MATH-521

Advanced analytic number theory

Cursus	Sem.	Type
Ing.-math	MA2, MA4	Opt.
Mathématicien	MA2	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Oral
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Remark

Pas donné en 2026-27 - Cours donné en alternance tous les deux ans

Summary

This year we will present some further applications of the theory of modular forms (compared to MATH-511). These may include the following: - Equidistribution of points on spheres - Construction of Ramanujan Graph - Invariant means on the spheres - Complex multiplication for elliptic curves

Content

The course will have some overlap with MATH-511 but the applications presented are somewhat different.
Harmonic analysis on the sphere
The upper half plane and the group of fractional linear transformations
Modular forms: définitions and examples (Eisenstein series, theta series)
Fourier coefficients of modular forms; Petersson inner product and Ptersson formula.
Hecke operators.
Equidistribution on the sphere.
Expander graphs/Ramanujan graphs
Modular forms and elliptic curves.

Keywords

Modular forms, theta series, Fourier coefficients
Equidistribution
Graphs
Elliptic curves

Learning Prerequisites

Required courses

Fourier Analysis
Harmonic analysis
Modular Forms

Recommended courses

Analytic Number Theory
Algebraic Number Theory

Learning Outcomes

- Quote the main results of the course
- Use the main results of the course
- Prove the main results of the course

Teaching methods

Ex cathedra lecture and exercises in the classroom

Expected student activities

Attendence to the lectures and active participation to thhe exercise sessions

Assessment methods

Oral exam
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Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Supervision

Office hours	No
Assistant.e.s	Yes
Forum	No
Others	moodle

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

Fred Diamond: A first course on modular forms.
Henryk Iwaniec: Topics on Classical automorphic forms
Peter Sarnak: Some applications of modular forms

Ressources en bibliothèque

- Find the references at the Library

Moodle Link

- https://go.epfl.ch/MATH-521

Prerequisite for

Fields medal