MA433-15 Fourier Analysis

26/27

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

Description

Introductory description

Fourier analysis lies at the heart of many areas in mathematics. This course is about the applications of Fourier analytic methods to various problems in mathematics and sciences.

Module web page

Module aims

The aim of the module is to convey an understanding of the basic techniques and results of Fourier analysis, and of their use in different areas of maths.

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.

Fourier analysis lies at the heart of many areas in mathematics. This course is about the applications of Fourier analytic methods to various problems in mathematics and sciences. The emphasis will be on developing the ability of using important tools and theorems to solve concrete problems, as well as getting a sense of doing formal calculations to predict/verify results. Topics

will include:

1. Fourier series of periodic functions, Gibbs phenomenon, Fejer and Dirichlet kernels, convergence properties, etc.
2. Basic properties of the Fourier transform on R^d, including L^p theory.
3. Topics on the Fourier inversion formula, including the Gauss-Weierstrass and Abel Poisson kernels, and connections to PDE.
4. A selection of more advanced topics, including the Hilbert transform and an introduction to Singular Integrals.

Learning outcomes

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

- Derive basic properties of Fourier series and Fourier transforms; Use the Dirichlet kernel to prove pointwise convergence of Fourier series for regular functions (Holder, BV, etc); Apply results about convolutions with good kernels to partial differential equations; Understand maximal operators and interpolation theorems and their relationship to almost sure convergence results for good kernels; Understand how to use results about Hilbert transforms to prove norm convergence of Fourier transforms in L^p.

Subject specific skills

Fourier analysis is a central topic in mathematics, physics and engineering, including applications to signal processing and cryptography. Students taking this module will develop their knowledge of Fourier analysis and its application to partial differential equations, as well as the mathematical analysis skills required for a deeper understanding of the topic.

Transferable skills

See subject specific skills.

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	Eligible for self-certification
Centrally-timetabled examination (On-campus) 3 hour exam, no books allowed	100%		No

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- Answerbook Gold (24 page)

Assessment group R

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit	100%		No

- Answerbook Gold (24 page)

Feedback on assessment

Exam feedback

Past exam papers for MA433

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
- 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 USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics

This module is Core option list F for:

- Year 4 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

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
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
- Year 4 of UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
- Year 4 of UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)

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)
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
- Year 4 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 5 of UCSA-G4G4 Undergraduate Discrete Mathematics (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 4 of G103 Mathematics (MMath)
- Year 4 of UMAA-G107 Undergraduate Mathematics (MMath) with Study Abroad
- 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 5 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated