MATHEMATICS 257/316 - Section 201

Partial Differential Equations

January--April 2026 (2025-2026 WT2)

Acknowledgement

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xʷməθkʷəy̓əm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on in their culture, history, and traditions from one generation to the next.

Course information

All lectures will be in-person. During the lectures, we will discuss the concepts and theory behind each topic and go over plenty of examples. All class lecture notes will be posted on Canvas. Occasionally, we will use Python to numerically solve the PDEs and also, to plot and visualize the solutions. All codes will be posted on Canvas. Students who are not familiar with Python are expected to acquire a basic knowledge of Python during the term.

Instructor

- instructor = Cyrille Kenne
- email = send through Canvas.
- office hours = there will be weekly office hours - see the course webpage

Class time and location

- class time = Mon Wed Fri 11:00 pm-12:00 pm
- class location = LSK-Floor 2-Room 200
- first day of teaching: Monday, January 05
- last day of teaching: Friday, April 10

Course webpage

- The course webpage is on Canvas

Prerequisites

- One of Math 215, 255, 256

Topics

The course will cover

- Ordinary differential equations (Revisit)
- Partial differential equations (PDEs): Heat, Wave, Laplace
- Numerical methods for PDEs
- Analytical methods to solve homogeneous boundary value problems (BVPs)

Schedule (Chapters refer to the 2012 Edition of Boyce & DiPrima)

1. Review of techniques to solve ODEs
2. Series Solutions of variable coefficient ODEs (Chapter 5)
    a. Series solutions at ordinary points (5.1-5.3)
    b. Regular singular points (5.4-5.7, 5.8 briefly)
3. Introduction to PDEs (Chapter 10): heat equation (10.5), wave equation (10.7), Laplace equation (10.8)
4. Introduction to numerical methods for PDEs
    a. First and second derivative approximations using finite differences - errors
    b. Explicit finite difference schemes for the heat equation - Stability and derivative boundary conditions
    c. Explicit finite difference schemes for the wave equation
    d. Finite difference approximation of Laplace Equation and iterative methods
5. Fourier Series and Separation of Variables (Chapter 10)
    a. The heat equation and Fourier Series (10.1-10.6)
    b. The wave equation (10.7)
    c. Laplace equation (10.8)
6. Boundary Value Problems and Sturm-Liouville Theory (Chapter 11)
    a. Eigenfunctions and eigenvalues (11.1)
    b. Sturm-Liouville boundary value problems (11.2)
    c. Nonhomogeneous boundary value problems (11.3)

Text

There is no required textbook for this course, however class notes and all other course materials will be posted on Canvas

Some recommended texts are:

- Elementary Differential Equations and Boundary Value Problems by Boyce & DiPrima, Any edition.
- Applied Partial Differential Equations with Fourier Series and Boundary Value Problems (4th Ed), R. Haberman, (Pearson), 2004.
- Partial Differential Equations for Scientists and Engineers (1st Ed), S. Farlow, (Dover), 1993.

Online resources:

- Professor Anthony Peirce's course material: https://www.math.ubc.ca/~peirce/
- Professor Richard Froese's lecture notes: http://www.math.ubc.ca/~rfroese/notes/Lecs316.pdf

Assessment

Breakdown of marks

(In exceptional circumstances, adjustments to the grading scheme may be made)

- 10% Assignments – Homework (5%) + Python assignments (5%)
- 40% (20% + 20%) Midterms (there will be two midterms)
- 50% Exam

Homework

See the course webpage for details

- I expect to give around 8 or 9 homework assignments + Python Assignments.
- Homework will be posted on Mondays and due on Sundays at 11:59 pm (ie around 6 days later)
- I will not accept late homework.
- There will be no "make up" homework.
- Note that if you miss a significant number of homework assignments due to valid reasons then part of the weight of the homework will be put onto the exam.
- Homework is completion-based (not graded). You will receive the full 5% homework credit by submitting at least 5 assignments.

Presentation of homework

- All homework **must be written by hand (typed submissions are not permitted)**. Completed assignments should then be scanned and submitted as a single PDF file via Canvas.
- Typeset or messy homework will not be accepted.

Midterms - February 13 and March 27

See the course webpage for details

- It will be held during regular class-time.
- It will be 50 minutes long (though this may be changed closer to the time).
- It will cover all topics done in class up until that point in the term unless otherwise specified.

Note - There will be **no make-up midterm exams**. If you miss **Midterm 1 or Midterm 2** for reasons that qualify for **academic concession**, the weight of the missed midterm will be **reallocated to the final exam**. Any student who misses a midterm exam for a valid reason must present to me within 72 hours the completed Department of Mathematics self declaration form. According to the UBC Policy V-135 on Academic Concession (http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,329,0,0Links to an external site.) you are allowed to present this form without documentations ONCE per course. For a second instance, you will be expected to provide documentation.

Exam

See the course webpage for details

It will cover all topics done in class unless otherwise specified.

General syllabus information

- The Mathematics Department has standard syllabus information. This includes standardized policies for academic concessions (i.e. missed homework + midterm) academic integrity (i.e. cheating)
- registration issues (I have no control over anything to do with registration) misc student resources
- You can find that information here