PHYS 2303 Syllabus

Vibrations and Waves — PHYS 2303, Section A, 3 Credits

Fall 2026

Instructor Information

Instructor: Michael Schatz
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Course Information and Policies

Description

An introduction to oscillations and waves in physical systems, illustrated with examples drawn from different settings (e.g., mechanics, electromagnetism, quantum mechanics).

Co-requisites

Phys 2212 (Principles of Physics II) or equivalent. Knowledge of linear algebra is expected. Knowledge of multivariable calculus and differential equations is useful but is not a prerequisite, as the necessary mathematical methods will be introduced as the need arises.

Course Learning Outcomes

Students will develop proficiency with the fundamental concepts and methods used to analyze vibrations and waves. In particular, students will be able to:

- Represent simple harmonic motion using phasors and complex exponentials.
- Apply the principle of superposition to describe free oscillations in systems with one or a few degrees of freedom.
- Perform normal-mode analysis of coupled free oscillators, including calculating eigenvalues and eigenvectors, identifying normal modes and normal coordinates, constructing general solutions, and applying initial conditions.
- Analyze free oscillations in systems with many degrees of freedom.
- Derive and interpret dispersion relations for discrete and continuous systems.
- Apply Fourier series and Fourier transforms to represent and analyze oscillatory and wave phenomena.

- Analyze damped and driven oscillations in systems ranging from one to many degrees of freedom.
- Characterize resonance phenomena and evaluate the behavior of mechanical and electrical filters.
- Construct and interpret traveling-wave solutions.
- Calculate and interpret reflection and transmission coefficients at boundaries and interfaces.

Course Materials

There is no required textbook; however, two textbooks are recommended:

1. *Waves*, Berkeley Physics Course Volume 3, by Frank S. Crawford Jr. (McGraw Hill, 1968). There is a copy on 2-hour reserve in the library.
2. *The Physics of Waves*, by H. Georgi. The latest version of this book (Sept. 2022) can be freely downloaded here: https://www.dropbox.com/scl/fi/98w680pnx72z6akq5bexe/onenew.pdf?rlkey=i2u6ks8gyl1nfiamb61ep6qpe&dl=0

Grading Policy and Description of Graded Components (including Attendance Policy)

Percentage ranges for final grades are as follows: 90–100% = A, 80–89% = B, 70–79% = C, 60–69% = D, 0–59% = F. There is no "grading on a curve" in this course.

The graded components and corresponding percentage weights on the final grade are:

- Final Exam: 32%
- Mid-Term Exam: 22%
- Class Participation: 13%
- Joint Homework–Quiz Assignments: 33%

Final Exam. The Final Exam will be held in-person from 8:00 am–10:50 am on Wednesday, December 16, 2026 at a location to be announced. The exam is cumulative, closed book, closed notes.

Mid-Term Exam. The Mid-Term Exam will be held in-person from 9:30 am–10:45 am on Wednesday, October 14, 2026 in our assigned classroom (Howey L5). The exam is cumulative (up to October 14), closed book, closed notes.

Class Participation. Class Participation is essential for doing well in this course. To encourage participation, a subset of students (typically chosen at random) will be called upon by name to answer (orally and/or at a white board) questions posed in class. For each lecture on or after August 31, 2026, earning class participation credit of 0.5% toward the final grade requires:

1. Showing up for class on time and being present for the entire class period, and

2. A good faith effort is made to answer whenever called upon by name to respond.

There is no partial credit for class participation.

Joint Homework–Quiz Assignments. Beginning the week of August 31, 2026 (with some exceptions noted below), each week a homework assignment will be due 9 am on Mondays and an in-class quiz based on the homework will be given on Wednesdays. Homework must be legible, labeled with the identifier that is assigned in class (do not write your name on the homework), and clearly indicate each problem number and part (e.g., Prob 1(d)). Prior to submission, homework must be properly scanned with all pages visible in the correct order and orientation, with good lighting and contrast while avoiding blur, glare and shadows. On or before the deadline, the scanned pages must then be uploaded to Gradescope as one complete PDF. Late homework will not be accepted.

The Wednesday quiz will be closely based on one to two problems from the Monday homework. The quiz will be graded using a rubric. The corresponding homework will be evaluated for completion: submitted homework must show a good-faith effort on every assigned problem. Each homework problem with a missing or inadequate submission reduces the corresponding quiz grade by 10%.

There will be no homework due or quiz given during the week of October 5 (Fall Break). Homework will be due but not evaluated for completion on the following Mondays: October 12, November 23, and December 7.

Policy on the Use of Generative AI

Generative AI such as ChatGPT, Claude, etc. can be a powerful tool for mastering new material, but it should be used cautiously, since AI is often wrong and can sometimes trick someone into thinking that they understand material when they don't. In this course, the use of AI on exams and quizzes is forbidden. Use on submitted homework is permissible; however, for each submission where AI is used, students must understand and be able to explain (without consulting the AI) all material they submit. Failure to follow these requirements will be considered Honor Code violations and handled as described below.

Academic Honesty

The policy on academic honesty as stated in the Honor Code (http://policylibrary.gatech.edu/student-affairs/academic-honor-code) will be fully enforced during this course for both the instructor and student. All Honor code violations will be referred to the Dean of Students office.

Collaboration with other students in this course on homework assignments and in-class activities is permitted and encouraged. Collaboration is not permitted during tests and quizzes. Students must work on the test individually and receive no assistance from any other person or outside resource. Students are allowed blank paper. Students are not allowed to use a calculator, unless explicitly directed to do so by the instructor.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Accommodations for Students with Learning Disabilities

A student with learning needs that require special accommodation should contact the Office of Disability Services at (404) 894-2563 or http://disabilityservices.gatech.edu/ to make an appointment to discuss their special needs and to obtain an accommodations letter. Once a letter is obtained, students must meet with Dr. Schatz prior to the implementation of any accommodations to discuss learning needs. In general we are able to accommodate all requests given advanced notice. However, any student with the request "ability to makeup missed work" must contact Dr. Schatz in advance of the deadline for each assignment in question to make the accommodation request; additionally, the time extension for each request must have reasonable limits (requests to extend the deadlines to the end of the course term are not reasonable).

Campus Support Services

It is not unusual for any of us to find ourselves in need of support during stressful periods. For a full list of student support resources please see the navigation link on the left menu bar GT Student Resources (https://gatech.instructure.com/courses/558804/external_tools/17721).