue 3:00 - 4:00, Thu 3:00 - 4:00, and by appointment,
<https://stonybrook.zoom.us/j/7316638666>

Texts / Homeworks (required)

1. *WebAssign for Thornton's Modern Physics 5e* **OR** *Cengage Unlimited*.

A link to access the WebAssign is provided in Brightspace. We will use WebAssign for homeworks and clicker questions. Cengage Unlimited subscribers do not have to purchase the course materials for this class. (Cengage Unlimited is a cost-saving option if you are taking multiple courses using Cengage.) There is a 24/7 Cengage Support: Live Chat Support and Online Self-Help at [Cengage.com/support](https://www.cengage.com/support), social media @CengageHelp or call 800-354-9706.

2. "A practical Guide to Data Analysis for Physical Science Students", L. Lyons ISBN-13: 9780521424639. This book can be purchased from Amazon or other booksellers.

Course format

The course is offered primarily in person. Lectures will be live broadcast online as well as recorded. The two midterms and the final exam will be in-person only. Recitations are also in-person.

In addition to the live and recorded lectures, I will post two printable versions of each lecture. Version one is the pdf of the lecture slides. Version two will be available after the lecture and it contains all the hand-written notes that were made during lecture.

We will strictly adhere to the schedule posted on the course WEB page. If a section is not covered in lecture, students are expected to study it from the book.

Technical requirements

For the homeworks and clickers all students need a device with a WEB browser capable to access WebAssign. Bring your laptop or smartphone to class, so that you can answer the clicker questions.

Course URL, Blackboard

Grades will be accessible on Brightspace. All other information about the course will be posted at <http://solidstate.physics.sunysb.edu/teaching/2024/phy251>.

Homeworks

To access the homeworks, visit the Brightspace page of the course, follow the “Links to HW clickers and Zoom” and select “PHY 251 Homeworks”. There is a maximum of 10 submissions for each problem, except for the multiple choice questions where the number of attempts is 2. The deadline to submit solutions is on Mondays at 11:59pm. The WEB site will not accept late homework. Solutions will be provided on the course WEB page after the due date.

It is not a good idea to leave the homework to the last moment. It is a good practice to do them right after the discussion of the corresponding Chapter is completed in the lectures. As you are working on the solution of the homework problems, you may use any resources, including artificial intelligence, consultation with your classmates or any other person. In fact, creating study groups for HW solutions is strongly encouraged.

Any requests for deadline extension should be documented and discussed with the instructor in a timely manner.

Homework 1: Pre-test

Experience shows that the main reason for failing this course is insufficient preparation in basic math. To protect students from this failure, we do a pre-test that is due as Homework 1, as seen in the course schedule.

Homework 1 has three parts. They are timed and the times are very short. The three sections of the tests are algebra (3 minutes), exponentials/complex numbers (4 minutes) and calculus (5 minutes). Once you start the test, the time is clicking and there is no way to stop it (even if you log out of WebAssign, the time will keep running). You will get full credit for the corresponding section if you do at least one problem correctly.

For most of you the questions will be very easy, but some of you may find them difficult. If you did not get full credit for all three sections, please talk to me.

Recitations, Quizzes

The recitations will give you an opportunity to ask questions about the last homework, or any other topic related to the course. Being at the recitation in-person is just as important as attending the lectures.

There will be a quiz at the beginning of most recitations. The quiz will be 10 minutes long and the problem will be similar to the homework problems from the previous week. The quiz is closed book/notes, but a formula sheet may be provided.

In calculating to final quiz score the 2 lowest quiz grades will be dropped. There is no make-up for the quizzes.

Multiple-choice questions (a.k.a. “clicker questions”)

There will be a several multiple-choice questions during the lecture. The purpose of these questions is to measure the progress of the class and adjust the lecturing accordingly. During each lecture you need to answer only a single question correctly in order to get full credit for the clickers.

We are not going to use the regular clickers. Instead, we use WebAssign. At the beginning of the lecture log in to WebAssign and be ready to answer the clicker questions there.

Exams

There will be two midterms and a final exam. The material covered in the midterms is indicated in the course schedule. The final exam covers the whole course material. A formula sheet will be provided for each exam.

Practice problems will be distributed before the exams. On the week of the midterms the Tuesday lecture will be dedicated to problem-solving in preparation for the midterm and the exam will be during lecture time on Thursday. Similarly, the last lecture of the course will be a preparation to the final exam.

