UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematical Analysis II

2627-2-E3502Q007

Aims

The aim of this course is twofold:

- to illustrate the main results concerning the differential and integral calculus for functions of several variables, the ordinary differential equations and the basic concepts concerning normed spaces;
- to illustrate the main techniques necessary to solve problems concerning the topics above.

Dublin Descriptors – Mathematical Analysis II (Bachelor's Degree in Mathematics)

1. Knowledge and understanding
The student will acquire fundamental knowledge of advanced Mathematical Analysis, with a particular focus on:
-sequences and series of functions;
-differential and integral calculus for functions of several real variables;
-ordinary differential equations;
-introductory elements of normed spaces.
These topics broaden and consolidate the foundations laid in the Mathematical Analysis I course, and provide a solid theoretical and conceptual base for more advanced mathematical studies.

2. Applying knowledge and understanding
The student will be able to apply theoretical knowledge to concrete problems, developing technical and operational skills such as:
-analyzing convergence of series and sequences of functions using appropriate criteria;
-computing derivatives and multiple integrals;
-solving ordinary differential equations;
-applying concepts from normed spaces in basic contexts.

3. Making judgements
The course aims to foster independent and critical thinking, especially in the context of abstract concepts, through:
-identifying the logical structure of mathematical problems;

-choosing appropriate analytical tools to solve them;
-interpreting and validating results with rigor.

4. Communication skills
Students will be encouraged to clearly articulate complex mathematical arguments using:
-formal mathematical language;
-logical and coherent exposition;
-the ability to explain concepts to both specialist and, when needed, non-specialist audiences.

5. Learning skills
The course will strengthen the student's ability to learn independently and continuously by providing:
-theoretical and methodological tools for reading advanced texts;
-skills necessary to approach more specialized courses in analysis and other areas of mathematics;
-familiarity with formalization and abstraction, essential for mathematical reasoning and research.

Contents

Sequences and series of functions; power series and Taylor series.
Metrics and norms on the Euclidean space and on some infinte dimensional vector spaces.
Differential calculus for functions of several variables.
Integration of bounded functions on bounded sets in Rn.
Ordinary differential equations.

Detailed program

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Prerequisites

Most of the topics covered in the courses Analisi I, Algebra lineare e geometria and Geometria are prerequites. Specifically the student should:

- be able to quickly draw the graph of a "simple" function of one variable, to compute limits and to study the convergence of numerical series;
- be able to compute "simple" integrals of functions of one variable;
- know the difference between a linear operator acting on the Euclidean space and the matrix that represents it;
- know the basics of topology (topology, neighbourhoods, connectedness, compactness, continuous functions);
- know the concept of metric space and the characterisation of compactness in metric spaces;
- be able to deal with scalar products, orthogonal bases, Euclidean space and lines, planes, and hyperplanes.

Teaching form

Lectures (32, two hours each, 64 ore, 8 CFU) and exercises classes (24, two hours each, 48 ore, 4 CFU) in presence. Language: Italian.

There will be also tutorials.

Textbook and teaching resource

Notes of the lectures and list of exercises will be made available on this page.

Useful references in Italian:

- E. Acerbi e G. Buttazzo, Secondo corso di Analisi matematica, Pitagora ed., Bologna, 2016.
- A. Bacciotti e F. Ricci, Lezioni di Analisi Matematica 2, Ed. Levrotto & Bella /Torino.
- E. Giusti, Analisi Matematica II, ed. Bollati Boringhieri.
- C. Pagani; S. Salsa, Analisi Matematica 1, Ed. Zanichelli (per la parte relativa al calcolo differenziabile in più variabili).
- C. Pagani; S. Salsa, Analisi Matematica 2, Ed. Zanichelli (per la parte rimanente del programma).

Useful references in English:

- W. Rudin, Principles of Mathematical Analysis, MacGraw-Hill.
- R.S. Strichartz, The Way of Analysis, revised Ed., Jones and Bartlett Publishers, Sudbury, Massachusetts, 2000.
- T. Tao, Analysis II, Texts and Readings in Mathematics, Volume 38, Third Ed., Springer Verlag, 2016.

Additional exercises with solutions:

- S. Salsa e A. Squellati. Esercizi di Analisi matematica 2, Ed Zanichelli, 2024.

Semester

First semester

Assessment method

Written and oral examinations. Details will be made available in due course.

Office hours

Upon appointment

Sustainable Development Goals

QUALITY EDUCATION