

MA953-15 Topics in Partial Differential Equations (PDEs)

26/27

Department

Warwick Mathematics Institute

Level

Research Postgraduate Level

Module leader

Florian Theil

Credit value

15

Module duration

10 weeks

Assessment

100% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This is a topics course. Such courses are designed to address material of particular interest in the year of delivery. By the nature of the course, the topic rotates, which means that the course will also be of use to PhD students in later years, even if they took the course for credit already. What we do specify for each year is that the course consists of rigorous PDE theory.

Module aims

To give breadth of training in PDE theory closer to the norm in Germany, France and Italy, for example.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Topic: Parabolic PDE theory.

Preamble: Originally introduced by Fourier to model the conduction of heat, parabolic PDE now

find themselves of central importance across physics, biology, image processing, option pricing, and pure mathematics.

- Review of the standard heat equation in Euclidean space; scaling properties; fundamental solution; interpretation; maximum principle
- Differential Harnack inequalities, log convexity and applications
- Review of solution via Fourier series; intuition from this instance that carries over to the most general parabolic PDEs
- Some examples of the most simple and natural nonlinear parabolic PDE; explicit solutions and consequences of the maximum principle; discussion of the most basic results such as short time existence, as motivation for general theory.
- Function spaces that are suited to parabolic PDE; parabolic Holder spaces, relevant Sobolev spaces
- General linear theory: a brief overview of the different types of forms of equation, e.g. divergence and nondivergence form equations; statements of theorems, and proofs in special cases.
- Nonlinear theory
- Detailed analysis of one or two explicit nonlinear parabolic PDE

Learning outcomes

By the end of the module, students should be able to:

- The broad PLOs are: 1) To understand how to apply the foundational material learned in the course MA4A2 Advanced PDE. 2) To profit from the very large number of techniques that have been developed in rigorous PDE theory since the 1950s. 3) To understand how PDE technology is being used in current research, and for specific equations.

Indicative reading list

[Reading lists can be found in Talis](#)

Subject specific skills

1. Understand how to apply the foundational material learned in the course MA4A2 Advanced PDE.
2. Develop a deep understanding and applicability of the very large number of techniques that have been developed in rigorous PDE theory since the 1950s.
3. Understand how PDE technology is being used in current research, and for specific equations.

Transferable skills

- sourcing research material
- prioritising and summarising relevant information
- absorbing and organizing information

- presentation skills (both oral and written)
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Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Private study	120 hours (80%)
Total	150 hours

Private study description

Review lectured material.

Work on supplementary reading material.

Source, organise and prioritise material for additional reading.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group A

	Weighting	Study time	Eligible for self-certification
Assessment component			
Oral Exam	100%		No
An oral exam involving a presentation by the student, followed by questions from the panel (2 members of the department)			

Reassessment component is the same

Feedback on assessment

Students will receive feedback from the course instructor after the oral exam, to cover also areas like presentation skills and use of technologies (or blackboard)

[Past exam papers for MA953](#)

Availability

There is currently no information about the courses for which this module is core or optional.