

Math 549 – Syllabus

Instructor: Wouter van Limbeek

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Lectures: MWF 900-950 AM in AH 303.

Office hours (subject to change):

M 4-5 pm. T 2-3 pm.

CRN: 39514. **Credits:** 4.

Prerequisites: MATH 310 or 320, and MATH 445.

Book: *Introduction to Smooth Manifolds* by John M. Lee (Springer, 2nd ed.). Free electronic copy available via the library. Homework will be assigned from the official textbook so you should have access to it.

Exams: There will be an in-class midterm, and a final exam. Dates for exams:

Midterm: In class, 3/4.

Final: TBD.

Grading policy:

Homework: 30%

Midterm: 30%

Final: 40%

Homework assignments: There will be weekly homework assignments, generally due on Wednesday at beginning of class unless otherwise announced. You are encouraged to work together in small groups (2 or 3 people) to solve the assignments. However, to ensure you understand the solutions of your group, you must write your own solutions (i.e. copying is prohibited).

Late homework will not be accepted. However to allow for occasional illness etc., your lowest 2 homework scores will be dropped.

Course description: This is a first course on smooth manifolds, topological spaces that are locally modeled on Euclidean space. We will develop the theory of calculus on these spaces and apply it to study their topology. We will introduce manifolds, tangent spaces, smooth maps and their derivatives, vector fields, differential forms, integration of smooth functions. If time allows we will discuss more advanced topics such as Lie groups and de Rham cohomology.

Course goals: Understanding of, and ability to apply, the main concepts in differential topology (smooth maps, tangent bundles, derivatives, vector fields, differential forms, integration on manifolds). Most of Chapters 1-17 of the textbook.

Disability services: Students with disabilities must inform the instructor of the need for accommodations. Those who require accommodations for access and participation in this course must be registered with the Disability Resource Center. Please contact ODS at 312/413-2183 (voice) or 312/413-0123 (TTY).

Academic integrity: Students should act in accordance with the Standards of Conduct as set forth by the university. Violations will be handled according to the Student Disciplinary Policy. Both are available at <https://dos.uic.edu/wp-content/uploads/sites/262/2021/09/Student-Disciplinary-Policy-2021.pdf>. You should not use external resources (i.e. other than the lectures and the textbook) for any part of the course. In particular do not look up or ask for solutions on the internet.

Approximate calendar of topics by week:

- (1) Definition of manifolds, smooth structures.
- (2) Smooth maps.
- (3) Tangent spaces, derivatives.
- (4) Submersions and immersions.
- (5) Submanifolds.
- (6) Sard's Theorem.
- (7) Lie Groups.
- (8) Vector fields.
- (9) Flows.
- (10) Vector Bundles.
- (11) Tensors and differential forms.
- (12) Exterior derivative and orientations.
- (13) Integration and Stokes' Theorem.
- (14) De Rham cohomology.
- (15) Degree theory.