

TENTATIVE: Phys 2303 Syllabus and Course Schedule

Vibrations and Waves, 3 Credits

Class Meetings: TBA

Times: TBA

Instructor Information

Instructor/Office

Michael Schatz/W306 Howey

Email

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Office Hours

By Appointment

General Information

Description

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

Co-Requisites

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

Course Goals and Learning Outcomes

Students will attain familiarity with basic ideas associated with vibration and wave phenomena. In particular, students will develop a familiarity with:

1. Representing Periodic Motions; Phasors, Complex Exponentials
2. Superposition of Periodic Motions
3. Paradigm Oscillatory Systems: Mechanical and Electromagnetic
4. Free Oscillations of Systems with One or Few Degrees of Freedom
5. Normal Mode Analysis
6. Free Oscillations of Systems with Many Degrees of Freedom
7. Dispersion Relations
8. Fourier Analysis
9. Damped, Driven Oscillations of Systems with One to Many Degrees of Freedom
10. Resonance, Filters
11. Traveling Waves; Reflection/Transmission Coefficients
12. Modulations, Pulses and Wave Packets
13. Waves in Two and Three Dimensions
14. Polarization
15. Interference and Diffraction

Course Requirements & Grading

Assignment	Date	Weight (Percentage, points, etc)
Quizzes (2)	See Course Schedule	20% each (40% total)
Homeworks (4)	See Course Schedule	5% each (20% total)
Final Exam	See Course Schedule	40 %

Description of Graded Components

Working homework problems is critically important for mastering concepts and methods in this course. It is also the best way to prepare for the quiz and final exam components of the graded work.

For each homework assignment, which will typically consist of 4-5 problems, solutions are to be submitted in two distinct ways: (1) Submission of video recording of you solving one problem on a whiteboard (the specific problem to be solved in this manner will be indicated in the homework assignment), (2) Submission of written solutions to the rest of the problems in the assignment. An example illustrating one way to present and to submit a problem solution on video is posted on Canvas.

You are welcome to discuss and brainstorm solutions to homework problems with your class mates, but you are expected to present your own independent solutions. Substantially correct and complete solutions will be awarded full marks in grading.

Homework assignments are to be turned in by the beginning of class on the due date.

The quizzes and final exam will involve solving problems of a style similar to those in the homework assignments; ample time will be available for working problems on the quizzes/final.

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

[At Georgia Tech, grades are awarded on a scale of A-F with no +/- grades permitted.]

According to policy, grades at Georgia Tech are interpreted as follows:

A	Excellent (4 quality points per credit hour)
B	Good (3 quality points per credit hour)
C	Satisfactory (2 quality points per credit hour)
D	Passing (1 quality point per credit hour)
F	Failure (0 quality points per credit hour)

See <http://registrar.gatech.edu/info/grading-system> for more information about the grading system at Georgia Tech.]

Course Materials

Course Text

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

1. *Vibrations and Waves*, A.P. French (CBS Publishers, 2020 e-Book) *aves*, The book is available inexpensively in electronic format from Amazon and viewed using a Kindle app installed on your electronic device.
2. *Waves, Berkeley Physics Course Volume 3*, by Frank S Crawford Jr., (McGraw Hill, 1968). The book is out of print; however, there is a copy on 2-hr reserve in the library. You are free to make copies of relevant sections for your own personal use.
3. *The Physics of Waves*, by H. Georgi (Prentice-Hall 1993). The book has been made available online by Prof. Georgi as a pdf file.

Additional Materials/Resources

I will place online a cleaned-up version of my class notes after each lecture, usually within 48 hours.

Course Website and Other Classroom Management Tools

Homework assignments, syllabus, notes and resources will be posted on Canvas.

Course Expectations & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Attendance and/or Participation

Regular class attendance and participation is expected of all students.

Collaboration & Group Work

Collaboration on assignments is discussed under the header to this section, above. Use of existing solutions to textbook or assignment problems, from whatever source, is not permitted.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Homework assignment extensions or a make-up for a missed quiz will be considered for (a) a documented medical absence or (b) for approved institute activities (e.g. field trips and athletic events). Students should contact the instructor by email or in person prior to the absence or late assignment.

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. See <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectation that you can have of me and that I have of you. 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.

Student Use of Mobile Devices in the Classroom

Taking notes electronically on computer is permitted.

Campus Resources for Students

In your time at Georgia Tech, you may find yourself in need of support. Below you will find some resources to support you both as a student and as a person.

