

Spring 2005 Math 74

INTRODUCTION TO ALGEBRAIC TOPOLOGY



Instructor: A. Shumakovitch
Time: MWF 10:00–11:05am. X-hour: Th 12:00–12:50pm
Room: 215 Silsby Hall
Textbook: O. Viro, O. Ivanov, N. Netsvetaev, and V. Kharlamov
Elementary Topology, A First Course: Textbook in Problems
available from <http://www.math.uu.se/~oleg/2topoman.pdf>

Secondary

textbook: Alan Hatcher, *Algebraic Topology*
Cambridge University Press, 2002; also available from
<http://www.math.cornell.edu/~hatcher/AT/ATpage.html>

Tentative syllabus

- I. Fundamental Group and Covering Spaces: homotopy; properties of path multiplication; definition of fundamental group; theorems of path lifting; universal coverings and calculations of fundamental groups.
- II. Fundamental Group and Mappings: induced homomorphisms and their applications (winding number, Borsuk-Ulam Theorem); retraction and fixed points; homotopy equivalence; covering spaces via fundamental groups; hierarchy of coverings.
- III. Cellular Spaces: examples of cellular spaces; fundamental group of a cellular space; Seifert–van Kampen Theorem; one-dimensional homology and cohomology.

If time permits, we can venture into the following subject as well:

- IV. Manifolds and Classification of Surfaces: locally Euclidean spaces and manifolds; isotopy; classification of one-dimensional manifolds; triangulation and handle decomposition; topological classification of compact surfaces.

Prerequisites

The course will require basic knowledge of algebra (group theory) and general topology. In particular, the words “normal subgroup”, “homeomorphism”, “compactness”, “Hausdorff axiom”, “path-connected space”, “quotient topology” etc. should be heard of and be understood. For example, courses Math 31/71 and Math 54 satisfy the prerequisite.