THE UNIVERSITY of MISSISSIPPI

DEPARTMENT OF PHYSICS AND ASTRONOMY

Phys 303: Physical Theory and Techniques

Fall 2025, TTh 09:30 – 10:45, Lewis 103A

"The career of a young theoretical physicist consists of treating the harmonic oscillator in ever-increasing levels of abstraction".
Sidney Coleman, physicist

Course Information Version: 08/25/2025

Instructor: Dr. Cecille Labuda
Office: Lewis 121B
Office Hours: MThF 14:30 – 16:30. T 14:00 – 14:45 Lewis 121B and by appointment
Email: cpembert@go.olemiss.edu (I typically respond to emails on weekdays within 24 hours)

Course Description

This course covers fundamental physical models widely applicable to the undergraduate physics curriculum. Emphasis is placed on the development of problem-solving skills using calculus, advanced algebraic concepts, estimation techniques, and computer modeling. Course prerequisites: Math 262 and Phys 214 or Phys 212.

Course Learning Outcomes

By the end of this course, you should be able to:

- Readily identify and work with a basic set of physical models that can later be applied to more complex physical systems.
- Use a set of typical math techniques to analyze, solve and model fundamental physical systems.
- Work with numerical models of simple physical systems.
- Use physical intuition and basic reasoning to solve Fermi problems.
- Write clear, concise solutions to physics problems explaining your reasoning along the way.

Course Texts and Materials

- Selected chapters of Halliday, Resnick and Walker. Fundamentals of Physics, Extended Edition. ISBN: 9781119773511 (Recommended as a reference but not required)
- Seymour Lipschutz, Murray R. Spiegel and John Liu. Schaum's Outline of Mathematical Handbook of Formulas and Tables. McGraw Hill, ISBN-13: 978-1260010534 (Required)
- Glowscript Vpython: www.glowscript.org
- Matlab by Mathworks: www.matlab.com

Course Assignments and Evaluation

Class Exercises, Summaries, Problem Presentations (5%)

In-class exercises and blackboard presentations of problem solutions during class meetings. Graded for completion; no make-ups.

Written exams (45%)

2 closed-book exams weighted as follows:

- Higher grade: 25%
- Lower grade: 20%

Oral exam [5%]

A presentation topic will be assigned to each student. Questions will be asked after the presentation.

Homework (20%) Note that the homework grade will only count if the exam average is >50%. *Otherwise the homework grade will be computed as zero.*

- Homework sets must be turned in at the beginning of class when due. [c]
- Students are encouraged to work together to solve the homework problems. However, students may not copy homework solutions, in particular, from each other, from solutions manuals or from any source whatsoever. Copied homework will be given a grade of zero.
- Homework solutions must be presented according to the homework rubric or it may not be graded.

Final exam (25%)

- The final exam will be comprehensive. The format will be similar to the tests.

Course Grades

- 90% ≤ A ≤ 100%
- 88% ≤ A- < 90%
- 86% ≤ B+ < 88
- 80% ≤ B < 86%
- 78% ≤ B- <80%
- 76% ≤ C+ <78
- 70% ≤ C <76
- 68% ≤ C- <70%
- 50% ≤ D <68
- F <50%

Attendance and Lateness

Class attendance is required. Students can have up to 3 absences without penalty; these absences are expected to cover illness, personal emergencies, university obligations, religious observances, and other circumstances. While allowances will be made for circumstances requiring extended absences, if these are deemed to be reasonable by the instructor, in general, no additional penalty-free absences will be allowed. If a student is absent for 3 or more classes during the semester, the final calculated grade will be reduced by a letter grade at the time grades are officially assigned. Arriving 15 or more minutes late for a class will be counted as an absence. Regular lateness (arriving any time after class starts 4 or more times, even if it less than 15 minutes each time) will be counted as one absence. If you must be absent for exams, you must speak to me before the exam to determine whether the absence will be excused and whether the exam will be rescheduled. For unexpected exam absences, you must contact me by email or telephone within 24 hours after the absence or the exam will not be rescheduled. The University requires students to attend the first meeting of every course and that their attendance be verified by the instructor. Verification will take place during the first week of class.

Academic Integrity

We share a responsibility to maintain academic integrity in our work and will follow the procedures outlined in the Academic Conduct and Discipline Policy and the M Book for any instance of academic misconduct. By choosing to be part of the University of Mississippi community, every student agrees to abide by the University of Mississippi Creed and the UM Academic Integrity Policy. Cheating is forbidden and, in this course, will result in a zero grade on the given assignment. If a second case of cheating occurs, this will result in an F for the entire course. Unless explicitly permitted by the instructor, distribution of materials provided in this class via the internet or otherwise. Accessing such materials for your own use is also in violation of the UM Academic Conduct Code. Additionally, the distribution of your own class notes is strongly discouraged except for occasional loaning of notes to students also enrolled in the class.

