

**UNIVERSITY OF PUERTO RICO
RIO PIEDRAS CAMPUS
DEPARTMENT OF MATHEMATICS**

**ALGEBRAIC TOPOLOGY
PH.D. QUALIFYING EXAM
SYLLABUS**

The Ph.D. qualifying exam in Algebraic Topology is based on a one semester graduate course which includes the fundamental group, covering spaces, and homology groups. For homology theory, the students only need to be familiar with one of the two theories: the simplicial homology or the singular homology, that is, the problems on this topic are designed to be solved by using either one of the two theories. Topics include:

1. Fundamental group: definition and calculation
2. Van Kampen's theorem
3. Covering spaces and lifting of maps
4. Simple calculation of homology group
5. Homotopy invariance of homology group and applications
6. Relative homology group and Mayor-Vietoris sequence

Exam format:

There will normally be six problems in the exam. Each problem is worth 20 points. Only the five best solutions of each student will be counted. The passing score is 60 points or more. There may be more than 6 problems, but only the 5 best solutions will be counted.

References:

1. M.A. Armstrong, *Basic Topology*.
2. J. Munkres, *Elements of Algebraic Topology*. Chapter 1- Chapter 4.
3. A. Hatcher, *Algebraic Topology*. Chapter 1 and 2.
4. M. Greenberg, J. Harper, *Algebraic Topology: A First Course*. Part I and II.