UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Algebraic and Complex Geometry

2526-1-F4002Q009

Aims

- **Knowledge and Understanding** Students will have acquired a solid foundation in the fundamentals of Complex Geometry, particularly Riemann surfaces, complex manifolds, and Kähler metrics. They will understand the connection between complex structures and algebraic-geometric properties.
- **Ability to Apply Knowledge and Understanding** Students will be able to apply the concepts they have learned to concrete examples, verifying the geometric properties of complex manifolds. They will be capable of studying the geometry of Riemann surfaces, analyzing a Kähler metric (including significant examples), and determining whether a complex manifold is algebraic.
- **Independent Judgment** The course aims to develop students' ability to critically analyze and form independent judgments based on the tools they have acquired.
- **Communication Skills** The tools learned will enable students to formulate clear and rigorous arguments—both orally and in writing—to describe the properties of complex manifolds.
- **Learning Skills** The course will provide the theoretical and methodological tools needed to independently pursue advanced studies in Complex and Algebraic Geometry.

Contents

Riemann surfaces, complex manifolds, divisors, line bundles, Kähler metrics.

Detailed program

- Riemann surfaces
- Holomorphic and meromorphic functions
- branched coverings

- Rimann-Hurwitz Thereom
- Holomorphic and meromorphic forms
- Riemann-Roch Theorem
- holomorphic functions in several variables
- complex manifolds
- divisors and line bundles
- blow-up in a point
- Kähler metrics

Prerequisites

Fundamentals of linear and multilinear algebra, general topology, and multivariable differential calculus. Topics from the third-year Complex Analysis course will be useful.

Teaching form

28 2-hour lectures, delivered in-person in a didactic format. In Italian, or english if needed.

Textbook and teaching resource

- P. Griffiths Introduction to Algebraic Curves (AMS)
- Jost, J. Compact Riemann Surfaces (Springer)
- Huybrechts, D. Complex Geometry: an introduction (Springer)

Semester

First semester

Assessment method

The exam will cover the course content, further insights, as well as highlights independent analysis and delivery.

During the oral exam, students may be asked to solve simple exercises relevant to the course program, alongside a discussion of theoretical aspects. The final overall grade, with no separate scores for problem-solving abilities or theoretical knowledge.

Office hours

By appointment

Sustainable Development Goals

QUALITY EDUCATION | REDUCED INEQUALITIES