

SYLLABUS

MATHEMATICAL METHODS FOR THE PHYSICAL SCIENCES

SPRING 2023

https://www.phys.uconn.edu/~rozman/Courses/P2400_23S/

Last modified: March 6, 2023

Course description: Physics 2400 *Mathematical Methods for the Physical Sciences* covers the basic mathematical tools used in sciences and engineering: complex analysis, ordinary and partial differential equations, integral transforms, asymptotic expansions, and special functions. The course introduces Computer Algebra Systems (as analytic calculators).

The goal of this course is to give an introduction to mathematical methods for solving hard problems that arise in the sciences. The approach requires a combination of “real” mathematics, skill in making legitimate approximations, and intelligent use of computers to get some motivation and verify the approximations. We will start with assorted tools of the trade and simple problems (simple integrals, simple differential equations, etc.) and progress toward more challenging topics.

Course website: https://www.phys.uconn.edu/~rozman/Courses/P2400_23S/

Lectures: TuTh, 5:00 pm – 6:15 pm, in [GW-001](#)

Instructor: Michael Rozman

email: michael.rozman@uconn.edu
office hours: TuTh, 6:15 pm – 7:15 pm, in [GW-001](#),
and by appointment

Course TA: Alessio Illari

email: alessio.illari@uconn.edu
office hours: Mo, 1 pm – 2 pm, GS-104

Textbook: not required but highly recommended – Hung Cheng, *Advanced Analytic Methods in Applied Mathematics, Science, and Engineering*, Luban Press, 2006

Exams: Three midterm exams, no final. Parts of the exams may be substituted by take-home projects.

Grading scheme: The course grade will be calculated using the following scheme.

Homework assignments	40%
3 Midterms	60%

Course grade = $0.4 \cdot \text{HW} + 0.2 \cdot (\text{M1} + \text{M2} + \text{M3})$, correctly rounded to integers and capped at 100%.

The percent grades are converted to the letter grades as following.

Percent grade	Letter grade
94+	A
90-93	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
50-72	C-

Mid-semester progress: the percent grade is calculated using the rule $0.5 \cdot \text{HW} + 0.5 \cdot \text{M1}$, correctly rounded to integers and capped at 100%.

Class schedule: for an up-to-date schedule consult the [Course Calendar](#)

Week(s)	Subject
1-2	Simple tools: Gaussian integrals; Euler's formula; Gamma function, $\Gamma(x)$, Beta function $B(x, y)$; differentiation with respect to a parameter for evaluation of integrals and sums; Leibniz's formula.
3-6	Complex analysis for physicists.
5	Midterm I - Thu, Feb 23
7-8	Asymptotic expansion of integrals and sums
9	Spring recess
10	Integral transforms
11	Midterm II - Thu, Mar 30
11	Perturbation methods
12-15	Solution of differential equations
15	Midterm III - Tue, Apr 25

Communications: talking in person is the preferred method to communicate with the instructor; email is an option to schedule an appointment or to ask/answer a very short question.

- use your UConn email address for class communications
- please include the tag ``[phys2400]`` (without quotes) in the subject of your email, e.g. "[phys2400] midterm II review session"
- the subject line of your email should communicate exactly what the email is about so that the recipient can prioritize the email's importance without opening it. E.g. "[phys2400] Tacoma bridge collapsed - cannot come to the exam" would be a good email subject (assuming email existed in 1940 ...); "urgent", "important", "a question", "please read" are bad ones. Do not use your name as subject – the sender name is already visible as a part of email header
- do not send instructor emails with attachments or embedded graphics
- do not include commercial advertising into your course-related emails

Homework assignments: are submitted for grading in class, in person, on the assignments' due dates; unsolicited online submission are not accepted.

At the discretion of the instructor, homework assignments submitted on time may be returned for corrections.

Late homework assignments are not accepted for grading after the solutions have been discussed in class, or have been posted online, or the assignments have were returned to class after grading.

You are welcome to discuss the homework problems with other students of the class. However, the work you turn in must be your own. In particular, you must run your own calculations (where applicable) and communicate and explain the results in your own words.

Members of collaborating groups must consistently list all collaborators names and submit assignments together.

Assignments that are hard to understand are also hard to grade correctly, therefore: (a) use words and pictures to supplement your equations; (b) work must progress linearly down the page.

Requirements for written assignments:

- Use letter-size paper.
- Box your final answer(s) and important intermediate results.
- Staple your notes together, (i.e. no paper clips, torn or folded corners) with the assignment cover page.

Honors conversion: Students interested in honors conversion should contact the instructor during the *second* week of classes.

Student responsibilities and academic policies: Students at the University of Connecticut are held to certain standards and academic policies. Review these important standards and policies — the links are provided on the course website.