UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Analisi Matematica

2526-1-E3102Q100

Aims

Learning Objectives

Knowledge and Understanding
The student will acquire knowledge of the fundamental concepts of Mathematical Analysis for real functions of a single variable, developed with appropriate logical-deductive rigor. The theoretical foundations of differential and integral calculus, limits, sequences, and series will be understood.

Applying Knowledge and Understanding
The student will be able to apply the acquired knowledge to solve exercises and elementary mathematical problems, developing suitable techniques and problem-solving strategies.

Making Judgements
The student will develop the ability to critically analyze the concepts learned and independently assess the correctness and logical consistency of definitions, theorems, and solution methods.

Communication Skills
The student will acquire the ability to clearly and rigorously present theoretical content, correctly using mathematical and formal logic language, both in written form and, if required, orally.

Learning Skills
The course will provide the student with the conceptual and methodological tools needed to successfully tackle subsequent courses involving this area of mathematics. It will foster the development of a learning approach based on deep understanding, logical reasoning, and thoughtful practice of exercises.

Contents

Real numbers. Sequences and infinite series. Differential and integral calculus in one variable.

Detailed program

Preliminaries
The field of real numbers
Supremum and infimum
Elementary functions
General properties of functions
Real functions of a single variable

Sequences
Concept of limit for real sequences
Theorems on limits
Principle of mathematical induction
Recursively defined sequences
Standard limits

Numerical Series
Concept of series, convergence, absolute convergence
Series with positive terms
Series with terms of variable sign

Limits and Continuity
Concept of limit for functions
Theorems on limits
Continuous functions
Global properties of continuous functions

Differential Calculus
Derivatives of a function
Theorems for differentiable functions
Convex and concave functions
Taylor's formula
Function graphs

Integral Calculus
Riemann integrable functions
Properties of the Riemann integral
Fundamental theorem of calculus and indefinite integrals
Integration methods

Prerequisites

Elementary algebra: symbolic algebra, equations and inequations of first and second degree; elementary trigonometry; logarithm and exponential.

Teaching form

48 hours of lectures delivered in a traditional, in-person format (6 ECTS credits)
20 hours of in-person exercise sessions delivered in a traditional format (2 ECTS credits)

The course is taught in Italian.

Textbook and teaching resource

A. Albanese, A. Leaci, D. Pallara, Appunti del corso di Analisi Matematica I

Additional bibliographic references:
A. Guerraggio, Matematica, Pearson

For the exercises:

- The material available on the course's e-learning page
- G. Monti, A. Peretti, R. Pini, Esercizi di Matematica, LED
- G. Catino, F. Punzo, Esercizi Svolti di Analisi Matematica e Geometria 1, Esculapio
- M. Ghisi, M. Gobbino, Esercizi di Analisi Matematica I. Parte A e parte B, Esculapio

Semester

First year, first semester

Assessment method

A midterm exam divided into two parts reserved for first-year students is scheduled.

In both the written exam and the (optional) oral exam, the following will be assessed: knowledge of methodologies, logical rigor, and the ability to explain results using appropriate terminology.

Evaluation of the exams (written and oral) will primarily consider the knowledge of the required topics and the rigor of reasoning.

Exam modality: written exam – optional oral exam

Midterm Exam
The maximum score for each part of the midterm exam is 15 out of 30. The exam consists of two parts:

The first part consists of 4 multiple-choice questions (simple exercises and short theoretical questions). Each answer is worth:
1.5 points if correct,
-0.5 points if incorrect,
0 points if not answered.
At least two answers among the multiple-choice questions must be correct; otherwise, the second part will not be

graded, and the exam will be considered failed.

The second part consists of written exercises, preceded by a theoretical question where the student is asked, for example, to provide complete definitions, theorem statements, and relevant examples.

If the student obtains a total score of at least 9, they may take the second partial exam (under the same format as the midterm), which will be held on the same day as the first written exam. If they also score at least 9 in the second partial exam, the written exam will be considered passed, with a final grade equal to the sum of the two partial scores.

Written Exam
The maximum score for the written exam is 30 out of 30. The exam consists of two parts:

The first part consists of 8 multiple-choice questions (simple exercises and short theoretical questions). Each answer is worth:
1.5 points if correct,
-0.5 points if incorrect,
0 points if not answered.

The second part consists of written exercises, preceded by a theoretical question where the student is asked, for example, to provide complete definitions, theorem statements, and relevant examples.

**If the score of the first part is less than 6, the second part will not be graded, and the student must retake the written exam in a subsequent session.
**
The final score of the written exam is calculated by adding the points from both parts.

Students who score 18 out of 30 or higher on the written exam may either accept and record the grade or choose to take the oral exam.

Oral Exam
Students who scored 18 out of 30 or higher in the written exam may still take the oral exam. They may be asked to state definitions, theorems, and provide simple proofs, according to the exam syllabus that will be published on the e-learning platform at the end of the course.

The final grade may be higher, equal to, or lower than the written exam grade.

1. A midterm exam divided into two parts *reserved for first-year students* is scheduled.
2. In both written and (optional) oral exams will be judged: the knowledge of the techniques shown during the course, the accuracy of the line of thinking, the ability to illustrate the results of the course.
3. The evaluation of both written and oral exams will take into account mainly of the knowledge of the subjects and the accuracy of the line of thinking.

Examination type: written examination (oral examination optional)

Intermediate written part

The intermediate written part is divided in two:

first part: 4 multiple choice questions (simple theoretical and practical exercises). Each answer: 1.5 points, if correct, -0.5 points, if wrong, 0 points, if not given. At least two multiple choice questions must be correctly answered (otherwise it is failed)

second part: exercises, together with a theoretical question (the student is asked to provide, for instance, definitions, statements of theorems, examples).

If the total score is no less than 9, the student can take the second part that will be delivered, with the same rules, at the same time of the first written exam. If the score of the second part is no less than 9, the final grade is the sum of the grades of the two parts.

Written part: maximum mark 30/30. The written part is divided in two:

first part: 8 multiple choice questions (simple theoretical and practical exercises). Each answer: 1.5 points, if correct, -0.5 points, if wrong, 0 points, if not given.

scond part: exercises, together with a theoretical question (the student is asked to provide, for instance, definitions, statements of theorems, examples).

If the total score of the first part is less than 6, the second part is not corrected and the student must repeat the written part of the exam.

The final mark of the written part is obtained by adding the mark of the first and the second part.

If the mark of the written part is more than, or equal to 18, the student can conclude the exam with the mark of the written part, without undergoing an oral exam, or, else, undergo an oral examination.

Oral part: If the mark of the written part is more than, or equal to 18, the student may as well decide to undergo the oral exam (this choice must be communicated in due time). The student will be asked to provide definitions, statements of theorems, simple proof according to the exam schedule.

The final mark can be greater, equal or lower than the mark of the written part.

Office hours

By appointment.

Sustainable Development Goals