

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
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**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>