



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Istituzioni di Matematiche

1920-1-G8501R006

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#### Course title

Foundations of mathematics

#### VERY IMPORTANT

The students of the course Istituzioni di matematiche are subdivided into groups AL (professor Daniela Bertacchi) and MZ (professor Pablo Spiga), according to the initial of the surname. The professor of your group is the one you must refer to for any question.

#### The enrollment password is

mateal for students AL  
matemz for students MZ.

#### Topics and course structure

This course introduces the basic results in arithmetics and in some other number fields. Moreover, we introduce some elements on sets and on functions and in probability theory.

- Elements of set theory: operations among sets.
- Functions, injective, surjective and bijective functions. Infinite sets.
- Binary relations. Equivalence relations and order relations: equivalence classes and partitions.
- The set of natural numbers. Introduction to the natural numbers via the Peano axioms. Sum, product and order in the natural numbers. Induction principle. Representation of natural numbers in base 10 and in other bases.

- The integers. Construction of the integers from the natural numbers. Divisibility: quotient and remainder. Congruences mod  $n$ , and some modular arithmetic. Prime numbers, fundamental theorem of arithmetic. Eratostene's sieve. Greatest common divisor and minimal common multiple via Euclide's algorithm.
- Rational numbers. Construction of the rational numbers from the integers. Elementary properties of rationals: algebraic and topological properties.
- Basic introduction to probability theory. Independent events and conditional probability. Elementary computation of probabilities. A brief introduction to the construction of the real field from the rationals.

## Objectives

At the end of the course the student is familiar with the classical mathematical deduction and with some arguments in logic. Moreover, the student is able to present the basic concept in arithmetic from a university level perspective.

## Methodologies

Lectures 42 hours

Exercise classes in small groups 14 hours (to attend one of these groups, it is compulsory to enrol at the beginning of the semester)

Exercises on interacting online platform.

## Online and offline teaching materials

Books (see bibliography).

Online: a list of exercises to be solved on paper, and interactive exercises on the platform wims.

## Programme and references for attending students

### *PROGRAMME*

Elements of set theory: operations among sets.

Functions, injective, surjective and bijective functions. Infinite sets.

Binary relations. Equivalence relations and order relations: equivalence classes and partitions.

The set of natural numbers. Introduction to the natural numbers via the Peano axioms. Sum, product and order in the natural numbers. Induction principle. Representation of natural numbers in base 10 and in other bases.

The integers. Construction of the integers from the natural numbers. Divisibility: quotient and remainder. Congruences mod  $n$ , and some modular arithmetic. Prime numbers, fundamental theorem of arithmetic.

Eratostene's sieve. Greatest common divisor and minimal common multiple via Euclide's algorithm.

*Textbook*

M. Cazzola, Matematica per scienze della formazione primaria

*Further material*

- S. Di Sieno - S. Levi, *Aritmetica di base*, McGraw-Hill, 2005
- G. Caiati - A. Castellano, *In equilibrio su una linea di numeri*, Mimesis, 2007
- A. Cerasoli, *Io conto*, Feltrinelli, 2010
- A. Cerasoli, *Sono il numero 1*, Feltrinelli, 2008
- P. Cereda et al, *L'aritmetica del Pirata Newton*, Mimesis, 2010
- P. Cereda – G.Dimitolo, *La ciurma del Pirata Newton*, Mimesis, 2008
- H. M. Enzensberger, *Il mago dei numeri*, Einaudi

## **Programme and references for non-attending students**

As for attending students

## **Assessment methods**

## **Office hours**

Office hours by appointment (send an email to your professor):

students AL: Daniela Bertacchi [daniela.bertacchi@unimib.it](mailto:daniela.bertacchi@unimib.it)

students MZ: Pablo Spiga [pablo.spiga@unimib.it](mailto:pablo.spiga@unimib.it)

## **Programme validity**

One year.

## **Course tutors and assistants**

Marco Daneluzzo

Maurizio Dini

Domenico Iannizzi

Paola Riva

Claudio Vailati

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