MATH-497 **Homotopy theory**

Cursus	Sem.	Type
Ing.-math	MA1, MA3	Opt.
Mathématicien	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
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

We propose an introduction to homotopy theory for topological spaces. We define higher homotopy groups and relate them to homology groups. We introduce (co)fibration sequences, loop spaces, and suspensions. We study long exact sequences. We construct Eilenberg-Mac Lane spaces.

Content

1. Compact-open topology
2. Higher homotopy groups
3. Cofibrations and fibrations
4. Loop spaces and suspension
5. Long exact sequences for homotopy groups
6. CW-approximation and cellular approximation
7. Eilenberg-Mac Lane spaces
8. Weak homotopy equivalences
9. Hurewicz homomorphism
10. Postnikov sections

Keywords

Homotopy groups, Cofibrations and fibrations, Loop spaces and suspension, Long exact sequence, Eilenberg-Mac Lane space, Hurewicz homomorphism

Learning Prerequisites

Required courses

Topology, Algebraic Topology, Group Theory, Rings and Fields

Recommended courses

Rings and modules

Important concepts to start the course

Fundamental group, Homology groups, cell complexes, excision in homology

Learning Outcomes

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

- Manipulate fibrations and cofibrations
- Perform elementary computations of homotopy groups
- Compare homotopy with homology groups
- Define the notions introduced in the course
- State the main theorems and prove them
- Apply the tools developed in the course to examples

Teaching methods

ex-cathedra teaching, exercise classes

Expected student activities

Attend the lectures and exercise sessions, solve exercises, hand in homework, prepare a presentation

Assessment methods

The final grade will be assigned based on:
20% - homework in small groups
20% - oral presentation during an exercise session
60% - written exam
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	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

Algebraic Topology, Allen Hatcher
Algebraic Topology, Tammo Tom Dieck
Algebraic Topology, Edwin Spanier
Introduction to Homotopy Theory, Paul Selick
Modern Classical Homotopy Theory, Jeffrey Strom

Ressources en bibliothèque

- Modern Classical Homotopy Theory / Strom
- Algebraic Topology / Dieck
- Algebraic Topology / Spanier
- Algebraic Topology / Hatcher
- Introduction to Homotopy Theory / Selick

Moodle Link

- https://go.epfl.ch/MATH-497