

PRELIMINARY SYLLABUS FOR GRADUATE TOPOLOGY 2023-24
GR6307-6308

FRANCESCO LIN

Contact. You can reach me at fl2550@columbia.edu.

Schedule. Monday-Wednesday 4:10-5:25PM in Math 507.

Office hours. After class 5:30-6PM, or by appointment on MWF, in my office Math 613.

Contents. This is the first year graduate level Topology sequence; it will introduce several fundamental techniques in Algebraic and Differential Topology that should be helpful also for those interested in related areas.

Roughly speaking, the main themes of the first semester will be:

- Differential topology
- Homotopy, homology and bordism

while the second semester will cover:

- Spectral sequences
- Characteristic classes and K-theory

When exposing the material we will work out as many concrete examples of the machinery as possible, and try to get a geometric intuition for our calculations. The final part of the second semester will have the style of a topics class.

References. I will post the (handwritten) notes that I use in class. Some useful references for the material we will cover are:

- Bott, Tu - Differential forms in Algebraic topology
- Davis, Kirk - Lecture notes in Algebraic topology
- Fuchs, Fomenko - Homotopical topology
- Hatcher - Algebraic Topology, Vector Bundles and K-theory
- Milnor - Topology from the differentiable viewpoint, Characteristic classes, Morse theory

Prerequisites. Basic notions of differentiable manifolds, commutative algebra of PIDs, fundamental group and covering spaces. Prior exposure to some form of (co)homology would be helpful but not strictly necessary.

Non-GSAS students. Please send me your (unofficial) transcript in order to be approved for the first semester. Provided you perform reasonably well in the Fall semester class, you will be approved for the second semester.

Grading. There will be (roughly) weekly assignments. You are welcome to collaborate with your peers and to come to office hours to ask for hints, but you should write up solutions yourself. Late assignments **will not be accepted under any circumstance**; if you know that you cannot meet a deadline, please let me know in advance. All assignments will be handled through Canvas.

For the Fall semester, there will be an in-class midterm and final exam, with the following weights:

- Homework 50%
- Final 50%

For the Spring semester, there will be an in-class midterm and a final essay-style project (5-10 pages) on some advanced topic of your own choice:

- Homework 50%
- Final 35%
- Essay 15%

I will provide a list of suggested topics mid-semester, but feel free to come up with your own topic.

Students with disabilities. In order to receive disability-related academic accommodations for this course, students must first be registered with their school Disability Services (DS) office.