UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Geometry I

2526-1-E3502Q003

Aims

Give an elementary introduction to geometry and topology.

More specifically, the learning outcomes—according to the Dublin Descriptors—are as follows:

1. **Knowledge and understanding**: Students will acquire a solid foundation in general topology and the geometry of Euclidean and projective spaces. This knowledge will be developed through rigorous theoretical understanding, supported by concrete examples and applications.
2. **Applying knowledge and understanding**: Students will be able to apply the concepts learned to solve topological problems, analyze proofs presented in lectures, and reproduce them. They will refine their ability to recognize and use topological models.
3. **Making judgments**: The course aims to develop students' ability to critically analyze mathematical statements and proofs, assess the validity of a mathematical argument, and independently select appropriate problem-solving methods.
4. **Communication skills**: Students will learn to express mathematical concepts clearly and rigorously, both orally and in writing.
5. **Learning skills**: The course equips students with the tools to pursue further independent study in various areas of mathematics.

Contents

Fundamentals of point-set topology and some aspects of euclidean and projective geometry will be discussed.

Detailed program

Topological spaces and continuous functions. Metric topology. Topological spaces. Basis of a topology. Subsets of a topological space. Continuous functions and homeomorphisms.

Examples of topological spaces. Subspaces. Products. Quotients.

Topological properties. Separation axioms and Hausdorff spaces. Compactness. Completeness and compactness in metric spaces. Connected and path-connected spaces. Locally Euclidean spaces and topological manifolds.

Euclidean and projective spaces. Geometry of euclidean and projective spaces.

Prerequisites

Limits and continuity of real functions. Linear Algebra.

Teaching form

72 hours classroom lectures delivered didactics will be split into: 48 hour theoretical sessions (discussion of relevant results of the theory, examples, and counterexamples), and 24 hours exercises sessions (training how to solve exercises and problems).

Textbook and teaching resource

Textbook:

- E. Sernesi, Geometria, vol. I-II. Bollati-Boringhieri (1989, 1994).
- M. Manetti, Topologia, 2a edizione. Springer-Verlag (2014).

Further readings:

- C. Kosniowski, A first course in algebraic topology. Cambridge University Press (1980).
- J. R. Munkres, Topology, 2nd edition. Prentice Hall (2000).

Semester

Spring.

Assessment method

- The exam is structured into three parts.

Theoretical Test - Answer ten multiple-choice questions. Scoring: 3 points for correct answers, -1 point for incorrect answers, and 0 points for unanswered questions. You pass with at least 15 points.

Written Test - Solve exercises (similar to practice sessions) in 120 minutes. Graded out of 30. You pass with at least 15 points.

The theoretical and written tests are on the same day, back-to-back.

Oral Test -Answer questions on course or exercises topics. To take the oral test, you need at least 15 points both on the theoretical test and the written test. Answers are evaluated for completeness, correctness, rigor, and clarity. The final grade includes the theoretical test score.

- Completing homework can earn bonus points added to the theoretical test score.
- There are exemptions from tests.

Oral Test Exemption - Scores of T and S at least 20 on the theoretical and written tests allow you to skip the oral test. The final grade is the lower of (T+S)/2 or 27. No grade above 27 is possible without the oral test, even if T=S=30.

Theoretical and Written Tests Exemption - Two partial tests during the course, if passed, allow you to take the oral test in one of the first two exam sessions. Each partial test has a theoretical (T1, T2) and written (S1, S2) score. Passing both gives T=T1+T2 and S=S1+S2, like regular session written tests. This exemption is not compatible with the oral test exemption. Failing the oral test or not accepting the grade means retaking the entire exam, including the theoretical and written tests.

- Passing the written test allows you to take the oral test in the same or the next session.

Office hours

By appointment.

Sustainable Development Goals

QUALITY EDUCATION | REDUCED INEQUALITIES