

**PRELIMINARY SYLLABUS FOR SPRING 2027 MATH GR6308:
ALGEBRAIC TOPOLOGY II**

FRANCESCO LIN

Contacts. You can contact me at fl2550@columbia.edu. My office is Mathematics 613.

Hours and location. MW 2:40-3:55PM location TBA.

My office hours. TBA.

Course Web Page. All class materials will be available on Coursework; all announcements will be made through the platform.

Contents. This is the second part of the Graduate Algebraic Topology sequence. Tentatively, it will consist of the following three parts:

- (1) The Serre spectral sequence and its applications.
- (2) Vector bundles, characteristic classes and K -theory.
- (3) Spin geometry and the Atiyah-Singer index theorem.

While most of the class will follow a traditional advanced algebraic topology sequence style (with a focus on concrete computations), the last part will be more similar in spirit to a topics class.

Assessment. Biweekly homework and final oral examination consisting of a short presentation on an advanced topic and problems regarding parts (1) and (2). I will post a list of suggested topics as the semester progresses.

Prerequisites. MATH GR6307: Algebraic topology I from Fall 2026. The last part of the class will require some basic familiarity in functional analysis and Riemannian geometry.

Materials. I will post the handwritten notes I use in class.

References. We will mostly follow these books:

- Milnor - Characteristic classes.
- Davis, Kirk - Lecture notes in Algebraic topology.
- Fuchs, Fomenko - Homotopical topology.
- Hatcher - Vector bundles and K -theory.
- Roe - Elliptic operators, asymptotic methods and topology.
- Shanahan - The Atiyah-Singer index theorem.