UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Analisi III

1920-3-E3501Q056

Aims

The course aims at providing the knowledge about the fundamental concepts and statements of advanced mathematical analysis. It will also build the skills needed to understand and use the most important proving arguments and techniques in the theory and the ability to solve exercises and deal with problems exploiting them.

Contents

Banach Spaces. Lp spaces. Hilbert spaces. Fourier series. Baire's Theorem. Open mapping Theorem. Banach Steinhaus Theorem. Hahn Banach Theorem. Dual space. weak convergence.

Detailed program

Definition of Banach space. Examples.

Definition of L ^ p (X, ?), ? positive measure.

Holder and Minkowski inequalities.

Completeness of L ^ p (X, ?).

Inclusions of spaces L ^ p (X, ?), finite ?.

Inclusions of spaces L ^ p (Z).

Relations between pointwise convergence, convergence in Lp, and in measure.

Density of Cc (Rn), Coo (Rn) and of the Schwartz space in L p (Rn).

Duality of Lp spaces (only statement).

Hilbert spaces.

Inner product.

Cauchy-Schwarz Inequality.

Hilbert space.

Points of minimum distance from a closed convex.

Projection theorem.

Bessel inequality.

Complete orthonormal systems.

Parseval formula.

Gramschmidt process.

Fourier series for functions on the thorus

Dirichlet kernel.

Convergence in L2.

Pointwise convergence.

Linear operators between normed vector spaces.

Dual space.

Baire's theorem.

The Banach-Steinhaus Theorem.

Divergence of the Fourier series.

Open Mapping Theorem.

Closed Graph Theorem.

Non surjectivity of the Fourier transform from L 1 (T) into c_0 (Z).

The Hahn-Banach Theorem. Weak convergence.

Prerequisites

Elementary topology. Linear Algebra. Differential calculus to one and more variables. Integral calculus. Measure theory. Complex numbers.

Teaching form

Lectures in the classroom, divided into: theoretical lessons in which the knowledge about definitions, results and relevant examples is given and other lessons in which students solve exercises at the blackboard showing their abilities to use the previous notions to deal with analitical problems.

Textbook and teaching resource

W. Rudin "Real and Complex Analysis"

H. Brezis "Analyse fonctionelle. Théorie et applications"

Notes

Semester

Second semester

Assessment method

Written and oral exam.

During the course students are invited to perform exercises (previously assigned) on the blackboard . For each exercise performed on the blackboard, a point is awarded (for a maximum of 3) which is then added to the written score.

Written exam

The written exam consists of exercises aimed at verifying the understanding of the course contents, the ability to apply the learning demonstration technique, the exposition clarity . Each exercise will be given a maximum partial score, due to its difficulty and length. In the evaluation of the student a score will be assigned based on the accuracy, completeness, rigor, clarity and organic nature of the performance. The maximum grade for the written exam is 33.
The proposed exercises are in line with those carried out during the lessons.

The student is admitted to the oral exam with an evaluation of at least 16 (before adding the points for the exposition on the blackboard).

The oral exam consists in a discussion of the written exam and in theoretical questions (definitions and theorems with proofs). In the oral exam the knowledge and understanding of the course content will be evaluated, as well as the ability to organize a coherent and punctual exhibition in a lucid, effective and well-structured manner.

The final grade is given by the average of the grade of the written exam (including points for the resolution of exercises on the balckboard) and the grade of the oral test.

Office hours

By appointment.