MA4A2-15 Advanced PDEs

22/23

Department
Warwick Mathematics Institute
Level
Undergraduate Level 4
Module leader
Felix Schulze
Credit value
15
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Partial differential equations have always been fundamental to applied mathematics, and arise throughout the sciences, particularly in physics. More recently they have become fundamental to pure mathematics and have been at the core of many of the biggest breakthroughs in geometry and topology in particular. This course covers some of the main material behind the most common 'elliptic' PDE. In particular, we'll understand how analysis techniques help find solutions to second order PDE of this type, and determine their behaviour. Along the way we will develop a detailed understanding of Sobolev spaces.

Module web page

Module aims

To introduce the rigorous, abstract theory of partial differential equations.

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.

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throughout the sciences, particularly in physics. More recently they have become fundamental to pure mathematics and have been at the core of many of the biggest breakthroughs in geometry and topology in particular. This course covers some of the main material behind the most common 'elliptic' PDE. In particular, we'll understand how analysis techniques help find solutions to second order PDE of this type, and determine their behaviour. Along the way we will develop a detailed understanding of Sobolev spaces.

Learning outcomes

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

- This course is most suitable for people who have liked the analysis courses in earlier years. It will be useful for many who intend to do a PhD, and essential for others. There are not too many prerequisites, although you will need some functional analysis, and some facts from Measure Theory will be recalled and used (particularly the theory of Lp spaces, maybe Fubini's theorem and the Dominated Convergence theorem etc.). It would make sense to combine with "MA3G1 Theory of PDEs", in particular the parts about Laplace's equation, in order to see the relevant context for this course, although this is not essential.

Subject specific skills

Students who have successfully taken the module will be able to investigate and solve second order partial differential equations using functional analysis techniques and also understand the regularity properties of the solutions obtained. They will obtain a solid grounding in Sobolev and Hölder spaces and understand the inequalities that relate them.

Transferable skills

They will be left with an excellent foundation for further study at graduate level, and will be able to apply the techniques they have learned in pure mathematics, the applied sciences and in many activities across engineering and finance.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	9 sessions of 1 hour (6%)
Private study	111 hours (74%)
Total	150 hours

Private study description

Review lectured material and work on set exercises

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group B1

	Weighting	Study time
In-person Examination 3 hour exam, no books allowed	100%	

- Answerbook Gold (24 page)

Assessment group R

	Weighting	Study time
In-person Examination - Resit	100%	

- Answerbook Gold (24 page)

Feedback on assessment

Exam feedback

Past exam papers for MA4A2

Availability

Courses

This module is Optional for:

- TMAA-G1PE Master of Advanced Study in Mathematical Sciences

    - Year 1 of G1PE Master of Advanced Study in Mathematical Sciences
    - Year 1 of G1PE Master of Advanced Study in Mathematical Sciences
- Year 1 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1P0 Postgraduate Taught Mathematics
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
- USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
    - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
    - Year 4 of G300 Mathematics, Operational Research, Statistics and Economics

This module is Option list A for:

- TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
    - Year 1 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
    - Year 2 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1P0 Postgraduate Taught Mathematics
- TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
    - Year 1 of G1PC Mathematics (Diploma plus MSc)
    - Year 2 of G1PC Mathematics (Diploma plus MSc)
- Year 4 of UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
    - Year 4 of FG31 Mathematics and Physics (MMathPhys)
    - Year 4 of FG31 Mathematics and Physics (MMathPhys)
- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 5 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list B for:

- TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
    - Year 1 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
    - Year 2 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
- TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
    - Year 1 of G1PC Mathematics (Diploma plus MSc)
    - Year 2 of G1PC Mathematics (Diploma plus MSc)
- Year 4 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 3 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 4 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list C for:

- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
    - Year 3 of G105 Mathematics (MMath) with Intercalated Year
    - Year 4 of G105 Mathematics (MMath) with Intercalated Year
    - Year 5 of G105 Mathematics (MMath) with Intercalated Year
- UMAA-G103 Undergraduate Mathematics (MMath)

    - Year 3 of G103 Mathematics (MMath)
    - Year 3 of G103 Mathematics (MMath)
    - Year 4 of G103 Mathematics (MMath)
    - Year 4 of G103 Mathematics (MMath)
- UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
    - Year 3 of G106 Mathematics (MMath) with Study in Europe
    - Year 4 of G106 Mathematics (MMath) with Study in Europe

This module is Option list E for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- Year 5 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated