

# MATH 752 – Algebraic Topology

Spring 2024

Hunter College

T 7:30pm-9:20pm HE 921

3.0 hours, 3.0 credits

**Instructor:**

**Email**

**Office:**

**Office Hours:** .

We will be using BlackBoard for this course.

## Course Description:

Here is a brief outline of the topics planned for this course:

- An introduction to general topology
- The fundamental group
- Covering spaces
- Applications of the fundamental group
- Homology groups
- Application: topological robotics
- Application: topological data analysis

## Grading, Homework:

There will be problem sets assigned during the semester, to be handed in. There will be a take-home final exam. The problem sets will count for 80% of the course grade, the final exam will count for 20%. The problem sets will be uploaded to BlackBoard.

## Recommended Texts

Point Set Topology

- Seymour Lipschutz, Schaum's Outlines, General Topology, McGraw-Hill

- Topology A First Course, James R. Munkres, Prentice-Hall

#### Algebraic Topology

- Notes for a first year graduate course in Algebraic Topology, L. Evens, R. Thompson
- Algebraic Topology: An Introduction, W. S. Massey, Springer GTM.
- Algebraic Topology, Allen Hatcher, Cambridge University Press.
- An Introduction to Algebraic Topology, Joseph J. Rotman, Springer-Verlag GTM.

#### Foundations

- Paul R. Halmos, Naive Set Theory, Springer UTM
- S. Mac Lane, Categories for the Working Mathematician, Springer GTM.

**Mode of Instruction:** This is an in-person class. I will be posting occasional video lectures for you to watch.

#### Expected Learning Outcomes:

- You will learn about the basic concept of a topological space, and some of the properties of topological spaces, illustrated by a number of examples.
- You will learn what the fundamental group of a topological space is, and learn some techniques for computing fundamental groups. The student will employ these techniques in a number of examples.
- You will learn what the homology groups of a topological space are, and learn some techniques for computing homology groups. The student will employ these techniques in a number of examples.
- You will learn about an application of algebraic topology to robotics and learn to apply these ideas to several examples.
- You will learn about an application of algebraic topology to data science and read about several examples.

**Prerequisites:** The mathematical background typical for a graduate student in mathematics or an allied field, or an advanced undergraduate student.

**Academic Integrity:** Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The college is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

**Disabilities:** If you have a disability that you believe requires special accommodations: In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical and/ or Learning) consult the Office of AccessABILITY located in Room E1214B to secure necessary academic accommodations. For further information and assistance please call (212- 772- 4857)/TTY (212- 650- 3230).

**Sexual Misconduct.** In compliance with the CUNY Policy on Sexual Misconduct, Hunter College reaffirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationships. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.

a. Sexual Violence: Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444).

b. All Other Forms of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose (jtrose@hunter.cuny.edu or 212-650-3262) or Colleen Barry (colleen.barry@hunter.cuny.edu or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Hunter East 1123.

**Changes:.** Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.