UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Topics in Geometry and Topology

2223-1-F4001Q083

Aims

The aim of the course is to take some classic topics in algebraic topology of simplicial complexes, introducing homology theory, cohomology theory and some aspects of homotopy theory, with some recent applications.

Contents

Simplicial complexes, homology and cohomology of polyhedra, triangulable manifolds, homotopy groups, applications to data analysis and dynamical systems.

Detailed program

Fundamental concepts: topological spaces, connectedness, compactness, function spaces, general ideas on Categories, push-out diagrams. Simplicial complexes. Chain complexes. Homology. Axioms for homology. Introduction to homological algebra. Category of polyhedra. Homology of polyhedra. Triangulable manifolds.

Cohomology ring, cap product. Triangulable manifolds. Surfaces and classification. Poincaré Duality. Fundamental group of polyhedra. Fundamental group and homology. Homotopy groups. Obstruction theory. Applications to: computational homology, persistent homology, data analysis and dynamical systems.

Prerequisites

Basic topics covered in bachelor courses of geometry and algebra

Teaching form

Lectures: 8 ECTS credits.

Textbook and teaching resource

Ferrario, Piccinini, "Simplicial structures in topology". CMS Books in Mathematics, Springer, New York, 2011. xvi+243 pp. ISBN: 978-1-4419-7235-4

Semester

1S

Assessment method

Oral examination on the topics covered in the course, with in-depth analyis and re-elaboration of them with a personal perspective. The date and the content of the seminar, which is part of the exam, have to be first discussed with the teacher.

Office hours

By appointment.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | INDUSTRY, INNOVATION AND INFRASTRUCTURE