THE UNIVERSITY of MISSISSIPPI
DEPARTMENT OF PHYSICS AND ASTRONOMY

Phys 308: Mathematical Physics

"God used beautiful mathematics in creating the world." – Paul Dirac, physicist.

Instructor: Cecille Labuda, Associate Prof of Physics & Astronomy
Class time/location: MWF 13:00 – 13:50, Lewis 104
Office hours/location: MW 09:00 – 10:30, T 14:00 – 14:45 and by appointment, Lewis 121B
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Syllabus V2 : 01/13/2026

Books

- Mary Boas. *Mathematical Methods in the Physical Sciences, 3rd edition.* ISBN: 978-0471198260
- Ian Stewart. *In Pursuit of the Unknown. 17 Equations that Changed the World.* ISBN: 978-0465085989
- Spiegel, Lipschutz and Liu. *Schaum's Mathematical Handbook of Formulas and Tables (5th or any edition).* ISBN: 978-1260010534

Purpose

This course is meant to help prepare students for upper-level physics courses and other technical science courses. It introduces new math techniques and constructs and reinforces math that students may have already learned. Math techniques will be applied to physical problems.

Prerequisites

Phys 212 or Phys 303. Corequisite: Math 353.

Course Objectives

On completion of this course, students should have developed familiarity with the mathematical constructs enumerated below and should be able to apply them to physical problems. Additional topics may be covered.

- Cartesian, cylindrical and spherical coordinates (basis vectors, line, area and volume elements and the basic operators such as the gradient and Laplacian operators, divergence and curl)
- Complex numbers and the complex plane
- Taylor series, Fourier series and Fourier transforms
- Partial differential equations
- Series solutions of differential equations
- Special functions (including Legendre and Hermite functions and polynomials, the delta function, Bessel functions and other special functions)
- The eigenvalue equation

Grading Scale

- $90\% \leq \mathbf{A} \leq 100\%$
- $88\% \leq \mathbf{A}- < 90\%$
- $85\% \leq \mathbf{B}+ < 88\%$
- $80\% \leq \mathbf{B} < 85\%$
- $78\% \leq \mathbf{B}- < 80\%$
- $75\% \leq \mathbf{C}+ < 78\%$
- $70\% \leq \mathbf{C} < 75\%$
- $68\% \leq \mathbf{C}- < 70\%$
- $50\% \leq \mathbf{D} < 68\%$
- $\mathbf{F} < 50\%$

Evaluation

Class Exercises and Book Summaries (5%)

This category includes group class exercises worked on whiteboards, book summaries and short book presentations leading class discussions. Exercises are graded for completion. Book summaries, presentations and leading discussions are graded for content and quality.

Written exams (45%)

3 closed-book exams weighted as follows:

- 2 exams highest grades: 17.5%+17.5%=35%
- 1 exam lowest grade: 10%

Oral exam [5%]

This exam comprises two parts. One part is an end-of-semester presentation selected from the topics covered. It must cover the meaning, physical applications and history of the development or discovery of equations or functions. The other part is

an individual oral exam. A short list of topics will be given ahead of the exam and students will be asked to present a problem from one of these topics, selected by the instructor, on the board. Questions will be asked during and after the presentation. This exam will be scheduled outside of the regularly scheduled class meeting.

Homework (20%)
The homework grade will only count if the exam average is 40% or higher with at least one exam grade of 50% or higher. *Otherwise the homework grade will be assigned as zero.*

- Homework sets must be turned in at the beginning of class when due.
- Students are encouraged to work together to solve homework problems. However, students may not copy homework solutions from each other, from solutions manuals or from any source whatsoever. This will result in 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.

Examination Dates

Test dates (except for the final exam) and topics are subject to change.
Test 1: 02/20
Test 2: 03/27
Test 3: 04/24
Final Exam: Wednesday May 06, 12:00 pm.

Policies

Attendance
Class attendance is **required**. Students are allowed 3 absences without penalty; these are expected to cover illness, personal emergencies, university obligations, religious observances and other circumstances. Generally, no additional penalty-free absences will be allowed; however, allowances will be made for circumstances requiring extended absences, if these are deemed to be reasonable by the instructor. For more than 3 but fewer than 6 absences, the final assigned grade will be **reduced by a partial letter grade** (+/-). For more than 6 absences, the final assigned grade will be reduced by a full letter. If you must be absent for exams, you must discuss this with me before the exam to determine whether the absence will be excused and rescheduled. For unexpected exam absences, you must contact me by email or telephone within 24 hours or the exam will not be rescheduled.

Academic Integrity
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 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. In particular, the use of AI is not permitted, as we will be developing skills that are important to practice on your own and AI use may inhibit the development of those skills. Using such tools for any purposes or attempting to pass off AI-generated work as your own, will violate our academic integrity policy.

Unless explicitly permitted by the instructor, distribution of materials provided in this class via the internet or otherwise is not allowed. Distribution of your own class notes is strongly discouraged except for occasional loaning of notes to students also enrolled in the class.

University of Mississippi Access and Inclusion
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 and Student Disability Services (sds@olemiss.edu) as soon as possible. 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.

Audio-video recording and electronic devices
Audio and/or video recording of class lectures is not allowed unless explicit permission is given by the instructor. Permitted recordings may not be distributed online or elsewhere and all must be deleted at the end of the semester. No electronic devices of any kind are allowed during class, except computers for coding exercises and only when explicitly announced by the instructor.

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