Academic support

- Center for Academic Success <http://success.gatech.edu>
 - 1-to-1 tutoring <http://success.gatech.edu/1-1-tutoring>
 - Peer-Led Undergraduate Study (PLUS) <http://success.gatech.edu/tutoring/plus>
 - Academic coaching <http://success.gatech.edu/coaching>
- Residence Life's Learning Assistance Program
<https://housing.gatech.edu/learning-assistance-program>
 - Drop-in tutoring for many 1000 level courses
- OMED: Educational Services (<http://omed.gatech.edu/programs/academic-support>)
 - Group study sessions and tutoring programs
- Communication Center (<http://www.communicationcenter.gatech.edu>)
 - Individualized help with writing and multimedia projects
- Academic advisors for your major
<http://advising.gatech.edu/>

Personal Support

Georgia Tech Resources

- The Office of the Dean of Students: <http://studentlife.gatech.edu/content/services>; 404-894-6367; Smithgall Student Services Building 2nd floor
 - You also may request assistance at https://gatech-advocate.symplcity.com/care_report/index.php/pid383662?
- Counseling Center: <http://counseling.gatech.edu>; 404-894-2575; Smithgall Student Services Building 2nd floor
 - Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, referral services, and crisis intervention. Their website also includes links to state and national resources.

- *Students in crisis may walk in during business hours (8am-5pm, Monday through Friday) or contact the counselor on call after hours at 404-894-2204.*
- Students' Temporary Assistance and Resources (STAR):
<http://studentlife.gatech.edu/content/need-help>
 - Can assist with interview clothing, food, and housing needs.
- Stamps Health Services: <https://health.gatech.edu>; 404-894-1420
 - Primary care, pharmacy, women's health, psychiatry, immunization and allergy, health promotion, and nutrition
- OMED: Educational Services: <http://www.omed.gatech.edu>
- Women's Resource Center: <http://www.womenscenter.gatech.edu>; 404-385-0230
- LGBTQIA Resource Center: <http://lgbtqia.gatech.edu/>; 404-385-2679
- Veteran's Resource Center: <http://veterans.gatech.edu/>; 404-385-2067
- Georgia Tech Police: 404-894-2500

Statement of Intent for Inclusivity

As a member of the Georgia Tech community, I am committed to creating a learning environment in which all of my students feel safe and included. Because we are individuals with varying needs, I am reliant on your feedback to achieve this goal. To that end, I invite you to enter into dialogue with me about the things I can stop, start, and continue doing to make my classroom an environment in which every student feels valued and can engage actively in our learning community.

Course Schedule

The following is a provisional schedule; the content sequencing may be significantly revised during the semester.

Week 1	Representing Periodic Motions; Phasors, Complex Exponentials
Week 2	Superposition of Periodic Motions
Week 3	Paradigm Oscillatory Systems: Mechanical and Electromagnetic
Week 4	Free Oscillations of Systems with One or Few Degrees of Freedom
Week 5	Normal Mode Analysis
Week 6	Free Oscillations of Systems with Many Degrees of Freedom
Week 7	Dispersion Relations
Week 8	Fourier Analysis
Week 9	Damped, Driven Oscillations of Systems with One to Many Degrees of Freedom
Week 10	Resonance, Filters
Week 11	Traveling Waves; Reflection/Transmission Coefficients
Week 12	Modulations, Pulses and Wave Packets
Week 13	Waves in Two and Three Dimensions
Week 14	Polarization
Week 15	Interference and Diffraction

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Final Exam TIME, Location TBD



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7.2	Harmonic Plane Waves and the Propagation Vector	332
7.3	Water Waves	346
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8.2	Description of Polarization States	395
8.3	Production of Polarized Transverse Waves	407
8.4	Double Refraction	419
8.5	Bandwidth, Coherence Time, and Polarization	427
	Problems and Home Experiments	437
 <i>Chapter 9 Interference and Diffraction</i>		451
9.1	Introduction	453
9.2	Interference between Two Coherent Point Sources	454
9.3	Interference between Two Independent Sources	466
9.4	How Large Can a “Point” Light Source Be?	470
9.5	Angular Width of a “Beam” of Traveling Waves	473
9.6	Diffraction and Huygens’ Principle	478
9.7	Geometrical Optics	498
	Problems and Home Experiments	519

Fourier analysis: Fourier series, Fourier transform.

Convolution: examples, point spread function, smoothing action

The bandwidth theorem: examples, ultrashort light pulses