

Partial Differential Equations (MAI0133)
Spring 2017
Course Document¹

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Course Aims: The aim of this course is to develop a good understanding of a selection of areas within the theory of partial differential equations (PDEs). By the end of the course you should:

- be familiar with abstract mathematical frameworks in which questions related to partial differential equations can be set;
- be able to classify PDEs which commonly appear in applications and identify appropriate techniques which can be used to solve and study them;
- apply this knowledge in a systematic and careful way to answer mathematical questions related to PDEs.

Useful References: We will probably make use of several books and other material during the course, although the material for the course will centre around *Partial Differential Equations* by L.W. Evans. When possible I will publish or link to course material on the website.

Syllabus: We will study a selection of the following topics.

- **Sobolev spaces**
- **Weak solutions of elliptic PDEs.**
- **Eigenvalues and eigenfunctions**
- **Galerkin methods and weak solutions for parabolic and hyperbolic PDEs.**
- **Nonlinear first-order PDE.**
- **Calculus of variations.**
- **The method of vanishing viscosity.**
- **Fixed point theorems.**
- **Inverse problems.**

We can also study other topics that are of particular interest to students.

Assessment: The course will be assessed via homework exercises to be completed by students during the course (6 ECTS points) and by successfully leading a seminar/lecture (2 ECTS points).

Homework and Tutorials: Exercises will be assigned regularly to help you understand and gain familiarity with the material and also as a form of assessment. I am always happy to discuss your thoughts and written solutions to exercises or other aspects of the course.

You are encouraged to work on problems together but make sure you really understand the material for yourself and write up solutions independently.

Academic Misconduct: Zero points for the course will be assigned if evidence of cheating or academic misconduct is found in any part of your work for it. Please see the University guidelines on plagiarism and related matters.

David Rule

¹Date: 9/2/17