

PHYS 301: Analytical Methods of Physics

Fall 2020

Course Description

“Provides a comprehensive introduction to the areas of mathematical physics”

Prerequisites: MATH 214 Elementary Differential Equations with a minimum grade of C or XS

Scheduled Meeting Times & Place: T Θ, 10:30am – 11:45am, Innovation Hall 204

Instructor: Prof. Ernest Barreto
Krasnow Institute 108. (703) 993-4431
ebarreto@gmu.edu. *Email is the best way to contact me.*
Office Hours: Tuesdays 3-5pm (but subject to change) or by appointment.

Textbook: Mathematical Methods in the Physical Sciences (3rd Edition) by M.L. Boas

Topics to be Discussed

- Chapter 6: Vector Analysis
- Chapter 2: Complex Numbers
- Chapter 7: Fourier Series and Transforms
- Chapter 12: Series Solutions of Differential Equations (selected sections)
- Chapter 13: Partial Differential Equations (selected sections)
- Chapter 3: Linear Algebra (selected sections)

Other potentially useful resources

- Div Grad Curl and all that: an informal text on vector calculus by H.M. Schey
- Mathematical Methods for Physicists by Arfken – any edition
- www.integral-table.com – an online table of integrals
- [HyperMath](#) – an online educational resource
- [NIST Digital Library of Mathematical Functions](#) – a useful online resource

Grading: Homework 40%, Midterm 30%, Final Exam: 30%

Midterm Exam: Thursday October 13, during class

Final Exam: Tuesday December 13, 10:30am – 1:15pm

I will drop your lowest homework score. I reserve the right to adjust exam scores based on my professional judgement of fairness and normalization. Letter grades for the course will be determined from total numerical grades as follows:

F	D	C	B-	B	B+	A-	A	A+
<60	[60-70)	[70-80)	[80-83)	[83-87)	[87-90)	[90-93)	[93-97)	[97-100]

Homework:

- Homework will be assigned throughout the semester, and due dates will be announced in class. The assignments, due dates, and solutions will be posted to Blackboard.
- I will not be able to grade all the homework problems. I may choose some problems to grade at random, so you should prepare solutions to the entire assignment.
- Full marks will only be given for homework THAT I CAN UNDERSTAND. Remember that *you will not be there to explain things* when I sit down to grade papers.
- Your grade will be based on *how* you get your answer (or try to), not *that* you get an answer. Show your work!
- You are encouraged to work on your homework assignments together in groups, BUT copying homework from each other is not permitted. Hand in only your own work.

Exams:

In-class exams will be closed-book and without calculators. An equation sheet with a few key equations will be provided. It is the responsibility of each student to PLAN AHEAD and attend classes during the scheduled exams regardless of work or family considerations. Make-up exams will be given only to students who encounter documented emergency situations, and will take place during the final exam period.

If you are a student with a disability and you need academic accommodations: please see me and contact the Office of Disability Services at 703.993.2474. All academic accommodations must be arranged through that office. Students must inform the instructor at the beginning of the semester, and the specific accommodation will be arranged through ODS.

Academic Integrity: GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The Honor Code reads: To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set forth this honor code: *Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.*

Study Strategy

To succeed in this course, you must do the following two things:

1. Actively read the textbook
2. Solve LOTS of problems

With few exceptions, the students who do best are those who attend class and remain engaged throughout.

Active Reading

Active reading means constantly challenging yourself to make sure you understand as you read.

- (a) Make sure you follow all the logical steps in arguments. After reading a passage in the book, you should pause to make sure that you can understand every step. You might imagine that you're trying to explain the argument to a classmate without looking back at the book.
- (b) Sometimes, some steps are omitted and left to the reader. You should pause to work these out before going on.
- (c) Sometimes, statements are made without explanation based on an earlier part of the book. The relevant sections are usually cited, and you should review those sections to make sure you understand.

Whenever you encounter something that you cannot make sense of, make a note of it. Discuss it with your peers and/or ask me about it in class, via email, or during my office hours.

The secret to learning physics (or mathematical physics)

The main goal in this course is to develop the mathematical skills needed to solve problems that you will encounter throughout your studies in physics. You will quickly learn that the secret to learning is to lay out the sequence of logical steps clearly *on paper*. Please note that this is a skill that has to be learned via sustained practice. It may or may not come naturally to you, and that's ok. As you write things out, ask yourself if one of your classmates could make sense of your work, or if you yourself will be able to understand your notes ten or fifteen years from now. Or perhaps more relevantly, ask yourself if the *grader* will be able to understand your paper when you're not there to explain what you've written.

In other words, *clarity of expression leads to clarity of thought*.

As with all skills, the only effective way to learn is through repeated practice. If you want to learn this stuff, you just have write out solutions to a lot of problems. There's really no other way. There are no shortcuts.

Actively reading the textbook and solving lots of problems are time-consuming activities and require concentration. Please note that you will be responsible for budgeting your time so that you don't fall behind. A little work each day is far better than leaving everything to the last moment.

Your mantra for the rest of your career is:

Clarity of expression leads to clarity of thought

Calendar Items to be Aware Of

8/29: Last day to add

9/5 (Monday): Labor Day, University closed

9/6: Last day to drop with 100% tuition refund

9/13: Last day to drop with 50% tuition refund

9/14 – 9/27: Unrestricted Withdrawal Period. No tuition refund

10/10 (Monday): Fall Break. No classes

10/11 (Tuesday): This day will follow a Monday schedule. Our class won't meet

9/28 – 10/24: Selective Withdrawal Period. No tuition refund

11/24 (Thursday): Thanksgiving

12/1 (Thursday): Our last class

12/13 (Tuesday): Final exam from 10:30am to 1:15pm