



**Code: MAT/05**

**Credits: 6**

**Matter: Calculus II**

**Main language of instruction: Italian**

**Other language of instruction: English**

## Teaching Staff

### Head instructor

**Prof.DANIELE D'ANGELI - daniele.dangeli@unicusano.it**

**Introduction** *The course of Calculus II is the natural extension of the concepts learned in the course of Calculus I. A large part of the program, in fact, consists in the extension to the multidimensional case of concepts already known to students, such as the study of maxima and minima of a function or the computation of definite integrals. In addition to the study of curves and surfaces and the relative curvilinear and surface integrals, a part of the course is dedicated to the study of ordinary differential equations, fundamental in the continuation of the course of study.*

**Objectives** *Objective of the course : The course has the following educational objectives:* • Familiarity with the functions of several real variables, relative differential calculus and search for maxima and minima • Solving differential equations • Computation of multiple integrals and curvilinear integrals • Understanding of the series of Functions • Ability in understanding and solving exercises

**Competencies:** *Calculus I exam is a prerequisite for this course II. Furthermore, it is necessary that the student who approaches the preparation of this subject has a good knowledge of some topics such as:* • notions of topology on the real line; • knowledge of elementary functions (polynomials, exponentials, logarithms and trigonometric functions); • study of functions of a real variable; • rules of derivation and integration of real variable functions; • numerical series.



## **Syllabus**

### *1. Programme of the course:*

*Sequences and series of functions - Module 1 - - Sequences of functions, punctual and uniform convergence. Function series. Power series. Taylor series. Fourier series. Convergence theorems.*

*Functions of several variables - Module 2 - commitment of about 30 hours: Recalls of topology in, spherical neighborhoods, internal, external and boundary points, open and closed sets, isolated and accumulation points, bounded and connected sets for polygons. Functions, definitions, domain and range and level sets. Limits and continuity of functions of several variables: definition of limit and theorems on the properties of limits, continuity. Bounded functions, Weierstrass theorem and intermediate values. Uniform continuity and Cantor's theorem. partial derivatives, gradient and differentiability. Properties of differentiable functions. Differential theorem and theorems on differential calculus. Tangent plane. Schwarz's theorem. Taylor's formula for functions of several variables. Search for maxima and minima for functions of two variables, changes of coordinates, bound extremes and Lagrange multipliers.*

*Ordinary differential equations - Module 3 - commitment of about 25 hours: definition of differential equation, Cauchy problem, lemmas and theorems of local and global existence and of existence and uniqueness of solutions. Linear differential equations. Integration of some types of differential equations (with constant coefficients, with separable variables, homogeneous and Bernoulli equation).*

*Multiple integrals - Module 4 - commitment of about 20 hours: integrable functions according to Riemann and properties of the integral. Curves and curvilinear integrals, surface integrals.*

*Vector fields and differential forms - Module 5 - commitment of about 25 hours, weeks 8-10: Vector fields, divergence, rotor, potential. Flow of a vector field. Divergence theorem and GaussGreen and Stokes theorems. Closed differential forms and summer.*

*+ 5 etivities*

## **Evaluation system and criteria**

*The written exam consists of 6 exercises. The exam contains 28 points. The student can choose whether to take the exam in full or to divide it into two separate tests, according to the modalities that will be foreseen.*

*The electronic exam consists of a single-choice test consisting of 6 single-answer questions. The student can choose whether to take the exam in full or to divide it into two separate tests, according to the modalities that will be foreseen. The*



*evaluation of the Etivity from 0 to 3 points (each etivity 0.6 points), is carried out, in itinere, during the duration of the course.*

**Bibliography and resources**

*Professor's notes +*

*R.A. Adams and C. Essex Calculus: a complete course*