EPFL

MATH-334 **Representation theory**

Cursus	Sem.	Type
Mathematics	BA6	Opt.

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

Remark

pas donné en 2023-24

Summary

Study the basics of representation theory of groups and associative algebras.

Content

Representations of associative algebras in complex vector spaces. General results: subrepresentations and semisimple representations. Modules over rings and associative algebras. Homomorphisms of modules. Wedderburn's theorem. Examples of algebras, group algebras of finite groups, quiver algebras and universal enveloping of Lie algebras. Representations of finite groups. Maschke's theorem. Tensor products.
The density theorem. Characters. The Jordan-Hölder and Krull-Schmidt theorems. Extensions of representations.

Keywords

Linear representation, subrepresentation, quotient, simple representation, subrepresentation, quotient representation, semisimple representation, character of a representation, associative algebra, representation of a finite group.

Learning Prerequisites

Required courses

Linear algebra or Advanced Linear algebra; Group theory

Recommended courses

Lie algebras, Coxeter groups

Learning Outcomes

By the end of the course, the student must be able to:
- Apply concepts and ideas of the course
- Reason rigorously using the notions of the course
- Choose an appropriate method to solve problems
- Identify the concepts relevant to each problem
- Apply concepts to solve problems similar to the questions in problem sets
- Solve new problems using the ideas of the course
- Implement appropriate methods to study and construct representations of groups and algebras

Teaching methods

Lectures and exercise sessions

Assessment methods

One take-home written assignment (15% of the grade)
Written exam (85% of the grade)

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Bibliography

1. P. Etingof, O. Goldberg, S. Hensel, T. Liu, A. Schwendner, D. Vaintrob, E. Yudovina, "Introduction to Representation Theory".   Student Mathematical Library Volume: 59; 2011. ISBN: 978-0-8218-5351-1
2. Fulton, William, and Joe Harris. *Representation Theory: A First Course.* Graduate texts in mathematics. Vol. 129. New York, NY: Springer, 1991. ISBN: 9780387974958.

Ressources en bibliothèque

- Introduction to Representation Theory / Etingof & ...
- Representation theory / Fulton & Harris

Moodle Link

- https://go.epfl.ch/MATH-334