Syllabus for PHYS 2601: Classical and Quantum Waves (Fall 2025)
Prof. James McIver

Course website: https://courseworks2.columbia.edu/courses/227331
All course content and announcements will be posted here. Turn on courseworks email notifications!

Course objective: This course aims at providing an introduction to the mathematical description of vibrations and waves as they appear in a broad range of physical contexts, from classical to quantum. Topics covered include simple harmonic motion (simple, damped, forced, coupled), traveling waves, standing waves, interference and diffraction of waves, dispersion of waves, the Schrödinger equation, and oscillations in quantum systems. The course is foundational for advanced work in all areas of physics and related fields.

Requirements: PHYS UN1602 or UN1402; corequisite: MATH UN1205 (recommended, combined Calc III+IV in one semester), or MATH UN1202 (Calc IV)

Lectures: Tuesday, Thursday 2:40-3:55pm (75 mins), Pupin 329

Lecturer: Prof. James McIver
Email: jm5382@columbia.edu
Office: NWC 1108
Office hours: Thursday 4-5pm, Pupin 814—for clarifying physical concepts covered in lecture

Recitations: Practice problem solving skills and Q&A for homework/exams (50 min)

PHYS UN2603 Physics III: Class/Quantum Wave - Rec. *0.00 points.*

Fall 2025: PHYS UN2603

COURSE NUMBER	SECTION/CALL NUMBER	TIMES/LOCATION
PHYS 2603	001/13286	M 5:10pm - 6:00pm Room TBA
PHYS 2603	002/13288	T 5:10pm - 6:00pm Room TBA
PHYS 2603	003/13289	T 6:10pm - 7:00pm Room TBA
PHYS 2603	004/13291	W 5:10pm - 6:00pm Room TBA
PHYS 2603	005/13292	W 6:10pm - 7:00pm Room TBA

TAs:
TBD

Homework Policy:

- One problem set due approximately every week
- Problem sets will be posted with one week's notice before the due date
- Due Sundays by 9:00am, digitally uploaded as a single, merged-pdf via gradescope (accessible via courseworks page). Individual problems must be tagged in gradescope to receive full credit

- Late submissions and submissions not adhering to the above penalized at 50%
- Lowest two problem set grades will be dropped (for when you just can't get your HW done for any number of reasons—it is up to you to manage these resources wisely)
- Zero exceptions or extensions, unless Prof. McIver is contacted directly by Disability Services or via a directive from a dean (such as with extensions due to religious holidays etc.)
- All emails requesting extensions not in line with this policy will be ignored

Exams: Two midterm exams covering Units 1 & 2 of the course, respectively, held during the normal lecture time/place. Final exam will cover all course material (but with a slightly heavier emphasis on Unit 3 content). Exams will be closed book and a formula sheet will be provided. Make-up exams in the case of illness or emergency will also only be offered under exceptional circumstances and will require a note from a doctor or a dean.

Midterm 1 (Unit 1): Tuesday, October 14, 2025
Midterm 2 (Unit 2): Thursday, November 13, 2025
Final (Units 1-3): December 18, 2025, 1:10-4pm (tentative, pending registrar)

Course grade: 30% problem sets (dropping lowest two grades), 10% recitation attendance (one missed recitation is allowed), 25% midterms average, 35% final exam. Grading will be merit based, not curve based (i.e., you are not competing with each other for grades).

Textbooks: Required: George King's *Vibrations and Waves* (Units 1-2).

The quantum waves portion of the course (Unit 3) will be taught from other resources that will be provided at a later date.

Recommended: French's *Vibrations and Waves* (Units 1-2);

Course outline: 26 classes with two in-class midterms -> 24 lectures. No classes on Nov 4 & 27 because of academic holidays. Occasionally I will need to miss a lecture due to travel, in which case I will upload a pre-recorded video lecture to courseworks and there will be no in-class lecture. These dates are currently scheduled to be Sept 9, Sept 11, Oct 28 & Nov 25.

Unit 1: Harmonic motion (Ch. 1-4, King's *Vibrations and Waves*)
Simple harmonic oscillator, damped harmonic oscillator, forced harmonic oscillator, coupled harmonic oscillators.

Midterm 1: October 14, 2024

Unit 2: Classical Waves (Ch. 5-8, King's *Vibrations and Waves*)
Traveling waves, standing waves, interference and diffraction of waves, dispersion of waves.