Use of Generative AI Not Permitted

Generative AI refers to artificial intelligence technologies, like those used for ChatGPT that can draw on a large body of data to create new written, visual, or audio content. In this course, we will be developing skills that are important to practice on your own. Because use of generative AI may inhibit the development of those skills, the use of generative AI for working on assignments is generally not permitted. Using such tools for any purposes, or attempting to pass off AI-generated work as your own, will violate our academic integrity policy. Students will be required to sign an academic integrity statement on each assignment submitted confirming that they are not using such tools for writing assignments.

Technology in the Classroom

Laptops and other computing devices may sometimes be used in class as learning resources and when needed I will ask you to take them out for use. At all other times, such devices must be put away.

Smartphones, in particular, cannot be used in the classroom and earphones are not allowed. Students who wish to take notes using electronic devices may only use devices with lay-flat screens. Handwritten note-taking is strongly encouraged as research studies have shown that the motor action of handwriting activates parts of the brain that enhance memory and learning in a way that typing does not. (Reference: Mangen A and Velay JL. Digitizing literacy: Reflections on the haptics of writing. Advances in Haptics 2010. Popular Reference: Better learning through writing. Science Daily).

Disability Access and Inclusion Policy

The University of Mississippi is committed to the creation of inclusive learning environments for all students. If there are aspects of the instruction or design of this course that result in barriers to your full inclusion and participation, or to accurate assessment of your achievement, please contact the course instructor as soon as possible. Barriers may include, but are not necessarily limited to, timed exams and in-class assignments, difficulty with the acquisition of lecture content, inaccessible web content, and the use of non-captioned or non-transcribed video and audio files. If you are registered with SDS, you must log in to your Rebel Access portal at **https://sds.olemiss.edu/rebel-access-portal** to request approved accommodations. If you are NOT registered with SDS, you must complete the process to become registered. To begin that process, please visit our website at **https://sds.olemiss.edu/apply-for-services**. SDS will: (1) complete a comprehensive review to determine your eligibility for accommodations, (2) if approved, disseminate to your instructors a Faculty Notification Letter, (3) facilitate the removal of barriers, and (4) ensure you have equal access to the same opportunities for success that are available to all students. If you have questions, contact SDS at 662-915-7128 or **sds@olemiss.edu**.

Phys 303: Schedule of Topics. The schedule of topics is flexible and subject to change; last update 08/26/2025)

Week	Topic	Textbook Sections and Other Material
00: 08/25 – 08/29	Projectile motion with constant acceleration and varying acceleration, Taylor series, computational solutions, uniform circular motion	Glowscript VPython, Matlab Online HRW Ch 4, 5, 6, SM
01: 09/01 – 09/05	LABOR DAY; Simple harmonic motion	HRW Ch 4, 5, 6, 15, SM
02: 09/08 – 09/12	Simple harmonic motion, simple pendulum, oscillatory motion and the region of simple harmonic motion	HRW CH 15, SM
03: 09/15 – 09/19	Damped-driven oscillator, wave equation; mechanical waves	HRW CH 15, 16, SM
04: 09/22 – 09/26	Waves on strings, standing waves; resonances **09/23: TEST 1**	HRW 16, SM
05: 09/29 – 10/03	Newton's law of gravitation, spherical shell theorems, inertial and non-inertial frames	Ch 13, SM
06: 10/06 – 10/10	Non-inertial frames, rotational motion	SM
07: 10/13 – 10/17	Newton's second law in curvilinear coordinates, Noninertial frames of reference, fictitious forces	HRW 32, SM
08: 10/20 – 10/24	Noninertial frames of reference, fictitious forces	SM
09: 10/27 – 10/31	Work, energy, potential energy and conservative forces, Bernoulli's equation and conservation of energy	HRW 7, 14
10: 11/03 – 11/07	Thermodynamics and statistical methods **11/05: Test 2**	HWR 18, 19, 20, SM
11: 11/10 – 11/14	Thermodynamics and statistical methods	HRW 18, 22, 23, 24, 31, 32, 33
12: 11/17 – 11/21	Maxwell's equations, wave equation, electromagnetic waves	
13: 11/24 – 11/28	**THANKSGIVING BREAK**	
14: 12/01 – 12/05	Presentations **Oral Exam Presentations**	

Final Exam: Thursday December 11, 08:00 – 11:00. The final exam date cannot be changed.