MA4H9-15 Modular Forms

26/27

Department
Warwick Mathematics Institute
Level
Undergraduate Level 4
Module leader
Samir Siksek
Credit value
15
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Modular forms are holomorphic functions on the complex upper half plane that enjoy certain additional symmetries. Whilst the definition is analytic they have many applications within number theory and algebra. In this module we study spaces of modular forms and their connections to L-functions, quadratic forms and elliptic curves.

Module web page

Module aims

Students will understand

- basic properties of modular forms, their spaces, Hecke operators
- the connection between divisor functions and Eisenstein series
- the connection between a positive quadratic form and theta series,
- the connection between the partition function and modular forms

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.

The modular group and the upper half-plane.

Modular forms of level 1 and the valence formula.
Eisenstein series, Ramanujan's Delta function.
Congruence subgroups and fundamental domains. Modular forms of higher level.
Hecke operators.
The Petersson scalar product. Old and new forms.
Statement of multiplicity one theorems.
The L-function of a modular form.
Modular symbols

Learning outcomes

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

- be able to perform simple computations involving modular forms and their Hecke operators
- be able to derive and use dimension formulae for spaces of modular forms
- appreciate the link between modular forms and elliptic curves via L-functions

Subject specific skills

Use methods of complex analysis to prove algebraic and number theoretic statements
Use linear algebra to prove identities between modular forms
Use the Poisson summation formula to derive transformation laws for theta series

Transferable skills

Ability to use Cauchy's residue theorem. Ability to translate between the analytic and algebraic worlds. Ability to solve problems.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (100%)
Total	30 hours

Private study description

Homework problems.

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 B

	Weighting	Study time	Eligible for self-certification
In-person Examination	100%	3 hours	No

Standard 3 hour written exam.

- Answerbook Gold (24 page)

Assessment group R

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

Standard 3 hour written exam.

- Answerbook Gold (24 page)

Feedback on assessment

Written feedback on the outcome of the exam.

Past exam papers for MA4H9

Availability

Courses

This module is Optional for:

- Year 1 of TMAA-G1PE Master of Advanced Study in Mathematical Sciences
- Year 1 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)

This module is Option list A for:

- Year 2 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)

This module is Option list B for:

- Year 2 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)

This module is Option list C for:

- Year 3 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- 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