

MATH-322

Differential geometry II - Smooth manifolds

Tsakanikas Nikolaos

Cursus	Sem.	Type
Mathematics	BA5	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	

Summary

Smooth manifolds constitute a certain class of topological spaces which locally look like some Euclidean space \mathbb{R}^n and on which one can do calculus. We introduce the key concepts of this subject, such as vector fields, differential forms, etc.

Content

- topological and smooth manifolds
- vector bundles
- tangent space and tangent bundle
- vector fields, integral curves
- differential forms, exterior derivative
- orientation, integration of differential forms
- Stokes' theorem (and applications)

Keywords

smooth manifold, tangent space, vector field, differential form, Stokes

Learning Prerequisites**Required courses**

Espaces métriques et topologique, Topologie, Analyse III et IV

Learning Outcomes

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

- Define and understand the key concepts (differentiable structure, (co)tangent bundle, etc.)
- Use these concepts to solve problems
- Prove the main theorems (Stokes, etc.)

Transversal skills

- Continue to work through difficulties or initial failure to find optimal solutions.

- Demonstrate a capacity for creativity.
- Access and evaluate appropriate sources of information.
- Demonstrate the capacity for critical thinking
- Assess one's own level of skill acquisition, and plan their on-going learning goals.

Teaching methods

2h lectures + 2h exercises

Expected student activities

- Attend classes
- Revise course content
- Solve exercises
- Read appropriate literature to understand key concepts

Assessment methods

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

Resources

Bibliography

John M. Lee: Introduction to Smooth Manifolds
Jeffrey M. Lee: Manifolds and Differential Geometry

Ressources en bibliothèque

- [Introduction to Smooth Manifolds / Lee](#)
- [Manifolds and Differential Geometry / Lee](#)

Websites

- https://slsp-epfl.primo.exlibrisgroup.com/discovery/search?tab=41SLSP_EPF_MyInst_and_CI&search_scope=MyInst_and_CI&vid=41
- <https://link.springer.com/book/10.1007/978-1-4419-9982-5>
- https://slsp-epfl.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_ebookcentral_EBC3114665&context=PC&vid=41
- <https://www.ams.org/books/gsm/107/>

Moodle Link

- <https://go.epfl.ch/MATH-322>