UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Advanced Calculus - 1

2526-2-E1802M118-E1802M130M-T1

Learning objectives

The aim of this course is to stimulate critical understanding of mathematical concepts, helping the students to recognize and use formal tools, having in mind in particular applications in economics, statistics and finance. The teaching provides the basic tools and concepts of sequences and series, linear algebra and integrals, presenting them as tools for analyzing and interpreting phenomena related to economics and business management.

Theory is flanked by exercises, with the aim to develop an autonomous method in solving problems.

At the end of the course:

1. **Knowledge and understanding:** students will have developed a solid understanding of the main concepts and will be able to apply successfully mathematical methods in order to solve problems and exercises consistent with the program of the course.
2. **Ability to apply knowledge and understanding:** students will be able to model real situations, mainly in economic, financial and social context, employing symbolic language and mathematical formalism.
3. **Independent judgment:** students will be provided with logical and analytical instruments to address complex problems, also in interdisciplinary areas.
4. **Communication skills:** students will be able to use a clear and rigorous mathematical language, so that they can express with precision and consistency the acquired knowledge.
5. **Learning ability:** students will have developed a good autonomy in learning the subject, useful to address with increased awareness more advanced studies.

Contents

Sequences and series, linear algebra and integrals.

Detailed program

1. **Sequences and series:** sequences, concept of series, convergence and necessary condition for convergence, series with nonnegative terms, harmonic series, geometric series, alternating series, telescoping series, absolute convergence.
2. **Linear algebra:** matrices, operations with matrices, determinant, inverse matrix, rank, systems of linear equations, Gaussian method, Rouché-Capelli theorem.
3. **Integrals:** Riemann integral, properties, mean value theorem and fundamental theorem of calculus, indefinite integral, integration rules, generalized integrals and criteria of convergence.

Prerequisites

The course "Matematica Generale I" (part of the course "Metodi Quantitativi per l'Amministrazione delle Imprese") is a prerequisite for the course of "Matematica Finanziaria" for students enrolled from 2024/2025.

The course "Metodi Quantitativi per l'Amministrazione delle Imprese" (formed by "Matematica Generale I" and "Statistica I") is a prerequisite for the course of "Matematica Finanziaria" for students enrolled before 2024/2025.

Teaching methods

The teaching method is based on lectures, exercises and tutoring in preparation for the exam.
Lectures will take place mainly in presence.

Assessment methods

The final assessment will be carried out with a **compulsory written exam**, either divided into two parts or in one unique exam.
The written exam is formed by exercises and theory questions.

There may be an **oral examination** in the following three cases:

1. exam requested by the professor
2. exam requested by the student
3. exam in order to have 30 cum laude

The exam evaluates the formal correctness of the passages, the adequacy of the mathematical language adopted, the skills
and knowledge acquired during the course.

Textbooks and Reading Materials

-“Successioni, serie e integrali”, Manuale modulare di Metodi Matematici, vol. 5, a cura di Giovanna Carcano, edizioni Giappichelli Torino

-“Algebra lineare”, Manuale modulare di Metodi Matematici, vol. 4, a cura di Maria Ida Bertocchi, edizioni Giappichelli Torino

Semester

First semester.

Teaching language

Italian.

Sustainable Development Goals

QUALITY EDUCATION