

PHY300, Waves and Optics, Spring 2025 Syllabus

The physics of oscillations and waves, from mechanical waves to light waves to electron waves. Topics include resonance and normal modes of coupled oscillators, the wave equation and wave propagation, interference and diffraction, polarization, imaging and coherence. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Professor: Laszlo Mihaly , Physics Building B145 (on the bridge to the Math building), Email: Laszlo.mihaly@stonybrook.edu. Office Hours Thursday 2:30-3:30pm

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TBA

Textbooks: 1. Vibrations and Waves by Anthony French, 2. Modern Optics by Grant R. Fowles

Lectures/Labs: MW 11:00am-12:20 pm, F 11:00am-12:50 pm

WEB site: Brightspace is used to post course material, announcements and grades.

Grading: HW 10%, Midterm Exams 30%, Worksheets 10%, Lab quizzes 5%, Lab reports 15%, Final Exam 30%

Learning objectives

1. Students will demonstrate mastery of physics concepts related to oscillations, waves, and optics. 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 partial differential equations and linear (matrix) algebra in solving quantitative physics problems.
3. Students will demonstrate scientific communication skills through thoughtful discussion, collaborative problem solving, and understanding of experimental results.

Course format: Lectures and laboratory experiments are integrated in a Studio Physics format.

1. A worksheet will be posted on the course WEB site and distributed in class before the Monday lecture.
2. Most of the worksheets have a lab experiment that will be done on Friday. The results of the experiments, together with a short evaluation of the experimental data, should be part of the submitted worksheet. This can be completed during lab time or shortly afterwards. (See more about worksheets and labs later.)
3. In preparation for the Friday labs you should watch a short video and complete the related quiz on Brightspace. The deadline for submitting the quiz is Friday, 11:00am.
4. Worksheets should be submitted for grading about one week after they were handed out. The deadline is Monday at 11:59pm.
5. Two formal lab reports are a required part of the course. The lab reports must be completed otherwise a severe penalty is applied to the final grade in the course. The deadline for the formal lab reports is 10 days after the lab, on Tuesday at 11:59pm.

6. Homeworks are due on Tuesday at 11:59pm, following the week when the homework topics were discussed in lecture. The course schedule is set up so that no homework is due at the times when the formal lab reports are due.
7. Homeworks, lab reports, worksheets should be submitted on Brightspace. Late submission will result in 20% penalty for each workday (Saturday, Sunday and school breaks do not count). For example, if a worksheet has a maximum score of 10 points and it is submitted on Tuesday (instead of Monday) the maximum score will be reduced to 8 points; on Wednesday, it is 6 points. All required material must be submitted eventually, even if the maximum score is zero.

Worksheets

Most questions on the worksheet are solved during lecture. Occasionally, the instructor may ask you to answer a few questions after the lecture. If this happens, a written announcement will be made either by email or on Brightspace. The worksheet questions not discussed in lecture or mentioned in an announcement should be disregarded.

The last part of most worksheets is about the lab experiment done on Fridays. Students should make teams of 2-3 members (4 students working together is not allowed). Occasionally, the instructors may ask a student to move to another group, due to the imbalance of numbers, or for other reasons. If that happens, we ask for your understanding.

The data should be collected and recorded during lab time. If possible, do the evaluation of the data during lab time as well. The lab worksheet must be signed by a TA before the lab ends. If you miss the Friday lab and you provide medical or other type of valid excuse, you may ask for a make-up time from the TAs. If a lab is missed without an excuse, the corresponding worksheet will get zero points.

The finished worksheet should have the following elements:

1. Short answers to the questions. If the question involves creating a graph, the axes should have labels and units
2. Short notes about the lab experiment, as necessary.
3. Tables of data with clear labels and units.
4. Most of the time a graph of the data, with clear labels and units on the axes, is required.
5. Most of the time we need a calculated curve on the same graph. The curve should be based on the theoretical understand of the data.
6. Numerical values and units of the results of the experiments.
7. If instructed, a short discussion of the uncertainty (error) of the measured parameters should be also included.

The submission in Brightspace may happen in several forms. The simplest way is the use a smartphone to scan the printed / hand-written documents. Another way is sending the pdf files generated by your data processing software. Make sure all files are named in a logical way. Formats accepted are .jpeg, .png and .pdf (preferred).

Lab quizzes

A short video explains the equipment used in each lab. After watching the video, you should complete the related quiz on Brightspace. If you have questions during the lab, you may want to look at the relevant part of the video again.

