

Calculus on Manifolds

(CO17-100261)

Fall Semester 2019

Up-to-date course information can be found on the course website
http://math.jacobs-university.de/petrat/teaching/2019_fall_calculus_on_manifolds/

1 Official Course Description

This course is a first introduction to modern concepts in geometry and topology which are fundamental to specialization topics in Pure Mathematics. Topics include manifolds, differential forms, and Stokes theorem (on differential forms and retranslation into its classical formulation).

2 Contact Information

Instructor: Prof. Sören Petrat
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3 Time and Place

Wed 08:15 – 09:30, WH-4 Seminar

Thu 11:15 – 12:30, WH-4 Seminar

First class: September 4, 2019; last class: December 5, 2019

No classes on October 3 (German Unity Day) and October 31 (Reformation Day)

4 Textbooks

The class material is similar to the following textbook:

- J. L. Lee - Introduction to Smooth Manifolds

5 Exercises

Each week there will be an exercise sheet/homework assignment. These are an integral part of the coursework and working on the exercise sheets consistently is the best preparation for the exams!

- The solutions have to be handed in at the beginning of class.
- No late submissions are accepted.
- The three worst exercise sheets are not considered for grading, in order to compensate for sickness, late adding etc.
- It is encouraged to discuss the exercise sheets with your classmates (e.g., discuss how to come up with the solution or what the right way of approaching the problem is). On the other hand, the solutions must be written down and handed in individually! Copying the solutions from somebody else is a violation of Academic Integrity.

6 Exams

There will be two exams, a midterm and a final. The midterm will cover all material from the first half of the course and the final will cover all material with emphasis on the second half. More details will be announced. Note that this class uses gradescope for grading exams, see <https://gradescope.com> for more information. (Note that you can opt out of this by notifying the instructor.)

7 Grading

The final grade is weighted as follows:

Homework:	20%
Midterm:	30%
Final:	50%

Note: If the midterm grade is worse than the grade of the final, then only the grade of the final counts for both midterm and final.

8 Tentative Class Schedule

Session	Date	Topic
1	Sep 4	Smooth functions
2	Sep 5	Inverse function theorem
3	Sep 11	Bump functions, Sard's theorem
4	Sep 12	Differentiable structures on manifolds
5	Sep 18	Examples
6	Sep 19	Groups on manifolds
7	Sep 25	Diffeomorphisms
8	Sep 26	Tangent space
9	Oct 2	Submanifolds
	Oct 3	German Unity Day
10	Oct 9	Immersions, submersions, rank theorem
11	Oct 10	Embeddings in Euclidean space
12	Oct 16	Vector field and integral curves
13	Oct 17	Tangent and cotangent bundle
14	Oct 23	Vector bundles
	Oct 24	Midterm Exam
15	Oct 30	Multilinear algebra
	Oct 31	Reformation Day
16	Nov 6	Differential forms
17	Nov 7	Differential forms
18	Nov 13	Manifolds with boundary
19	Nov 14	Integration on manifolds
20	Nov 20	Integration on manifolds
21	Nov 21	Stokes's theorem
22	Nov 27	Lie groups
23	Nov 28	Lie groups
24	Dec 4	Lie groups
25	Dec 5	Lie algebra
	TBA	Final Exam