UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics II

2021-1-E2702Q075

Aims

To describe the simplest characteristics of functions of several variables and their use and operations most useful in applications

Knowledge and understanding
After the class the student knows:
- the main definitions related to linear systems and to the methods to treat them
- the definitions of continuity, differentiability and stationary points for functions of several variables and the main criteria to find and characterize the stationary points
- the definition of line integrals and the definition and properties of conservative vector field
- the main types of ordinary differential equations

Applying knowledge and understanding
After the class the student is able to:
- study linear systems with m equations and n unknown, homogeneous and inhomogeneous; he/she is able to study existence and uniqueness of solutions and to write explicitely the solutions whenever possible
- to study points of maximum, minimum, or saddle points of functions of two variables
- to compute line integrals and to establish if a vector field is conservative or not
- solve simple examples of first order equations and of linear second order equations

Making judgements
To be able to find the most suitable methods to treat the various proposed problems

Communication skills
To describe in written form as clearly as possible and in synthetic and precise form the goals, procedure and results of the mathematical techniques learned

Learning skills
To apply the learned knowledges to different applied contexts and to further deepen the topics treated by means of new bibliographical tools

Contents

Elements of linear algebra. General characteristics of fucntions of several variables. Partial differentiation. Optimization. Free extremes. Constrained extremes (Lagrange multiplier method). Vector fields and integration along curves. Elementary differential equations.

Detailed program

Vectors: algebraic and geometric. Main operations with vectors: sum, multiplications with scalars, scalar product and metric properties. Cartesian coordinates, lines and planes in three and higher dimensional space.

Vector spaces in general. Vector subspaces. Linear dependence and linear independence of vectors. Dimension of a vector space. Matrices and linear operators. Kernel and range of linear transformation. Inverse and transpose. Determinants. Rank of a matrix. Applications to systems of linear equations. Cramer theorem. Eigenvalues and eigenvectors.

Differential calculus for functions of two and several variables. Graph of a functions, domain, limits and continuity. Partial derivatives and differentiability. Geometric interpretation. Taylor formula. Optimization. Free and constrained extrema.

Curves in R^n, line integrals, vector fields and differential forms. Irrotational vectro fields and their meaning.

Differential equations. Main properties and integration techniques for first order equations and linear second order equations with constant coefficients.

Prerequisites

Mathematics I

Teaching form

Lectures and exercises sessions

During the possible Covid-19 emergencies teaching will be held in a blended way: partial presence and videoregistered lectures (asyncronous or syncronous when possible).

Textbook and teaching resource

Main text:

Marco Bramanti, Carlo D. Pagani, Sandro Salsa

"Matematica. Calcolo infinitesimale e Algebra lineare", Editore Zanichelli

Corresponding exercises:

M.Bramanti, Esercizi di Calcolo infinitesimale e Algebra lineare,

Editore Esculapio

Further material will be provided by the instructor during the lectures

Other text:

A. Guerraggio “Matematica per le Scienze”, Editore Pearson
J. Stewart, “Calcolo: Funzioni di più variabili”, Editore Apogeo
M. Bertsch, R. Dal Passo, L. Giacomelli “Analisi Matematica” Editore McGraw-Hill

Semester

II semester 2020-2021

Assessment method

Written examination with optional oral colloquium. Intermediate written exams will be proposed. Students are not committed to do them, but in case they do they are allowed to skip the final complete written examination. The goal of the evaluation (partial, complete and oral colloquium) is to ascertain a correct assimilation of concepts and techniques studied during lessons and exercises sessions. In particular, to have a correct assessment, in evaluating the written examination completeness, accuracy and clarity will be taken into account.

During the possible Covid-19 emergencies oral exams will be online and not in presence. They will be held using the WebEx platform and in the e-learning page of the course there will appear a public link to allow participation of virtual attendants.

Office hours

By appointment