All exams are in person, proctored. Sufficient room will be provided for distancing between students. The exams are closed books and all work must be done by the student without outside help. A formula sheet will be provided.

The **midterm exams** will be held during the regular lecture hours as indicated in the course schedule published on the WEB site. There will be no make-ups for the midterms. Instead, if proper medical or other explanation is provided, the weight factor of the missed midterm will be reduced to zero and the weight factor of the other midterm will be doubled. In the absence of explanation, the midterm grade will be counted as zero with its full weight factor.

The **final exam** will be held at the time and place assigned by the Registrar. Students missing the final exam will get an “incomplete” grade, but only if proper medical explanation is provided. These students take the written exam later, followed by an oral examination. In the absence of explanation, the course grade will be F.

Cheating on the exams will be immediately reported to the Academic Judiciary and the minimum penalty will be an F in the course.

Artificial Intelligence (AI)

The use of AI is allowed, except during the quizzes and exams. For example, looking at ChatGPT, in my experience it can correctly approach many of the homework and exam problems in PHY 251. It also gives a nice verbal explanation, outlining the basic steps to the solution. It acts a little bit like a private tutor.

For some problems ChatGPT makes mistakes. It still gives a nice – looking explanation, that is incorrect. If you follow ChatGPT’s advice, and WebAssign flags your solution as incorrect, you should try to figure out the source of the mistake. Discovering the error in ChatGPT’s reasoning is also very educational.

It is very important that you make and attempt to solve the problem before asking an AI. Turn to ChatGPT only if WebAssign rejects your answer. Please keep in mind that you can use AI as a learning tool, but at the exams and quizzes you will have to rely on your own knowledge, because there will be no outside help allowed.

Grading

Your final PHY251 course grade will be determined by weighting the various portions of the course as follows:

- 20% quizzes
- 5% multiple-choice questions during lectures (participation)
- 40% midterm exams (20% each midterm)
- 5% homework
- 30% final exam

It is obvious from the weight factors that you can get a good grade even if you do not do the homeworks. Nevertheless, it would be a huge mistake to skip them, because you cannot get a decent score on the quizzes and the exams if you do not practice. The problems on the quizzes and the exams will be similar to homework problems.

Grades: The course is graded “on the curve”. The average score (S) and the standard deviation of the scores (d) will be calculated (students who did not do the final exam will be excluded from the calculation). Students with scores larger than $S + 0.6d$ will get an A grade. The lower cut-offs for the rest of the grades are: $A^- : S + 0.4d$, $B^+ : S + 0.2d$, $B : S - 0.1d$, $B^- : S - 0.3d$, $C^+ : S - 0.7d$, $C : S - 1.2d$. *These numbers are not final and may change depending on the actual distribution of the grades.*

Laboratory

PHY 252 (the lab) is a separate course from PHY 251 (the lecture and the recitation), but several elements of PHY 251 and 252 are “synchronized”. For example, there will be no labs during the week of the midterm exams. **Most students take the lecture/recitation and the lab concurrently.** The labs are listed in the course schedule; see the link there for the separate course WEB page for the labs. Labs are in-person only.

Learning objectives

Students will demonstrate mastery of physics concepts related to modern physics, including the theory of relativity, quantum mechanics, statistical physics, nuclear- and solid state physics.

1. Students will be able to think critically and apply appropriate physics concepts in analyzing qualitative problems.
2. Students will demonstrate the ability to apply mathematical reasoning, including calculus, in solving quantitative physics problems.
3. Students will demonstrate scientific communication skills through thoughtful discussion, collaborative problem solving, and understanding of experimental results.

Learning strategies, getting help

- Be organized. Start solving new homework problems well before the deadline. If you have questions, go to the office hours of the instructor course. If you want to ask questions by Zoom, send an email message first.
- Be there. Do not skip lectures for watching them online or looking at the video. Come to the lecture room. Go to recitations and ask questions. The more you are absent, the more likely you will have difficulties with the course.
- Be social. Organize or join a study group and discuss the homeworks with your friends. If you are one of the better students, you will learn a lot by explaining. If you are a bit behind, sometimes your peers can explain the stuff better than the instructor.
- Be active. Ask questions during the recitation. Do not be afraid of asking questions during the lectures. I really need your questions in order to calibrate the proper level of the lecture. Also, if you think I made a mistake, do not hesitate to correct me.
- Be engaged. Respond to the multiple-choice questions during lectures.
- Print out the lecture notes before each lecture and use the printout for note-taking. When you prepare for the exam, print out the annotated lecture notes as well, and use them with your own notes.
- Before each exam, practice problems will be published on the course WEB page. Try to solve these problems before the lecture/recitation where the instructor solves them. Ask questions if you do not understand something.
- When solving homework or practice problems and quizzes use the formula sheet provided on the course WEB page. This way you will be familiar with it when the exam comes.
- If your first midterm happens to fall below 30% of the maximum score, immediately contact the instructor and discuss how can you improve.

