

PHYS 3807: Mathematical Physics I

Winter 2025

Instructor Information

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Class Information

Course Dates: January 06, 2025 – April 08, 2025
Lecture Time(s): Mondays and Wednesdays, 10:05 am - 11:25 am
Classroom: Please check your Carleton Central for the class location
Course Website: <https://carleton.ca/brightspace/>

Tutorial Information

Tutorial Location: Please check your Carleton Central for the tutorial location
First Tutorial: January 13, 2025
Tutorial Schedule: Mondays, 5:35 pm - 6:25 pm

Official Course Description

The main objective of this course is to introduce some well-known mathematical methods widely used in a range of problems arising in physics. This course aims to introduce key mathematical methods commonly applied to a variety of problems in physics. The main topics include solving Second-order linear differential equations, Complex Analysis, Green's Functions, and Sturm-Liouville Theory. The general sequence of topics is as follows:

- Second order linear differential equations: Power series solutions, Frobenius method, and Separation of variables
- Fourier Series: Fourier theorem, Fourier series application to differential equations
- Sturm-Liouville theory: Sturm-Liouville problem and its application to physics, problems with cylindrical and spherical symmetry, and concept of orthogonal functions
- Complex Analysis: Function of complex variables, derive Taylor and Laurent series of complex functions, methods to solve definite integrals in the complex plane, concept of poles and zeros, Residue theorem
- Green's Function

Prerequisites

PHYS 2202 (Wave Motion and Optics), MATH 2004 (Multivariable Calculus for Engineering or Physics), MATH 3705 (Mathematical Methods I). Some of these prerequisites can be waived with the permission of the department.

Student Hours

Please feel free to email me to schedule an in-person or Zoom appointment for assistance with the course material.

Course Delivery

This course is intended for in-person delivery and is not suited for an online format. Lectures are primarily delivered on the blackboard during the scheduled hours at the designated classroom location.

Required Textbook

Susan M. Lea, Mathematics for Physicists, Thomson - Brooks/Cole, ISBN 0-534-37997-4 is the primary textbook for this course. As this textbook is out-of-print, used copies can be found and a PDF of the book is posted on Brightspace. There are **no ancillary fees** associated with this course (e.g., textbooks, course packs, lab manuals, etc.).

Supplementary material

There are many other excellent textbooks covering some of the materials in this course such as:

- Copley, Mathematics for the Physical Sciences, de Gruyter.
- Weber, Arfken and Harris, *Essential Mathematical Methods for Physicists*, 7th edition, Elsevier

Marks Distribution

Assignments:	40%
Midterm Examination:	20%
Final Examination:	40%

- Assignments will be posted on Brightspace, with the due date and time noted there. Assignments will be given roughly every week, and they will be due the following week in class. There will be approximately 6-8 assignments in total throughout the semester. Working through problems is an essential part of developing a deep understanding of the material in this course. Students are encouraged to work together to understand the problems; however, the work **handed in must be original**. The completed assignments must be submitted either as a **printed paper copy or electronically** through Brightspace. It is imperative to

remember that it is considered an academic offence if you provide solutions that are copied from a source on the internet or other students. Late assignments **will not be accepted** unless permission is received from the instructor for documented reasons (illness, injury or other extraordinary circumstances beyond the student's control).

- The midterm exam will be 1.5 hours long and will be given during the regular class period. This will be a closed-book in-class examination, which is scheduled to occur on **February 26, 2025**. You will be provided with a formula sheet. In the case of an accommodation for a **missed** midterm, the weight of the midterm will be transferred to the final exam
- The final exam will be 3 hours long, given during the Carleton final examination period in April. The exact format of the final exam will be discussed further well in advance. This will also be a close book exam, and a formula sheet will be provided. Accommodations for **missed** final exams must be arranged through the registrar's office.

