



PARTIAL DIFFERENTIAL EQUATIONS I

MAT 5133/MATH 5406 – WINTER 2026

Instructor: Diane Guignard (STM 523, dguignar@uottawa.ca)
Personal Webpage: <https://dianeguignard.github.io>
Course Webpage: <https://uottawa.brightspace.com/d21/home> (Brightspace)
Classes: Mo 04:00pm-05:20pm at 60 University (SMD), room 429
 We 02:30pm-03:50pm at 550 Cumberland (TBT), room 325
Office Hours: We 10:00am-12:00pm in STM 523
 or by appointment (in person or on Zoom)

Course-related material, such as homework assignments and topics covered per course, will be posted on Brightspace. Important information might also be sent by emails.

Main Reference:

Lawrence C. Evans, *Partial Differential Equations*, 2nd edition, AMS

Catalog Description:

First-order equations, characteristics method, classification of second-order equations, separation of variables, Green's functions. L_p and Sobolev spaces, distributions, variational formulation and weak solutions, Lax-Milgram theorem, Galerkin approximation. Parabolic PDEs. Wave equations, hyperbolic systems, nonlinear PDEs, reaction diffusion equations, infinite-dimensional dynamical systems, regularity. This course is equivalent to MATH 5406 at Carleton University.

Course Outline (tentative):

This course will cover the following topics from Evans (exact topics, order, and duration subject to changes).

Subject	Duration	Reference (from the textbook)
Introduction	0.5 week	Chapter 1
Four Important Linear PDEs	3.5 weeks	Chapter 2
Sobolev Spaces	2.5 weeks	Chapter 5
Second-Order Elliptic Equations	1.5 weeks	Chapter 6
Linear Evolution Equations	1.5 weeks	Chapter 7
The Calculus of Variations	1.5 weeks	Chapter 8
Nonlinear First-Order PDEs	1 week	Chapter 3 (Sections 3.1 and 3.2)

Learning Outcomes:

By the end of the course, students will be able to:

- Classify first- and second-order PDEs (elliptic, parabolic, hyperbolic) and construct analytical solutions using methods such as characteristics, separation of variables, and Green's functions.
- Analyze existence, uniqueness, and regularity of solutions to second-order elliptic equations using Sobolev spaces, weak formulations, and the Lax-Milgram theorem.
- Formulate and analyze nonlinear PDEs arising from variational principles using calculus of variations techniques.
- Study linear evolution PDEs, in particular second-order parabolic and hyperbolic equations, by energy methods.

Homework:

Exercises will be posted on Brightspace. Throughout the term, there will be about 5 assignments to be turned directly on Brightspace by the assigned due date. You are encouraged to work with others while solving homework problems, but you must write up your own solutions. Moreover, late homework will not be accepted except in the case of an excused absence.

Exams:

There will be one midterm exam and one final *comprehensive* exam. The midterm will take place on **Monday, March 2**, during the usual class time. The final exam will be held during the exam period. A description of the material covered by each exam will be provided on Brightspace in due time.

Grading Policy:

The final grade will be based on the homework assignments, the midterm exam, and the *comprehensive* final exam. It will be computed according to the following distribution:

- Homework: 20% of your grade;
- Midterm exam: 30% of your grade;
- Final exam: 50% of your grade.

Comprehensive Exam:

The final exam for the course may be counted towards the Comprehensive Exam requirement for PhD students in the Ottawa-Carleton Institute (MAT 9907 - Differential Equations II for uOttawa). The passing grade (Grade S - satisfactory) is a B, namely 70%.

Important Dates:

Below is a summary of the important dates for the fall 2024 term. You will find more information at the website

<https://www2.uottawa.ca/current-students/important-academic-dates-deadlines>

January 12	First day of the term and of this course
February 15-21	Reading week (no classes)
March 2	Midterm (4:00pm-5:20pm in SMD 429)
April 3-6	Easter break
April 13	Last day of this class
April 15	Last day of the term (redefined day, Saturday courses)
April 17-30	Exam period (scheduled posted in uoZone on February 12)

Attendance Policy and Make-up Policy:

Attendance is STRONGLY recommended, but attendance will not be taken. There will be no make-up for the midterm. However, if you miss the midterm for a **valid reason**, then its weight will be transferred to the final exam.

Materials Copyright:

All materials generated for this class are protected by Copyright laws. Distributing copies or sale of any of these materials is strictly prohibited.

Academic Fraud:

Academic fraud is an act by a student that may result in a false evaluation. It is not tolerated by the University. Examples of academic fraud are: plagiarism, cheating of any kind or submit a work for which you are not the author, in whole or part. Any person found guilty of academic fraud will be subject to severe sanctions. Please consult the webpage <https://www.uottawa>.

ca/vice-president-academic/academic-integrity/resources-students which contains regulations and tool to help you avoid plagiarism.

Bilingualism:

Except in programs and courses for which language is a requirement, all students have the right to produce their written work and to answer examination questions in the official language of their choice, regardless of the course's language of instruction.

Health and Wellness:

Your wellness is an integral part of your success. If you don't feel well, it can be hard to focus on your studies. Dedicated professionals and fellow students who care about you are always ready to provide advice and support. Depending on your needs, many activities and services exist to accompany you during your academic journey.

Services include:

- opportunities to connect;
- counselling sessions;
- peer support;
- physical activity;
- wellness activities and workshops;
- spiritual guidance.

If you want to connect with a counsellor, you can book an appointment online or go to their walk-in clinic at 100 Marie-Curie, fourth floor. You can also drop-in to our wellness space, chat online with a peer helper, or access 24/7 professional help through the website.

For more information and to access these services, go to <https://www.uOttawa.ca/wellness>.

Academic Accommodations:

We try to make sure all students with disabilities have equal access to learning and research environments, the physical campus and University-related programs and activities. The Academic Accommodations service works with other campus services to create an accessible campus learning environment, where students with disabilities have an equal opportunity to flourish. We offer a wide range of services and resources, provided with expertise, professionalism and confidentiality.

Services include:

- help for students with disabilities in making the transition;
- permanent and temporary accommodation measures;
- learning strategy development;
- adaptive exams;
- transcriptions of learning material;
- interpretation (ASL and LSQ);
- assistive technologies.

If you think that you might need any of our services or supports, email the Academic Accommodations service (adapt@uOttawa.ca).