Religious Holidays: If the schedule of home works, exams or other assignments is in conflict with your religion's Holidays, please let me know in an email by the end of the first week of instructions and I will do my best to accommodate your needs. Please note that I cannot make changes in the course schedule after the first week of classes. No consideration will be made if someone approaches me in this matter at a time close to the due date or the exam date.

Americans With Disability Act: If you have a physical, psychological, medical or learning disability that may impact your ability to carry out assigned course work, contact the staff in the Disabled Student Services office (DSS), 128 Educational Communications Center, 632-6748/9. DSS will review your concerns and determine with you what accommodations are necessary and DSS will advise me. All information and documentation of disability is confidential.

University Academic Integrity Statement: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at:

<http://www.stonybrook.edu/uaa/academicjudiciary/>

Critical Incident Management: Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

PHY 251/252, Spring 2024

| Monday | Tuesday | Thursday | Recitation (Tue. and Thu.) | Lab |
|---|---|--|-------------------------------|--------------------------|
| 22-Jan | 23-Jan Ch1 19th century physics | 25-Jan Ch2 Relativity | No recitation | No lab |
| 29-Jan HW1 due | 30-Jan Ch2 Relativity | 1-Feb Ch2 Relativity | Error propagation | Michelson interferometer |
| 5-Feb HW2 due covers 3 lectures! | 6-Feb Ch3 Quantum physics | 8-Feb Ch3 Quantum physics | HW2 Ch 2 | Photoelectric effect |
| 12-Feb HW3 due | 13-Feb Ch4 Structure of atom | 15-Feb Ch5 Quantum mech. 1 | HW3 Ch3 | Electron charge |
| 19-Feb HW4 due | 20-Feb Ch5 Quantum mech. 1 | 22-Feb Ch6 Quantum mech. 2 | HW4 Ch4 | Bragg scattering |
| 26-Feb HW5 due | 27-Feb Ch6 Quantum mech. 2 | 1-Mar Ch6 Quantum mech. 2 | HW5 Ch5 | e/m for electrons |
| 4-Mar No HW due | 5-Mar Midterm 1 prep. Ch 2,3,4,5 | 7-Mar Midterm 1 Ch 2,3,4,5 | Midterm 1 prep. Ch 2,3,4,5 | No lab |
| 11-Mar No HW due Spring break | 12-Mar Spring break | 14-Mar Spring break | No recitation | No lab |
| 18-Mar HW6 due | 19-Mar Ch7 H atom | 21-Mar Ch7 H atom | HW6 Ch6 | Make up labs |
| 25-Mar HW7 due | 26-Mar Ch8 Atoms | 28-Mar Ch8 Atoms | HW7 Ch7 | Hydrogen spectrum |
| 1-Apr HW8 due | 2-Apr Ch9 Statistical physics | 4-Apr Ch9 Statistical physics | HW8 Ch8 | Scattering angles |
| 8-Apr HW8 due | 9-Apr Midterm 2 prep. Ch 6,7,8 | 11-Apr Midterm 2 Ch 6,7,8 | Midterm 2 prep. Ch 6,7,8 | No lab |
| 15-Apr HW9 due | 16-Apr Ch10 Molecules, solids | 18-Apr Ch10 Molecules, solids | HW9 Ch9 | No lab |
| 22-Apr HW10 due | 23-Apr Ch11 Semiconductors | 25-Apr Ch12 Nuclear physics | HW10 Ch10 | Nuclear decay |
| 29-Apr HW11 due | 30-Apr Ch13 Nuclear power | 2-May Final exam prep. Ch 9,10,11,12 | HW11 Ch 11,12 | Make up labs |
| 6-May HW12 due (Ch13) | | 14-May Final exam 8:00 - 10:45 am | | |