

MATH-317

**Algebra V - Galois theory**

Michel Philippe

Cursus	Sem.	Type
Mathematics	BA5	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

Galois theory aims at describing the algebraic symmetries of fields. After reviewing the basic material (from the 2nd year course "Ring and Fields") and in particular the Galois correspondence, we will describe applications to classical problems as well as more advanced developments.

**Content**

Galois theory aims at describing the algebraic symmetries of fields.

This is a basic topic in mathematics with connections to commutative algebra, algebraic and arithmetic geometry, number theory and also with more applied areas like cryptology). This is an essential course to anyone interested in the algebra track.

The topics covered may include

- Finite extensions of fields: separable and normal extensions.
- The Galois group and the Galois correspondence.
- Galois theory of finite fields.
- venerable applications: Ruler and compass construction; equations solvable by radicals: Galois criterion.
- Computation of Galois groups and applications.
- Galois theory of cyclotomic fields.
- Specialization theorems and application to the inverse Galois problem.
- Infinite Galois theory.

**Keywords**

Field extension, Galois group

**Learning Prerequisites****Required courses**

MATH-211  
MATH-215

**Important concepts to start the course**

Groups, Ring and Fields

**Learning Outcomes**

By the end of the course, the student must be able to:

- Quote the results from the course
- Apply the results from the course to other problems
- Prove the main theorems of the course

### Teaching methods

ex-cathedra

### Expected student activities

Attendance to the course and active participation to the exercise sessions

### Assessment methods

written exam

### Supervision

Assistants	Yes
Forum	No
Others	moodle page

### Resources

#### Bibliography

Chambert-Loir: A field guide to algebra  
James Milne: Galois Theory

#### Ressources en bibliothèque

- [A field guide to algebra / Chambert-Loir](#)
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#### Références suggérées par la bibliothèque

- [Fields and Galois Theory / Milne \[PDF on author's website\]](#)

#### Notes/Handbook

a pdf (in french) will be provided during the course

#### Moodle Link

- <https://go.epfl.ch/MATH-317>

### Prerequisite for

MATH-328  
MATH-417  
MATH-429  
MATH-482  
MATH-489  
MATH-494  
MATH-535