Course Outline 2020 MATH 257/316: Partial Differential Equations

Course Information

Course Title	Course Code Number	Credit Value
Partial Differential Equations/ Elementary Differential Equations II	Math 257/316	3 Credits. Credit only given for one of Math 256, 257, 316.

Prerequisites

One of Math 215, 255, 265.

Contacts

Course Instructor(s)	Contact Details	Office Location	Office Hours
Mona Rahmani	mrahmani@math.ubc.ca	Mathematics 110	Mondays 2-3 pm, Wednesdays and Fridays 1-2 pm.

Course Structure

Section 201 meets MWF at 11am in LSK 201. Section 202 meets at 9 am in LSK 201. Lectures include introduction to the concepts, physical examples and Matlab demos. Class notes will be posted on Canvas after each lecture.

Schedule of Topics

Topics: (Chapters refer to the 2012 Edition of Boyce & DiPrima)	Approximate Time
1. Review of techniques to solve ODEs	1 hr
2. Series Solutions of variable coefficient ODEs (Chapter 5)	
a. Series solutions at ordinary points (5.1-5.3)	3 hrs
b. Regular singular points (5.4-5.7, 5.8 briefly)	4 hrs
3. Introduction to PDEs (Chapter 10): heat equation (10.5), wave equation (10.7), Laplace equation (10.8)	2 hrs
4. Introduction to numerical methods for PDEs using spread sheets	3 hrs
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)	9 hrs
b. The wave equation (10.7)	3 hrs
c. Laplace equation (10.8)	5 hrs
6. Boundary Value Problems and Sturm-Liouville Theory (Chapter 11)	
a. Eigenfunctions and eigenvalues (11.1)	1 hr
b. Sturm-Liouville boundary value problems (11.2)	1 hr
c. Nonhomogeneous boundary value problems (11.3)	2 hrs
Tests	2 hrs
Total:	36 hrs

Learning Outcomes

This course introduces the heat, wave, and Laplace equations in different physical contexts. Students are taught to formulate and implement finite difference numerical solution schemes as well as analytic methods to solve homogeneous boundary value problems (BVP) via separation of variables and Fourier Series and inhomogeneous BVP using eigenfunction expansions.

Learning Materials

- Class notes and all other course materials will be posted on Canvas.
- Any edition of *Elementary Differential Equations & Boundary Value Problem* by W.E. Boyce & R.C. DiPrima, (John Wiley & Sons) will serve as an optional text.
- Professor Anthony Peirce's course materials: `https://www.math.ubc.ca/~peirce/`

Assessments of Learning

The final grades will be based on:

- Homework (10%) including Matlab problems
- Two in-class midterm exams (2x20%=40%)
- One final exam (50%)

Course policies on assignments and exams:

- There are no make-up exams or assignments in this course. If you miss any of the exams or assignment deadlines for a valid reason, the weight of that assessment will be transferred to the final exam. Any student who misses an assessment must present within 72 hours the completed Department of Mathematics self declaration form (available on Canvas).
- A student must get at least 40% on the final exam to pass this course.
- Assignments should be submitted electronically on Canvas by 11:59 pm of the due date.

Midterm dates:

- Midterm 1: Friday, February 14, in class
- Midterm 2: Friday, March 20, in class

Final date: TBA

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the `https://senate.ubc.ca/policies-resources-support-student-success`UBC Senate website.

Learning Analytics

This course will be using the following learning technologies: Canvas, Piazza.

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