MATH_V 516 101 2024W1 Partial Differential Equations I

✎ Edit

Math 516 Partial Differential Equations I

Term 1 (Classes: Sep 4 (Wed), 2024 to Dec 6 (Fri), 2024)

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Class: Mon Wed Fri | 1:00 p.m. - 2:00 p.m. | 2024-09-03 - 2024-12-06.

Classroom: LASR-Floor 2-Room 211

Office hours: TBA

Brief Description:

This course is an introduction to the qualitative theory of partial differential equations, focusing on elliptic and parabolic problems. Our main goal is to understand basic concepts of weak solutions in appropriate function spaces such as Sobolev spaces. This course should be useful to students with interests in applied mathematics, differential geometry, mathematical physics, probability, harmonic analysis, dynamical systems, and other areas, as well as to PDE-focused students.

Learning objectives:

- Students will be familiar with basic questions on partial differential equations and related theories.
- Students will be able to solve problems concerning basic properties of the Sobolev spaces.
- Students will be able to solve problems on qualitative behaviour of solutions to partial differential equations.

Learning outcomes:

- By the end of this course, students will be able to read research papers on qualitative theory of partial differential equations, especially those that use Sobolev spaces.

Main textbook (optional): Partial Differential Equations 2/E.   L. C. Evans. AMS

Pre/co-requisites

- Basic measure theory, such as Math 420 (or equivalently Math 507) is necessary. Some functional analysis, such as Math 421 (or equivalent Math 510) would be helpful, as would some previous exposure to PDE.

Evaluation:

- Homework assignments (3 problem sets): 60%
- Class participation: 40%.
  - If you regularly attend classes and actively participate in, then you will get the full participation mark.
- **All grades are subject to scaling.**

Topics (subject to changes):

- 1. Laplace / heat / wave equations (2 - 3 weeks)
  - fundamental solutions
  - mean value properties, regularity, maximum principles, uniqueness for boundary (and initial) value problems.
- Sobolev Spaces (4 weeks)
- Linear Elliptic Equations (3 - 4 weeks)
  - existence of weak solutions
  - regularity
  - maximum principles
  - eigenvalues / eigenfunctions
- Linear Parabolic equations (1 + 1/2 weeks)
  - existence of weak solutions
  - regularity, maximum principles
- Supplementary topics (only if time permits): De Giorgi-Nash-Moser theory.

HW policy:

- Students may work together on the HW assignments but must write up their solutions **independently**. Copying is forbidden. Any 2 (or more) assignments with some virtually identical answers deemed the result of copying will be given 0 total credit, and there will be further consequences for such dishonest actions. The students are reminded of the plagiarism policies of UBC.
- We will be using Canvas for collecting the HWs.

- **Late homework is not accepted.**
- Unreadable homework will get a zero mark. You should write neatly and organize your material for a third party can understand.
- Work must be shown.
- Missed homework will count as a zero mark.
- The number of each homework problem should be clearly printed.
- It is probable that only a subset of those problems turned in would be graded, and you will not be informed (in advance) which ones these are. For example, if your homework does not contain any of the problems to be graded (which will be known only after the due date), you will get zero mark. So, it would be better for you to do all the problems to be handed in.
- **For each problem, please list any collaborators if you had, as well as any resources you used.**

Policy on Generative AI tools:

- One of the points of the course is to develop one's understanding and intuition on the course material, including problem solving skills. It is very important to learn by doing. Also, this course focuses on abstract and theoretical aspects rather than computational ones.
- **Therefore, the use of generative AI tools, including ChatGPT and other similar tools, to complete or support the completion of any form of assignment or assessment in this course is not allowed and would be considered academic misconduct.**
- On the other hand, communication is an essential part in learning. Therefore, discussion with other students are encouraged.

Copyright:
All materials of this course (course handouts, lecture notes, assessments, course readings, etc.) are the intellectual property of the Course Instructors or licensed to be used in this course by the copyright owner. Redistribution of these materials by any means without permission of the copyright holder(s) constitutes a breach of copyright and may lead to academic discipline.

Important days:

- Wednesday, September 4, 2024 - The first class.
- Monday, September 16, 2024 - Last day for change in registration and for withdrawal from most Winter Session Term 1 courses without withdrawal standing of W recorded on a student's academic record. This is known as the "add/drop date".
- **Monday, September 30, 2024 – National Day for Truth and Reconciliation. University closed.** Consider attending the **[Intergenerational March to Commemorate Orange Shirt Day (https://apsc.ubc.ca/event/2024/2024-intergenerational-march-to-commemorate-orange-shirt-day)](https://apsc.ubc.ca/event/2024/2024-intergenerational-march-to-commemorate-orange-shirt-day)**

(Sept. 30th) or this **[Faculty of Medicine Indigenous Speaker Series (https://redi.med.ubc.ca/coming-home-honouring-the-resiliency-of-all-survivors-of-the-indian-residential-school-experience/)](https://redi.med.ubc.ca/coming-home-honouring-the-resiliency-of-all-survivors-of-the-indian-residential-school-experience/)** event (Sept. 25th).

- **Monday, October 14, 2024 – Thanksgiving Day. Lectures and laboratories cancelled.**
- Friday, October 24, 2024 – Last day for withdrawal using Workday from Winter Session Term 1 courses with a withdrawal standing of W recorded on a student's record.
- **Monday, November 11, 2024 – Remembrance Day. University Closed**. Service in War Memorial Gymnasium for all students, faculty, alumni, staff, and friends at 10:45 am.
- **Monday, November 11 to Wednesday, November 13, 2024 – midterm break. Lectures and laboratories cancelled.**

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar at http://calendar.ubc.ca/vancouver/index.cfm?tree=3,54,111,0.

Course Summary:

Date	Details	Due