

PHY 210: Mathematical Methods in the Physical Sciences and Engineering

Fall 2022

Web:	Course Moodle site
Text:	Mathematical Methods in Engineering and Physics
Instructor:	Casey Berger
E-mail:	cberger@smith.edu
Office hours:	TBD and by appointment: https://calendly.com/caseyberger * zoom or in-person
Office:	McConnell 310A

Course Description

This course covers a variety of math topics of particular use to physics and engineering students. Topics include differential equations, complex numbers, Taylor series, linear algebra, Fourier analysis, partial differential equations, and a review of multivariate calculus, with particular focus on physical interpretation and application.

Prerequisites: MTH 212 and PHY 117 or PHY 119, or permission of the instructor.

A course schedule will be made available on Moodle, subject to change. The schedule on Moodle will be kept up-to-date, and any changes in the schedule will be announced in class and over email.

Course Logistics

Objectives

By the end of this course, you will be able to

- use mathematical tools to describe physical scenarios
- pose scientific questions about physical scenarios using mathematical tools
- distinguish between when to apply analytical mathematical techniques and when to apply numerical techniques
- use Mathematica to perform calculations and visualize mathematical situations

Topics

This course covers the following content:

- Ordinary differential equations
- Series expansions and approximations
- Complex numbers
- Line and surface integrals
- Linear algebra and matrix manipulation
- Vector calculus
- Fourier series

Course Components

Midterms and homeworks are broken into three categories: **essentials, depth, and effort**. There are three midterms in this course, and all of them will be take-home and open-book, open-note. You will have one week to do them. Each midterm will have two parts: one essential and one depth. Homework will represent the effort portion of the grade.

Midterms: essentials

These should be your first focus in this class. You must receive an “S” on all essentials in order to pass the class, but remember that you can use tokens to re-do any midterm portions you do not receive a satisfactory grade on.

Midterms: depth

The depth portions of the midterms are things that would be good for you to learn in this class. They are not required to pass, but if you want to deepen your understanding of mathematical methods, especially if you plan to go to graduate school in physics or engineering, they are highly recommended. You must receive an “S” on at least one depth assignment to get above a B- in this course, but you do not have to do them all to get an A.

Weekly homeworks: effort

Every week, I will suggest a number of practice problems. You should do whatever you find helpful from those problems (or problems from previous weeks), and then you will fill out a form each week letting me know what you worked on (if anything), why you chose those problems (or no problems), and whether you have any questions or feel you’re struggling in any particular areas. This homework form will receive a “S” simply for completion. Not turning it in or leaving questions blank will result in a “U.” Unfortunately, there is no re-doing homework since it’s about consistent and timely communication, so make sure you can find 5 minutes to fill out the poll each week.

I recognize this type of grading may be unfamiliar to many of you. I am always open to questions and discussion about this. Please don't hesitate to email me or come by my office hours if you are struggling with content OR with how this grading method works or why I am using it.

Grading distribution

Essential	Depth	Effort
Midterm 1 Essentials	Midterm 1 Depth	WHWs 01-12
Midterm 2 Essentials	Midterm 2 Depth	
Midterm 3 Essentials	Midterm 3 Depth	

Deadlines and Extensions: Because you have the opportunity to redo your midterms, I strongly recommend staying on top of the due dates. However, I am always willing to be flexible. If you want an extension on any deadline, you must ask me first, but I will almost always grant it. If I don’t immediately grant it, I will work with you to figure out an alternative that will help you achieve your goals in this class.

Grading

In this course, I will not be giving numerical or percentage grades to homeworks or midterms.

Your goal in this class should be to learn, and [grades do not help with learning](#). In fact, they steal attention away from the more important feedback that contributes to growth and improvement.

I will be using a form of alternative grading called specifications grading. Using this, every “graded” item will receive either a satisfactory or unsatisfactory grade, and I will also leave detailed feedback and commentary, in order to help you improve your work.

