Topology I
Shubham Dwivedi

Humboldt-Universität zu Berlin
Summer Semester 2021

Course description and syllabus

General Information

Instructor: Dr. Shubham Dwivedi (lectures + problem sessions)
HU Institut für Mathematik (Rudower Chaussee 25), Room 1.310
dwivedis@math.hu-berlin.de
Office hour: Friday 10-11 via Zoom

Website: https://www.mathematik.hu-berlin.de/ dwivedis/Topology1SS21

Moodle: https://moodle.hu-berlin.de/course/view.php?id=103749

Lectures: Tuesdays 13:15-14:45 via Zoom
Fridays 11:15-12:45

Problem sessions: Tuesdays 15:15-16:45 via Zoom

The course will be conducted online via Zoom. Links for the Zoom meetings will be made available on the moodle for this course shortly before the start of the semester.

Language: The course is counted as a *BMS Basic Course,* and thus will be offered in English.

Prerequisites: Contents of the HU's courses *Analysis I* and *II*, *Lineare Algebra und Analytische Geometrie I* and *II* and the algebraic content of *Algebra und Funktionentheorie.* Students will be assumed to be comfortable with the theory of metric spaces from first-year analysis and with the basic notions of groups, rings and fields.

Short Description

An introduction to topology with emphasis on geometric applications: metric and topological spaces, separation axioms, compactness and connectedness, the fundamental group, homotopy invariance, Seifert-van Kampen theorem, covering spaces. Introduction to homology theory: topological manifolds, simplicial complexes and triangulations, singular homology, long exact sequences, the Brouwer fixed point theorem, cellular homology.

Syllabus

The course is roughly divided into three units:

(1) General topology (weeks 1-3)
(2) The fundamental group (weeks 4-9)
(3) Homology (weeks 10-14)

More detailed course planning will be announced as the course progresses.

Literature

The course will not follow any particular book. Handwritten lecture notes will be updated on the course website after every class. The general structure for the course and the topics covered within can be found in the following books.

- Jänich, *Topologie*, Springer (online access available via the HU Library)
- Jänich, *Topology*, translated from German by Silvio Levy, Springer (available in the HU Library)
- M. Armstrong, *Basic Topology*, Springer (online access available via the HU Library)
- James Munkres, *Topology*, (available in the HU Library)

The above list will be mainly used for the material covered till week 4/5. For the *algebraic topology* part, following sources will be useful.

- Allen Hatcher, *Algebraic Topology*, Cambridge University Press 2002 (also freely downloadable from the author's webpage)
- Glen Bredon, *Topology and Geometry*, Springer (online access via the HU Library).

Finally, a very useful reference for the course is Prof. Chris Wendl's lecture notes on Topology I from previous years.

Exam and problem sets

Grades in this course will be determined by a **written exam** soon after the end of the semester and the mode of the examination (i.e., electronic or in-person) will be determined in due course, depending on the situation.

Problem sets will be posted on the course website every Tuesday and solutions can be submitted via moodle any time until the following Tuesday. The solutions will be discussed in the problem session.

The problem sets are voluntary, but your scores on these assignments can be used to boost your final exam grade according to the following rule:

- Problem sets $\geq 50\% \implies 2,0 \to 1,7$ or $1,7 \to 1,3$ etc.
- Problem sets $\geq 80\% \implies 2,0 \to 1,3$ or $1,7 \to 1,0$ etc.