

# Course Outline Form: Fall 2016

## General Information

**Course Title: MATH4270 Advanced Partial Differential Equations**

**Course Title: MATH6041 Partial Differential Equations**

**Course Description MATH4270:** 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.

**Course Description MATH6041:** Classification of partial differential equations. The Hyperbolic type, the Cauchy problem, range of influence, well- and ill-posed problems, successive approximation, the Riemann function. The elliptic type: fundamental solutions, Dirichlet and Neumann problems. The parabolic type: boundary conditions, Green's functions and separation of variables. Introduction to certain non-linear equations and transformations methods. Offered in conjunction with MATH\*4270. Extra work is required for graduate students.

**Credit Weight: 0.5**

**Academic Department (or campus):** Mathematics & Statistics

**Campus:** University of Guelph

**Semester Offering:** Fall 2016

**Class Schedule and Location:** TUE, THU 11:30-12:50, CRSC403

## Instructor Information

**Instructor Name:** Hermann J Eberl  
**Instructor Email:** heberl@uoguelph.ca  
**Office location and office hours:** MACN508, TUE 15:30-16:30

## Course Content

**Specific Learning Outcomes:**

MATH\*4270/6041

- Students will obtain an overview of modern concepts of partial differential equations, one of the most important areas in applied mathematics that has bearing on many areas of science and technology, such as engineering, physics, and biology
- Students will learn to distinguish between different types of PDE problems and to identify appropriate methods for their treatment; they will be able to recognize when such problems are well- or ill-posed
- Students will refine their mastery of techniques of mathematical proofs
- Students will learn to make use of mathematical skills they acquired in foundational mathematics courses to solve advanced problems

additional for MATH\*6041

- Students will learn to independently read mathematical literature that builds on but extends beyond the material presented in class. This will provide the ability for independent hands-on application of the learned lecture content
- Students will gain mathematical communication skills by learning how to present mathematical material to a group of peers.

**Lecture Content:**

1. Introduction: Three basic PDEs (Laplace, Heat, and Wave Equation)
2. Classification of 2<sup>nd</sup> order PDEs and Characteristics
3. Elliptic and Parabolic Maximum Principles
4. Diffusion-Reaction Equations and Applications in Biology and Engineering
5. Quasilinear First Order Systems and Applications in Physics and Engineering
6. Loose Ends

MATH\*6041 students will be assigned a reading project with material that builds on but extends beyond the material presented in the lectures.

**Assessment and Grades**

**Course Assignments and Tests:**

Assignment 1	Thu Sep 22
Assignment 2	Thu Sep 29
Assignment 3	Thu Oct 6
Assignment 4	Thu Oct 13

Assignment 5	Thu Oct 20
Assignment 6	Thu Oct 27
Assignment 7	Thu Nov 3
Assignment 8	Thu Nov 10
Assignment 9	Thu Nov 17
Assignment 10	Thu Nov 24

Assignments will be distributed in class and posted on  
<http://www.uoguelph.ca/~heberl/MPDE.html>

**Final examination date and time:** Mon, 05/12/2016, 19:00-21:00; room TBA

**Graduate student presentations:** during the last 3 lecture weeks (scheduled in class)

## Grades

MATH4270:

Assignments: 56% best 8 out of 10, at 7% each  
Final Exam: 44%

MATH6041:

Assignments: 40% best 8 out of 10, at 5% each  
Final Exam: 40%  
Reading project: 20%

## Course Resources

**Required Texts:** none

**Recommended Texts:**

M Renardy, RC Rogers, An Introduction to Partial Differential Equations,  
Springer, Heidelberg, 2004

**Additional resources**, including material for graduate student presentations will be announced in class.

## **Course Policies**

### **Grading Policies**

- late assignments will not be accepted without *a priori* instructor consent
- see also <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-grds.shtml>

### **Course Policy on Group Work:**

Students are encouraged to hand in their assignments individually, but written assignments may be handed in by group of two or three students.

### **Course Policy regarding use of electronic devices and recording of lectures**

Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

## **Additional Course Information**

The use of computers is an important part of this course. All students must make sure that they have access to a suitable computer (e.g. through CPES computing laboratories, their personal computers, or resources in their grad student offices). We will use software that is freely available for Linux, Windows and MacOS/X operating systems.

## **University Policies**

### **Academic Accommodation of Religious Obligations**

If you are unable to complete a course requirement due to religious obligations, please let the instructor know within the first two weeks of class. See the academic calendar for more information:  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

### **Academic Consideration**

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration:  
<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

## Academic Misconduct

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 discourages misconduct. 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.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

## Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibilities Services (SAS) as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email [csd@uoguelph.ca](mailto:csd@uoguelph.ca) or see the website: <http://www.uoguelph.ca/csd/>

## Course Evaluation Information

Please see <http://www.mathstat.uoguelph.ca/files/TeachevaluationformF10.pdf>

## Drop date

The last date to drop one-semester courses, without academic penalty, is **Friday, November 4, 2016**. For regulations and procedures for Dropping Courses, see the Academic Calendar: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>