Mathematical analysis D

Finalità
The course provides the basic notion of calculus for functions of one complex variable and of ordinary differential equations.

Programma
Complex numbers.
Algebra of complex numbers. Topology of the complex plane. Sequences and series of complex numbers. Limits and continuity for functions of one complex variable. Complex paths and integration. Complex exponential and trigonometric functions. Euler's formula.

Holomorphic functions.
Basic properties. Cauchy-Riemann equations.

Sequences and series of functions.
Pointwise and uniform convergence. Weierstrass's M-test. Power series: Abel's lemma and radius of convergence, Cauchy-Hadamard's formula, differentiation and integration of power series.

Cauchy theorem.
Index of a path. Cauchy's theorem. Cauchy's formula and applications: power series representation, Cauchy estimates, Liouville's theorem and the fundamental theorem of algebra.

Singularities.
Classification of singularities. Laurent series. Residue Theorem and applications.

Ordinary differential equations.
Definiton and examples. Local existence and uniqueness. Maximal and global solutions. Solving special class of scalar ode's: linear, separation of variables, Bernoulli's equations.

Linear systems of ode's.
Fundamental system of solutions. Wronski matrix. Lagrange's variation of constants. Linear algebra: semisimple and nihilpotent matrices, Jordan's canonical form. Exponential matrix. Linear ode's of higher order.

Attività d'esercitazione
An exercise course takes place.

Modalità d'esame
Final written and oral exams take place.

Testi consigliati
Lecture notes and material taken from the following textbooks:
G. C. Barozzi: Matematica per l'ingegneria dell'informazione, Zanichelli, Bologna, 2001;
J. B. Conway: Functions of one complex variable, Graduate Text in Mathematics n.11, Springer-Verlag, New York, 1978;
M. W. Hirsch - S. Smale: Differential equations, dynamical systems, and linear algebra, Academic Press, New York, 1974;
C. D. Pagani - S. Salsa: Analisi matematica vol.2, Masson, Milano, 1991.