Grade Definition:

In accordance with the Carleton University Undergraduate Calendar Regulations, the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100	A = 85-89	A- = 80-84
B+ = 77-79	B = 73-76	B- = 70-72
C+ = 67-69	C = 63-66	C- = 60-62
D+ = 57-59	D = 53-56	D- = 50-52

F < 50

WDN = Withdrawn from the course

ABS = Student absent from final exam DEF = Deferred

Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

Inclusive teaching statement

Science is for everyone. I am committed to fostering an environment for learning that is inclusive for everyone. All students in the class, the instructor, and any guests should be treated with respect during all interactions. I would appreciate any feedback related to class throughout the course.

The Faculty of Science EDI statement: <https://science.carleton.ca/about/edi/>

Academic Accommodations, Regulations, Plagiarism, Etc.

Carleton University is committed to providing access to the educational experience in order to promote academic accessibility for all individuals. Academic accommodation refers to educational practices, systems and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University. More

information can be found [here](#). University rules regarding registration, withdrawal, appealing marks, and almost anything else you might need to know can be found on the university's website, [here](#).

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at **613-520-6608** or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the Paul Menton Centre website.

Addressing Human Rights Concerns

The University and all members of the University community share responsibility for ensuring that the University's educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at equity@carleton.ca

Religious Obligations

Please contact me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the [Student Guide to Academic Accommodation](#).

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: <https://carleton.ca/sexual-violence-support/>

Accommodations for Missed Work

Carleton recognizes that these are unprecedented times during the COVID-19 pandemic and that students may be experiencing greater stress and other life factors that are not in their control. As a result, Carleton has put into place a protocol for students to apply for accommodations using a self-declaration form in the event of missed work. The form can be found at: <https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf>

For Pregnancy

Please contact me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the [Student Guide to Academic Accommodation](#).

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the [Senate Policy on Accommodation for Student Activities](#).

Academic Integrity

Academic misconduct undermines the values of honesty, trust, respect, fairness, and responsibility that we expect in this class. Carleton University provides support such as academic integrity workshops to ensure, as far as possible, that all students understand the norms and standards of academic integrity that we expect you to uphold. Your teaching team has a responsibility to ensure that their application of the Academic Integrity Policy upholds the university's collective commitments to fairness, equity, and integrity. (adapted from Carleton University's Academic Integrity Policy, 2021). Examples of actions that do not adhere to Carleton's Academic Integrity Policy include:

- Plagiarism
- Accessing unauthorized sites for assignments or tests
- Unauthorized collaboration on assignments and exams

Students **are expected to familiarize** themselves with and follow the Carleton University Student Academic Integrity Policy. The Policy is strictly enforced and is binding on all students. For more information, please see [Carleton's academic integrity page](#). The use of chat-GPT/Generative AI to solve assignment problems is prohibited. Faculty of Science penalties for violation of the Carleton policies on academic integrity are very serious.

- First offence: a grade of zero on the work(s) associated with the misconduct and a deduction of up to three grade points from the final course grade (e.g. a grade of B could be reduced to a C.)
- Subsequent offences will result in increasingly severe sanctions ranging from
 - A final grade of F in the course
 - Suspension from studies for up to 3 semesters
 - Expulsion of enrolment from the University

Course Copyright

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copyright protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s). Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are **not** permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

Assistance for Students

Here are some resources that might be useful:

- Academic and Career Development Services Writing Services: <https://carleton.ca/career/>
- Peer Assisted Study Sessions (PASS): <https://carleton.ca/csas/group-support/pass/>
- Math Tutorial Centre: <https://carleton.ca/math/math-tutorial-centre/>
- Science Student Success Centre: <https://sssc.carleton.ca/>

Additional Information

Students must always retain a hard copy of all work that is submitted.

Carleton University is committed to protecting the privacy of those who study or work here (currently and formerly). To that end, Carleton's Privacy Office seeks to encourage the implementation of the privacy provisions of Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) within the university. In accordance with FIPPA, please ensure all communication with staff/faculty is **via your Carleton email** account. To get your Carleton Email, you will need to activate your MyCarletonOne account through Carleton Central. Once you have activated your MyCarletonOne account, log into the MyCarleton Portal.

1 Important Dates

<https://calendar.carleton.ca/academicyear/>

<https://carleton.ca/registrar/registration/dates/academic-dates/>