

COURSE SYLLABUS

Math 535a: Differential Topology

Spring 2025

BASIC INFORMATION

Lectures: MWF 10:00–10:50am, KAP 427

Instructor: Wenyuan Li

Email: wenyuan.li@usc.edu

Office Location: KAP 424A

Office Hours: W 11:00pm–12:30pm, F 1:30pm–3:00pm or by appointment

Teaching Assistant: Siyang Liu

Email: liusiyang@usc.edu

Course Description: (4 units) .

Prerequisites: Math 440.

Text: Foundations of Differentiable Manifolds and Lie Groups by F. Warner (Chapter 1–4) and Differential Topology by M. Hirsch (Chapter 3–5).

Reference: Introduction to Smooth Manifolds by J. Lee.

ASSIGNMENTS, EXAMS AND GRADING

Assignments: There will be weekly assignments due on Mondays.

Exams: There are two exams in this course: Midterm Exam: Mar 7; Final Exam: Friday May 2. Each exam will consist of a take home and in class component, weighted equally.

Your grade in the course is calculated as follows: Homework 60% + Midterm Exam 20% + Final Exam 20%.

COURSE CALENDAR (TENTATIVE)

Week 01: Introduction, Smooth Manifolds, Partition of Unity (Warner 1.1–1.3, Hirsch 1.1; Lee *Ch.1–2*).

Week 02: Tangent Vectors and Differentials (Warner 1.4; Lee *Ch.3*). **Monday no class.**

Week 03: Submanifolds, Inverse Function Theorem, and Implicit Function Theorems (Warner 1.5–1.6, Hirsch 1.3; Lee *Ch.7–8*).

Week 04: Vector Bundles, Tangent and Cotangent Bundles (Warner 1.4, Hirsch 1.2, 4.1–4.2; Lee *Ch.4–6*).

Week 05: Vector Fields, Flows, Distributions and Frobenius Theorem (Warner 1.7–1.8; Lee *Ch.4, 17 & 19*).

Week 06: Tensor and Exterior Algebras, Tensor Fields (Warner 2.1–2.2; *Lee Ch.11*). **Monday no class.**

Week 07: Differential Forms, Lie Derivatives and Differential Ideals (Warner 2.2–2.4; *Lee Ch.12, 18 & 19*).

Week 08: Orientation and Integration on Manifolds (Warner 4.1–4.2, Hirsch 4.4; *Lee Ch.13–14*). **Midterm Exam on Friday Mar 7.**

Week 09: Integration on Manifolds and De Rham Cohomology (Warner 4.2–4.3; *Lee Ch.14–15*).

Week 10: **Spring recess. No class.**

Week 11: Morse–Sard Theorem and Transversality (Hirsch 3.1–3.2; *Lee Ch.10*).

Week 12: Tubular Neighbourhood Theorem, Whitney Embedding Theorem (Hirsch 4.5–4.7; *Lee Ch.10*).

Week 13: Degree of Maps, Intersection Number and Euler Characteristic (Hirsch 5.1–5.2; *Lee Ch.18*).

Week 14: De Rham Cohomology and Poincaré Duality (Warner 4.3, Hirsch 5.2; *Lee Ch.15*).

Week 15: Lie Groups, Lie Algebras and Homomorphisms (Warner 3.1–3.3; *Lee Ch.9 & 20*).

Week 16: Topics in Riemannian Geometry.

OTHER POLICIES

Academic Integrity: The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, compromises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university’s mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or “recycle” work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the

course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Disability Services: USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.