Midterm 2: November 13, 2024

Unit 3: Quantum waves (various sources)
Schrödinger equation, matter waves, oscillations in quantum systems.

Final Exam: December 18, 2024 (tentative)

Additional resources: In addition to lecture, recitation and office hours, the Physics Help Room is another valuable resource. The Physics Help Room (413 Pupin) is staffed by physics graduate students

each weekday afternoon during the semester. They are there to help guide students with course material/questions, however they will not answer homework questions directly.

https://www.physics.columbia.edu/content/help-room-hours

Help Room Hours

The Physics Help Room (Pupin 413) is staffed by graduate students Monday, Tuesday, Wednesday, and Thursday 1 p.m. - 6 p.m., and Friday 1 p.m. - 4 p.m.

If the TA is not present or if you have any other problems, please contact the physics preceptors at physicspreceptors@columbia.edu.

PHYS UN1201, UN1202, UN1402, UN1602, and UN2802

Table 1

Monday	Tuesday	Wednesday	Thursday	Friday
1:00 p.m. - 6:00 p.m.	1:00 p.m.- 6:00 p.m.	1:00 p.m. - 6:00 p.m.	1:00 p.m. - 6:00 p.m.	1:00 p.m. - 4:00 p.m.

Expectations:

What you can expect of me:

- A well-organized and well-prepared course, with a clear definition of what we will cover in class
- Enthusiasm and encouragement
- Accessibility - primarily in class and in office hours, but also via email. I will try to be as responsive as possible

What I ask of you:

- Science is a highly collaborative endeavor and I encourage everyone to consider their classmates as collaborators, rather than competitors. Give and request help from each other often! This collaborative spirit is an essential skill to develop, and one that distinguishes great scientists from average scientists
- Come to class prepared, having completed any assigned advance reading. You will get much more out of class, and the course, if you follow this advice
- Attend every lecture. The course moves quickly, and skipping any material will make it hard to keep up
- Attend the recitation. These sessions will help you develop critical problem-solving skills, which is perhaps the best way to improve your understanding of the material. Recitations will also provide an opportunity for you to ask questions about homework-related topics
- Complete all homework assignments on time
- Try to honestly gauge your progress, and if you feel you are having difficulty, reach out to me and/or the TA immediately - early intervention works best!
- Behave honestly. Make sure that all assessed work is your own

Code of conduct: All course participants (myself, TA, students) are expected to treat each other in a professional and respectful manner. Communication should be appropriate and considerate of the fact that that people may come from different cultural backgrounds. Please use people's stated pronouns. Be kind to others.

We should all aim to create a classroom environment that is accessible, productive, and enjoyable for all, regardless of gender, sexual orientation, disability, age, physical appearance, body size, ethnicity, nationality, religion, or other protected characteristics. Harassment in any form, including sexist, racist, or exclusionary comments or jokes, and offensive or belittling comments are unacceptable. Sexual language and imagery are not appropriate.

If you find that someone is making you or someone else uncomfortable, you are welcome to discuss the matter with me. Should you feel more comfortable speaking with someone else, there are also CU resources that can help, a list of which can be found at:
https://cdi.physics.columbia.edu/content/resources

Academic Integrity: Students are expected to do their own work on all tests and assignments for this class and act in accordance with the Faculty Statement on Academic Integrity and Honor Code established by the students of Columbia College, the School of Engineering and Applied Science and the School of General Studies. Because any academic integrity violation undermines our intellectual community, students found to have cheated, plagiarized, or committed any other act of academic dishonesty can expect to either fail the class or receive a zero for the work in question and may be referred to the Dean's Discipline process.

Working collaboratively with friends/peers on homework problems is encouraged, and can build understanding. However, students are responsible for submitting their own, individually-authored work for all problem sets and exams.

It is each students' responsibility to ensure their work maintains the standards expected. Should you have any questions or concerns regarding your work, you should ask me, or refer to the Columbia University Undergraduate Guide to Academic Integrity.

DS Accommodations: In order to receive disability accommodations, students must first be registered with Disability Services (DS). More information on the DS registration process is available online at http://health.columbia.edu/disability-services. Registered students must contact DS to arrange accommodations for this course, including exam accommodations.

Students who have, or think they may have, a disability are invited to contact DS for a confidential discussion at 212.854.2388 (V) 212.854.2378 (TTY), or by email at disability@columbia.edu.