Your final grade will be determined based on the number of S or U grades you receive in each category, in the following way:

1. You **must** receive a Satisfactory grade on the five essential assignments to pass the class
2. An “S” on only the essential portions of the midterms and a “U” on all depth portions of the midterms and homeworks will result in a C
3. To get a B or an A, you must receive satisfactory grades on at least some of the depth midterms and/or homeworks

There is a [template grading sheet](#) provided which can help you see how this breaks down and even test out putting in different grades.

You will be able to re-do any midterm portions that receive a “U” grade. Each re-do (of either an essential or a depth section) costs one token, and tokens can be earned in a number of ways. No “U” midterm grade is final until you decide it is. The goal is to learn, which means you can always go back and try again!

You can earn tokens in the following way:

1. Responding to the syllabus question/comment form (up to 2 tokens)
2. Taking the math pre-test by the end of September (1 token)
3. Filling out the office hours poll before the end of the day on Sunday, September 11 (1 token)
4. Filling out the first day of class poll before the end of the day on Sunday, September 11 (1 token)
5. Completing a shortened-format practice midterm on time (1 token)

Note that this is enough tokens to re-do both parts of every midterm! Additional tokens can be earned if they are needed. Schedule a meeting with me and we will work out a plan together.

Community

Land Acknowledgment

We acknowledge that we are on Indigenous land: the territory of the Nonotuck peoples. We are grateful for the opportunity to live, learn, and grow on this sacred land, and extend our respect to citizens of this nation who live here today, and to their ancestors who have lived here for hundreds of generations. We recognize the repeated violations of sovereignty, territory, and water perpetrated by invaders who have impacted the original inhabitants of this land for over 400 years. We know this acknowledgement is insufficient, and does not undo the harm that has been done and continues to be perpetrated now against Indigenous people and their land and water.

Classroom Culture

We will build this part of the syllabus together, and it will serve as our community expectations. How will we protect and support each other in order to make this classroom environment one where we can all thrive?

Our community guidelines here

A general note on emails and availability:

If you email me on a weekday, you can expect a response from me within 24 hours. If you email me on a weekend, you can expect a response from me by class time on Monday (or the first day back if it's a long weekend or holiday).

A general note on COVID-19:

If you are feeling at all unwell, please do not come to class. Not only is rest important for your own health, but it's also important to do all you can to protect your community. Stay home, message me to arrange any accommodations (I will be very flexible!), and take a symptomatic test at the self-serve kiosk at the Campus Center. Contact the Schacht Center if you need any assistance with this (413-585-2250).

More information about Smith's COVID-19 response is available at the [Culture of Care](#) page.

College Policies

Academic Integrity and Honesty

Honor Code Statement:

Students and faculty at Smith are part of an academic community defined by its commitment to scholarship, which depends on scrupulous and attentive acknowledgement of all sources of information and honest and respectful use of college resources.

Smith College expects all students to be honest and committed to the principles of academic and intellectual integrity in their preparation and submission of course work and examinations. All submitted work of any kind must be the original work of the student who must cite all the sources used in its preparation.

Students voted to establish the academic honor system in 1944. The basis of the Academic Honor Code is articulated in Article X of the SGA Constitution and Article VII of the SGA Bylaws.

Accommodations for Disabilities

I **do not** require a letter from ODS to make accommodations for disabilities. If you would like to work through ODS, I am happy to do so, and you can contact them at ods@smith.edu. You may also just let me know what accommodation you need, and we will work to ensure you are properly supported. You do **not** need to tell me your disability.

Resources

There are tons of resources at Smith to help you succeed in this course and in your college career. If you think of resources I have not included here, please let me know, so I can add them.

- Your instructor! I am here to help you and you are welcome to reach out to me any time.
- [Spinelli Center math reviews](#)
- [Workshops for time management and managing stress](#)
- [Writing help from the Jacobson Center](#)
- [Crisis Resources](#)
- [Mental Health Crisis Hotline: call or text 988](#)
- [Counseling Resources](#)
- [Wellness Services](#)
- [Gender Identity and Expression](#)
- [Where to report sexual misconduct and other forms of discrimination](#)