Lab reports

Two formal lab reports will be required. The worksheets belonging to these labs must be finished the same way as any other worksheet, but in the formal report a complete description of the experimental method and apparatus, together with the discussion of the theoretical underpinning of the experiment are also needed. The lab report usually involves more evaluation of the data and error analysis. A sample lab report is provided on the course WEB page. Lab reports may not be longer than 10 pages.

If a student misses a Friday lab that has a formal lab, the student must make up the lab at a time agreed with the TAs, and submit the formal report by an agreed-upon deadline. The latest deadline is the date of the last lecture in the semester. Missing a formal lab report will result in a 6 point reduction in the final letter grade for the course (for example from A to C, or B to D). Naturally, missing both lab reports will result in an F.

Exams

There will be two midterms and one final exam. The midterms are on Fridays during class time, see the attached course schedule. The exams are closed books, no external help. A formula sheet will be given with the exam. Missed exams will be excused if a doctor's note is submitted. For the midterms there is no make-up exam. Instead, the other midterm's result will count twice for the calculation of the final grade.

Working with others

Collaboration between students members is encouraged. This includes answering the worksheet questions, working together on the lab experiment. As long as you are present and actively involved in the lab measurements, sharing the collected raw data is allowed in any form (e.g. sharing Excel files). In terms of evaluating the data (items #5 to #7 on the list in the "Worksheets" section), collaboration is allowed, but direct sharing or copying is prohibited. For example, you are allowed to share the raw data tables and the graph of the raw data collected in the lab, but the fitted curves and the evaluation of the results cannot be directly copied from others in the group. Answers to worksheet questions should not be copied either.

Artificial Intelligence (AI)

The use of AI is allowed and encouraged, except during exams. Consulting, for example, ChatGPT can give ideas about how to start the solution of a homework problem. Please note that ChatGPT makes occasional mistakes. Discovering the error in ChatGPT's reasoning is also very educational.

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:

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.

Week of	Topic	Reading	Worksheet	Friday Lab	Homework/Lab Reports
25-Aug	Simple Harmonic Oscillator	French Ch 1, 2	#1	Simple Harmonic Oscillator	#1 French 1-1, 1-2, 1-5, 2-2, 2-3, 2-4
1-Sep	Labor Day, Damping, Driving, Energy	French Ch 3,4	#2	Damped Oscillator	#2 French 3-1, 3-2, 3-3, 3-13, 4-3, 4-5, 4-10
8-Sep	Two Coupled Oscillators	French Ch 5	#3	Two Coupled Oscillators	#3 French 4-16, 5-2, 5-4, 5-9, 5-10
15-Sep	N Coupled Oscillators	French Ch 5	#4	LC Circuits	Lab report #1 Coupled Oscillators
22-Sep	Strings, Fourier Series	French Ch 6	#5	String Demo (no lab)	#4 French 6-1, 6-2, 6-6, 6-11, 6-12, 6-14a
29-Sep	Review			(no lab)	Midterm 1
6-Oct	Travelling Waves	French Ch 7	#6	Vibrating Rod, Sound waves	#5 French 7-2, 7-3, 7-4, 7-6, 7-8, 7-9
13-Oct	(Fall Break) EM Plane Waves	Fowles Ch 1	#7	(no lab)	#6 Fowles 1.2, 1.3, 1.5, 1.6
20-Oct	Polarization	Fowles Ch 2	#8	Polarization	#7 Fowles 2.1, 2.3, 2.8, 2.10, 2.12
27-Oct	Reflection & Refraction	Fowles Ch2	#9	Reflection & Refraction, Thin lens	Lab report #2 Polarization
3-Nov	Review			(no lab)	Midterm 2
10-Nov	Ray Optics	Fowles Ch 10, pp294 - 301	#10	Ray Optics	#8 2.16, 2.17, 2.22, 10.2, 10.4, 10.5
17-Nov	Interferometers	Fowles Ch 3,4	#11	Interferometers	#9 Fowles 3.2, 3.3, 4.1 (see eqns 4.9 and 4.20), 4.5
24-Nov	Thanksgiving				
1-Dec	Diffraction	Fowles Ch 5	#12	Diffraction	#10 Fowles 5.4, 5.9, 5.12 (Note typo, should be $2h/b+1$)

13-Oct Fall break

3-Oct Midterm 1 covers worksheets #1 - #4

7-Nov Midterm 2 covers worksheets #5 - #8

24-Nov No classes, Thanksgiving

18-Dec 11:15am - 1:45pm, Final exam, covers 50% worksheets #1- #8, 50% #9 - #12