UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics II

2627-1-ESM02Q005

Aims

The aim of the course is to provide the student with a second course in basic mathematics. The course introduces differential and integral calculus in several variables and some basic notions of linear algebra.

The expected learning outcomes include:

Knowledge and understanding of the definitions and fundamental statements and some significant demonstrations.

Applying knowledge and understanding: students, in addition to understanding the theory, must be able to illustrate it through meaningful examples and solve a wide range of exercises related to them.

Communication skills and learning ability: students must be able to organically expose, with clarity and precision, the theoretical results learned. The course also aims to provide students with sufficient autonomy to be able to read scientific texts that make use of vector calculus.

Contents

Differential and integral calculus for functions of several variables.

Detailed program

Elements of linear algebra. Vectors and geometry in the Euclidean space. Lines and planes. Matrices. Determinant. Linear systems: Cramer's rule. Quadratic forms.

Functions of several variables. Limits and continuity. Partial derivatives. Differentiability, tangent planes and linear approximations. Directional derivatives and gradient. Regular curves. The chain rule. Surfaces and level curves. Taylor's formula. Maxima, minima, and saddle points. Constraints and Lagrange multipliers. The implicit function theorem.

Integral calculus for functions of severable variables. Jordan measure. Multiple integrals. Iterated integrals. Reduction of multiple integrals: cross section and shadow methods. Change of variables in multiple integrals.

Vector Analysis. Lenght of a curve and line integrals of first kind. Vector fields and line integrals of second kind. Surface area and surface integrals of first and second kind. Green's formula. Conservative vector fields. Curl. Solenoidal vector fields. Stokes and Gauss-Ostrogradski theorems.

Prerequisites

The course of Mathematics I

Teaching form

42 hours of in-person, lecture-based teaching (6 ECTS)
24 hours of in-person, lecture-based exercises classes (2 ECTS)

Course delivered in Italian

Textbook and teaching resource

1. Lecture notes.

2. James Stewart: Multivariable Calcululs.

Semester

Second semester

Assessment method

Written and oral examination. Usually the written examination consists in the solution of 5 problems: two problems of differential calculus and three problems of integral calculus. The minimum grade to pass to the oral part is 15/30. The oral examination can be performed in the same session of the written part, as well as in the subsequent session.
During the course there will be two partial written exams. The first one is focused on the differential calculus and

consists of 3 exercises: one exercise is about the study of critical points of a function of two variables and the remaining ones require the study of absolute maxima and minima, also in the presence of constraints. The second partial exam, scheduled after the end of the course, is mainly focused on integral calculus and consists of 3 exercises: one exercise requires the computation of a double or triple integral using standard techniques (reduction to repeated integrals, change of variables), one exercise is about vector fields (line integrals, computation of the potential of conservative vector fields, etc), one exercise is about classical formulas of vector calculus (Green, Stokes and Gauss). Passing these tests is equivalent to passing the written exam with a grade equal to the average of the grades (at least 15/30 for each test). Those who pass the partial exams should take the oral exam within the last session of the year (2025). The oral exam is based on the lectures notes of the course.

Office hours

By appointment.

Sustainable Development Goals

QUALITY EDUCATION