UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Advanced Calculus - 2

2526-2-E1802M118-E1802M130M-T2

Learning objectives

The course aims to foster a critical understanding of mathematical concepts, helping students recognize and use formal tools in their education, particularly with a view to applications in economics, statistics, and finance. The teaching provides the fundamental notions of linear algebra, sequences and numerical series, and integral calculus, presenting them as useful tools to analyze and interpret phenomena related to economics and business management. The theoretical part will be accompanied by classroom exercises, with the goal of supporting the development of an independent method for solving problems.

At the end of the course, students will:

1. Knowledge and comprehension
   Have acquired a solid understanding of the main topics covered and will be able to effectively apply mathematical methods to solve problems and exercises consistent with the course program;

2. Ability to apply knowledge and understanding
   Be able to model real situations, especially in economic, financial, and social contexts, using symbolic language and mathematical formalism;

3. Autonomy of judgment
   Possess logical and analytical tools useful for tackling complex problems, including interdisciplinary ones;

4. Communication skills
   Use clear and rigorous mathematical language that allows them to express acquired knowledge precisely and coherently;

5. Learning skills
   Have developed autonomous learning abilities, useful to approach more advanced subsequent studies with greater awareness.

Contents

Sequences and series, linear algebra, integrals.

Detailed program

1. **Sequences and series.** Sequences, the concept of series, convergence and necessary condition for convergence, series with non-negative terms, harmonic series, geometric series, alternating series, telescoping series, absolute convergence.

2. **Linear algebra.** Matrices, matrix operations, determinant, inverse matrix, rank, systems of linear equations, Rouché-Capelli theorem, Cramer's rule.

3. **Integrals.** Riemann integral, properties, mean value theorem and fundamental theorem of calculus, indefinite integral, integration rules, improper integrals and convergence criteria.

Prerequisites

Starting from the 2024–2025 cohort, the course Matematica Generale per la Gestione Aziendale is a prerequisite for the Metodi Matematici course and, consequently, for the Matematica Generale II module.

For previous cohorts, the course Metodi Quantitativi per l'Amministrazione delle Imprese (Matematica Generale I + Statistica I) is a prerequisite for the Metodi Matematici course and, consequently, for the Matematica Generale II module.

Teaching methods

The course is structured into lectures, exercises, and tutoring sessions in preparation for the exam.
The course will be delivered primarily in person. Part of the teaching (up to 30% of the hours) may be conducted remotely. Remote sessions will be communicated by the instructor with adequate advance notice and may be delivered via live streaming or asynchronously.

A hybrid teaching approach is employed, combining expository teaching (ET) and interactive teaching (IT). ET includes the presentation and detailed explanation of theoretical content, which usually takes place during the first part of the lesson. IT involves active student participation through responses to questions and problems posed by the instructor, brief interventions, group discussions, and is typically carried out during the second part of the lesson. It is not possible to precisely determine in advance the number of hours dedicated to ET and IT, as these modes dynamically intertwine to adapt to the needs of the course and promote participatory and integrated learning, combining theory and practice.

Specifically:

28 hours of lectures will be conducted using the hybrid approach described above.

12 hours of exercises will be carried out in an interactive mode.

Assessment methods

A **mandatory written exam** that can be taken in two ways: either two partial tests or a single comprehensive test. Both types of written exams include theoretical open-ended questions and problems/exercises.

An **oral exam** in the following cases:

1. Student summoned by the instructor;

2. Student who requests to take the oral exam (a minimum score of 18/30 on the written exam is required);

3. Confirmation of honors (cum laude) awarded in the final evaluation of the Mathematical Methods course.

All students taking the oral exam will receive a second grade during the oral session, which will be averaged arithmetically with the written exam grade. Therefore, in the overall evaluation of written and oral exams, the written exam score may increase or decrease. If the average of the written and oral exams is below 18, the student is considered to have failed and must retake the written exam. Under no circumstances will the same written exam score be valid for more than one oral exam attempt.

In both types of exams, the formal correctness of the steps, the adequacy of the mathematical language used, and the skills and knowledge acquired during the course will be assessed.

Textbooks and Reading Materials

Textbook:

Matematica 4/Ed.
Angelo Guerraggio
ISBN Cartaceo: 9788891931870 – ISBN Digitale: 9788891931887
https://he.pearson.it/bundle/521?isbn=9788891931887

Additional reference texts (optional):

Sequences, Series, and Integrals, Modular Manual of Mathematical Methods, vol. 5, edited by Giovanna Carcano, Giappichelli Editions, Turin;

Linear Algebra, Modular Manual of Mathematical Methods, vol. 4, edited by Maria Ida Bertocchi, Giappichelli Editions, Turin.

Additional teaching materials:
Slides and lecture notes provided by the instructors (available on the e-learning platform).

Semester

First semester

Teaching language

Italian

Sustainable Development Goals

QUALITY EDUCATION | GENDER EQUALITY | DECENT WORK AND ECONOMIC GROWTH