SUNY Geneseo
Department of Physics and Astronomy
Class: MW 12:30am; ISC 229
Web: www.geneseo.edu/~pogo

Online Office Hours:
MW 8:30-10:20;T 8:30-9:20; M 1:30-2:20

Dr. Pogo
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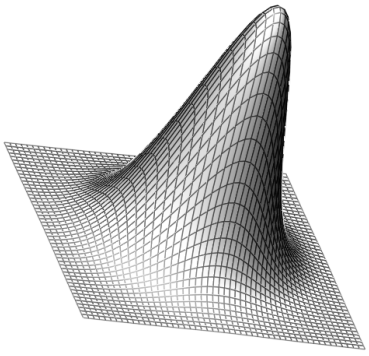
Mathematical Methods For Physicists

(Phys 228-01)

Spring 2024



What am I doing here? At the end of this course, your skill with a variety of commonly used mathematical and numerical methods in physics in engineering (as listed below) will be substantially increased. You should already have some prior exposure to most of these techniques through your calculus and differential equations courses. We will focus on the practical rather than the theoretical aspects of each technique, but there will naturally be some theory involved. The topics include derivatives and partial derivatives, infinite series (including Fourier series and Taylor series), vector calculus, complex numbers, linear algebra and tensors, differential equations, and probability. There will also be some examination of commonly used numerical techniques.

What do I have to read? The textbook is: *Mathematical Methods in the Physical Sciences*, by Mary Boas (3rd edition, Wiley). This book is very readable.

How will I be graded? Your grade will be determined by:

Assignments & quizzes:	35%
Participation in Office Hours	5%
Exams (3 total):	60%
	100%

Final Exam: The final exam will be held on Tuesday, May 14, 2024, from noon to 2:30 pm, and will be comprehensive.

Assignments: Homework will be done primarily on CAPA this semester. However, some assignments will also require submission of Mathematica documents, or other supporting written work. This work will be graded on clarity (a combination of neatness and completeness) and *presentation quality*. Be warned: an answer is not the same as a solution. Assignments that are too hard to understand are also too hard to grade, and will receive zeroes.

Here are some tips for successful Mathematica submissions:

- Use the correct filename, EXACTLY. Do not change or misplace a single character.
- In a text cell, put your name and the assignment number into the top of the worksheet. Also, label each individual problem with the corresponding problem number in a text cell.
- Do the assignment correctly. Make sure your final solution is not just a "naked" number floating without sufficient context.
- Choose reasonable and unique variable names.
- Run your *entire* notebook as a whole before submitting! ! ! !
- Appearance counts: your work should be reasonably spaced and (* documented *).
- Supplement your equations with text and/or diagrams when necessary. A third party who is not in the class should be able to determine both the question *and* the answer from your solution, without needing to even see the assignment itself.
- Plots should have a sufficient and reasonable range for the independent variable. Contour and surface plots should have correct aspect ratios.

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What is the course schedule? Here is a tentative schedule of topics for the semester:

Class	Date	Topic
1	Monday, January 22	Infinite Series [Ch. 1]
2	Wednesday, January 24	Series II; Taylor series and approximations of derivatives [Ch. 1]
3	Monday, January 29	Vector calculus I: dot, cross, del, and grad [Ch. 6]
4	Wednesday, January 31	Vector calculus II: divergence, curl, Laplacian [Ch. 6]
5	Monday, February 5	**Numerics:** Plotting with Mathematica
6	Wednesday, February 7	Derivatives/Chain rule [Review/Ch. 4]
7	Monday, February 12	Complex analysis I [Ch. 2]
8	Wednesday, February 14	Complex analysis II [Ch. 2]
9	Monday, February 19	**Numerics:** General computing with Mathematica
10	Wednesday, February 21	Linear algebra I [Ch. 3]
11	**Monday, February 26**	**Exam #1 (covers classes 1-8)**
12	Wednesday, February 28	Linear algebra II [Ch. 3]
13	Monday, March 4	**Numerics:** Curve fitting
14	Wednesday, March 6	Eigenvalues & Eigenvectors [Ch. 3]
		No class: Spring Break
15	Monday, March 18	Tensors [Ch. 10]
16	Wednesday, March 20	Coordinate Transformations [Ch. 10]
17	Monday, March 25	Multi-variable integration review with **Numerics** [Review/Ch. 5]
18	Wednesday, March 27	1st order ordinary differential equations (separation of variables) [Ch. 8]
19	Monday, April 1	2nd order ordinary differential equations (constant coefficients) [Ch. 8]
20	Wednesday, April 3	**Numerics**: Differential equations (Mathematica DSolve, NDSolve)
	Monday, April 8	***No class: Eclipse***
21	**Wednesday, April 10**	**Exam #2 (covers classes 9-17)**
22	Monday, April 15	Fourier series I [Ch.7]
23	Wednesday, April 17	Fourier series II & Fourier Transforms [Ch. 7]
24	Monday, April 22	Partial differential equations (heat equation) [Ch. 13]
	Wednesday, April 24	***No class: GREAT Day***
25	Monday, April 29	Partial differential equations (wave equation) [Ch. 13]
26	Wednesday, May 1	Probability: interpreting a pdf, counting, "choosing" [Ch. 15]
27	Monday, May 6	Probability: common distributions (normal, binomial, Poisson) [Ch. 15]
28	Wednesday, May 8	Statistics: standard deviation [Ch. 15]
{29}	***Tuesday*, May 14**	**Final Exam (comprehensive): noon**

Assignments are due every Thursday morning from February 1 through May 2 (except March 14). Because "study day" is a Thursday this year, Assignment #14 is instead due on Friday, May 10.

What if I have trouble with the homework? Visit me during online office hours (see times listed above) and I'll try to point you in the right direction. Also, I know that most of you will work in groups, and I won't attempt to stop it. However, the learning is in the doing. Nobody on this planet learns from copying somebody else's work, no matter how clear or correct it is. Every part of every problem that you let somebody else do for you is something that you are deciding that you just don't want to learn. You will not have their help on exams!

For this course, use of online homework solutions is considered academic dishonesty. Students must not turn in homework problems that someone else has solved or copied solutions found online. At best you will not receive credit for the homework; at worst you will be charged with academic dishonesty.

Learning Outcomes

At the end of this course, students will:

- Gain proficiency in taking derivatives and partial derivatives
- Gain proficiency in the use of geometric series, power series, Fourier series, and Taylor series
- Gain proficiency in the use of vectors and vector operators
- Gain proficiency in the use of complex numbers
- Gain proficiency in the use of linear algebra and tensors
- Gain proficiency in the use of differential equations
- Gain proficiency in basic probability and statistical analysis
- Gain proficiency in some basic types of numerical analysis using tools in Mathematica and Excel
- Learn multiple practical uses for each of the above topics.

Also, the college provides information at the following URL relating to a variety of topics:

https://wiki.geneseo.edu/display/PROVOST/Syllabus+Resources+Related+to+Student+Success