UNIVERSITY of GUELPH

MATH*4270 Partial Differential Equations

Fall 2019
Section(s): C01

Department of Mathematics & Statistics
Credit Weight: 0.50
Version 1.00 - September 04, 2019

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1 Course Details

1.1 Calendar Description

This course focuses on first and second-order partial differential equations, with examples and applications from selected fields such as physics, engineering and biology. Topics may include the wave equation, the heat equation, Laplace's equation, linearity and separation of variables, solution by Fourier series, Bessel, Legendre and Green's functions, an introduction to the method of characteristics and Fourier transforms. The classification of linear second-order partial differential equations is discussed.

Pre-Requisites: MATH*3100

1.2 Course Description

Statement of purpose, goals and objectives

Partial differential equations play an important role in many areas of mathematics and its applications. Computer simulations of aircrafts, automobiles, etc are based on partial differential equations. Predictions of weather patterns, flood waves, pollution outfalls etc, are based on partial differential equations. In physics partial differential equations are the language used in the formulation of theories. The formation of traffic jams can be explained using partial differential equations. Pattern formation in spatio-temporal chemical reactions is described by partial differential equations. Biochemical processes with spatial variability, e.g. in cells or tissues, and spatially or physiologically structured populations are often described by partial differential equations. In mathematics, partial differential equations arise, for example, in the context of certain optimal control problems (applied mathematics), or in differential geometry (pure mathematics).

This course is a first introduction to the topic, focusing on the most fundamental and best understood types of problems. It aims to draw connections between mathematics and its areas of science and technology, by discussing specifically partial differential equations that appear as models in biology, physics and various branches of engineering. It aims to be not only a course that provides methods that can be applied in other disciplines, but also to be an

introduction to partial differential equations as a field of inquiry in its own right.

1.3 Timetable

TUE, THU 10:00am -11:20am

Room: ROZH107

Timetable is subject to change. Please see WebAdvisor for the latest information.

1.4 Final Exam

FRI December 13, 2019, 11:30am-1:30am

Room: tba

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Hermann Eberl
Email: heberl@uoguelph.ca
Telephone: +1-519-824-4120 x52622
Office: MACN 508
Office Hours: TUE 15:45-16:45

                     Room: MacN508

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3 Learning Resources

3.1 Recommended Resources

Recommended Texts (Textbook)
    References to additional/supporting literature will be given in class for each chapter

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4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:
1. Numeracy and Quantitative Skills
2. Critical Thinking
3. Application of Knowledge
4. Knowledge of Methodologies
5. Mathematical, scientific and technical communication
6. Depth of Understanding

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5 Teaching and Learning Activities

Method of instruction

The course follows a traditional lecture model, supported by regular assignments for students to practice and gain more in-depth understanding of the course material. Students will be expected to take their own notes in class.

5.1 Lecture

Topics:	Introduction: what are partial differential equations?
Topics:	Linear and semilinear first order equations and their characteristics
Topics:	Classification of linear and semilinear second order equations
Topics:	Elliptic linear problems and the Laplace equation: separation of variables, variational formulations, the maximum principle and comparison theorems
Topics:	Parabolic linear problems and the Heat equation: separation of variables, ill-posed problems, upper and

	lower estimates, energy estimates, comparsion theorems
Topics:	Hyperbolic linear problems and the Wave equations: separation of variables, the d'Alembert solution, domain of dependence and influence, energy estimates;
Topics:	Quasilinear first order equations and their generalized solutions: Shocks and rarefaction waves
Topics:	Diffusion reaction equations and their longterm behaviour: travelling waves and steady states

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6 Assessments

6.1 Marking Schemes & Distributions

The normal grading system that is in use by the university applies, based on letter grade and percentage grades. The interpretation of grades is described in detail in the undergraduate calendar.

Name	Scheme A (%)
Assignments	50
Final Exam	50
Total	100

6.2 Assessment Details

Assignments (50%)
There will be 10 assignments. The average that enters the final grade calculation will be taken over the best 8 submissions.

Assignments are an important part of the course, not only as a method of evaluation, but also and primarily so, as a method of learning, to gain a deeper understanding of the course material. Assignments are to be submitted in class on the due date. Late assignments are not accepted, with possible exceptions due to illness or compassionate reasons, see below. Students are VERY STRONGLY recommended to submit individual

work for better learning success, but I will accept group submissions of up to three students. In the case of group submissions all students must contribute to the homework that is submitted. Group submissions require a statement to that effect, signed by all group members. Anticipated due dates for assignments are:

Assignment 1: September 12

Assignment 2: September 19

Assignment 3: September 26

Assignment 4: October 3

Assignment 5: October 10

Assignment 6: October 24

Assignment 7: October 31

Assignment 8: November 14

Assignment 9: November 21

Assignment 10: November 28

Final Exam (50%)
The final exam will be a written exam, to be taken on Dec 13, 2019, 11:30-13:30, room tba. Exam work will be individual work. This is a closed book exam, but students will be allowed to bring one self-compiled sheet with notes.

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7 University Statements

7.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

7.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

7.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

7.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

7.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

7.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

7.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

7.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

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