

MATH-535

Topics in algebraic geometry

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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	

Summary

This course is aimed to give students an introduction to the theory of algebraic curves and surfaces. In particular, it aims to develop the students' geometric intuition and combined with the basic algebraic geometry courses to build a strong foundation for further study.

Content

- Separated and proper morphism, varieties using the language of schemes
- Recap: Divisors, sheaf cohomology and morphisms to projective spaces
- Riemann-Roch and Serre duality for curves
- Classification of curves
- Embedding of curves in projective spaces
- Algebraic surfaces
- Intersection theory on smooth surfaces
- Blow-ups
- Fibrations of surfaces

Keywords

Algebraic geometry, curves, surfaces, singularities, birational geometry

Learning Prerequisites**Required courses**

- Linear algebra
- Group Theory
- Rings and Modules
- Modern Algebraic geometry

Recommended courses

- Topology I & II
- Algebraic topology

- Differential geometry
- Algebraic number theory
- Schemes
- Complex manifolds
- Complex Analysis

Learning Outcomes

- Analyze basic problems in algebraic geometry of curves and solve them.
- Recall the statements of basic theorems like Riemann-Roch, Serre duality, etc, and understand their proofs
- Compute geometric and birational invariants of curves and surfaces in basic examples.
- Formulate a sketch of the birational classification of surfaces and how to approach its proof.
- Reason intuitively about the geometry and topology of curves over the complex and finite fields.

Teaching methods

2h lectures+2h exercise sessions weekly.

Assessment methods

Oral Exam

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources

Bibliography

We will follow mainly

- Hartshorne, Algebraic Geometry
- Liu, Algebraic Geometry and Arithmetic Curves
- Beauville, Complex Algebraic Surfaces

Other resources students may want to look at are

- R. Miranda, Algebraic Curves and Riemann Surfaces
- M. Reid, Chapters on Algebraic Surfaces

Ressources en bibliothèque

- [Chapters on Algebraic Surfaces / Reid](#)
- [Algebraic Curves and Riemann Surfaces / Miranda](#)
- [Algebraic Geometry and Arithmetic Curves / Liu](#)
- [Algebraic Geometry / Hartshorne](#)
- [Algebraic Curves and Riemann Surfaces / Miranda](#)
- [Complex Algebraic Surfaces / Beauville](#)

Références suggérées par la bibliothèque

- [Algebraic Varieties / Osseman](#)

Moodle Link

- <https://go.epfl.ch/MATH-535>