



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Mathematical Analysis II

2324-2-E3001Q040

---

#### Aims

The course has the following targets:

1. Knowledge of the course topics: differential and integral calculus in several variables, curves and surfaces, differential forms, sequences and series of functions, ordinary differential equations, metric and functional spaces
2. Development of criticism;
3. Problem solving.

#### Contents

Differential calculus in several variables, integral calculus in several variables, sequences and series of functions, curves and surfaces, differential forms, ordinary differential equations, metric and functional spaces.

#### Detailed program

- Metric spaces: metrics, neighborhoods, open and closed sets, topology associated to a metric space, density, continuity, completeness and compactness.
- Normed spaces: definition of norm, Banach spaces.
- Differential calculus in several variables: partial derivatives, differentiable functions, chain rule, higher order derivatives, Taylor's formula, maxima and minima of functions of several variables.
- Integral calculus in several variables: Lebesgue integral, integrability of continuous functions, evaluation of multiple integrals by repeated lower dimensional integration, change of variables, polar coordinates in 2 and 3 dimensions, application to area and volume.

- Curves, surfaces, differential forms: curves and surfaces, length of curves, area of surfaces, Implicit Function Theorem, constrained minimization, Lagrange multipliers, differential forms, closed and exact differential forms, Gauss-Green's Theorem, Stokes' Theorem.
- Sequences and series of functions: metric and normed spaces, Cauchy sequences, point-wise and uniform convergence of sequences and series of functions, completeness of the space of continuous functions with the uniform norm, power series, Fourier series.
- Ordinary differential equations: the Cauchy problem, reduction of an equation of order  $n$  to a system of  $n$  equations of the first order, the Banach Contraction Theorem and the existence/uniqueness of solutions to differential equations, linear differential equations, first order equations, separation of variables, linear and exact equations. Linear systems. Linear systems with constant coefficients, the exponential of a linear transformation, linear differential equations of higher order with constant coefficients. Maximal solutions. Qualitative study of solutions.

## Prerequisites

The contents of the Mathematics courses of the first year are required.

## Teaching form

- Lessons (64 hours)
- Tutorials (48 hours)

## Textbook and teaching resource

- E. Giusti: *Analisi matematica 2*, terza edizione, Bollati Boringhieri.

### Other books:

- P. Marcellini, C. Sbordone: *Esercitazioni di Matematica*, secondo volume, parte prima e seconda.
- N. Fusco, P. Marcellini, C. Sbordone: *Analisi Matematica due*, Liguori Editore.
- E. Giusti: *Esercizi e complementi di analisi matematica 2*, Bollati Boringhieri.
- G. De Marco: *Analisi Due*, Zanichelli Decibel.
- G. De Marco, C. Mariconda: *Esercizi di Analisi Due*, Zanichelli Decibel.
- C. D. Pagani, S. Salsa: *Analisi matematica 2*, Zanichelli.
- V. Barutello, M. Conti, D.L. Ferrario, S. Terracini, G. Verzini: *Analisi 1 e 2*. Apogeo.

## Semester

Second year, first semester.

## Assessment method

The exam consists of a written part (mandatory) and of an oral one (optional). The written exam is divided into two parts.

1. **Multiple choice test:** 15 multiple choice questions. The evaluation is done by assigning the following scores: +3 for a right answer, ?1 for a wrong answer, 0 for a question left unanswered. The grade will then be rescaled on a scale of thirty points. The minimum threshold for passing this test is 15/30 points. Duration: 30 minutes.
2. **Open-ended test** (exercises and theoretical questions): exercises such as those carried out in class, or of a different type, and answers to theoretical questions. The minimum threshold for passing this test is 15/30 points. Duration: 120 minutes.

The overall grade of the two written tests is obtained by calculating the weighted sum, with weights 3 and 6 respectively, of the marks of the two tests.

Further information on the tests, details and timetable of the tests can be found in the *e-learning* space of the course.

## Office hours

By appointment.

## Sustainable Development Goals

---