UNIVERSITÀ DI PAVIA

Anno Accademico 2018/2019

MATHEMATICAL ANALYSIS 3

Enrollment year	2017/2018
Academic year	2018/2019
Regulations	DM270
Academic discipline	MAT/05 (MATHEMATICAL ANALYSIS)
Department	DEPARTMENT OF MATHEMATICS "FELICE CASORATI"
Course	MATHEMATICS
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	1st semester (01/10/2018 - 18/01/2019)
ECTS	9
Lesson hours	84 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	SCHIMPERNA GIULIO FERNANDO (titolare) - 9 ECTS
Prerequisites	In order to follow this course with the due preparation it is necessary to have acquired the basic competences resulting from the courses of the first year, in particular: differential and integral calculus for scalar and vector functions, matrices and linear transformations, sequences and series, power series, complex numbers, differential forms, polar coordinates.
Learning outcomes	Learn the basic results and techniques of the theory of ordinary differential equations and dynamical systems. Be able to apply the methods of the ODE theory to study simple real-world applications and physical models. Acquire skill in manipulation and transforms of complex numbers and understand the first but deep results of complex function theory. Learn the main integration techniques based on the Residue theorem.
Course contents	The course is divided into two parts: the first one is devoted to the

	theory of ordinary differential equations and systems, with an introduction to the study of dynamical systems. The second part is an introduction to the theory of functions of one complex variable. Extended summary Models and examples of ODE's. General results concerning existence, uniqueness, comparison and stability for Cauchy problems. Elementary techniques for solving simple differential equations. Cauchy-Peano's theorem (existence without uniqueness). Linear systems of ODE's: general results and structure, exponential matrix. Asymptotic behaviour of dynamical systems, stability (linearisation and Lyapunov method). Examples of complex functions. Differentiability. Power series and contour integrals. Holomorphic functions. Cauchy's theorem. Singularities, Laurent expansion and residues. Cauchy theorem. Application to the evaluation of integrals. Analytic extension. Argument principle. Open mapping theorem. Further geometrical properties of holomorphic functions.
Teaching methods	Lectures and exercise sessions. The two parts of the course (1 - ordinary differential equationa and 2 - complex analysis) will proceed in parallel (generally 2 or 3 hours per week will be devoted to complex anlysis and the remaining ones to differential equations). The exercises sessions will be scheduled at the end of each part of the the theory.
Reccomended or required readings	M. W. Hirsch, S. Smale, R. L. Devaney: Differential equations, dynamical systems, and an introduction to chaos. Pure and Applied Mathematics, Vol. 60. Elsevier/Academic Press, Amsterdam, 2004. S. Salsa, A. Squellati: Esercizi di analisi matematica 2. Masson, 1994. G. Gilardi, Analisi Matematica 3, McGraw- Hill Italia. Lecture notes will be also provided.
Assessment methods	Written and oral test. The written test will be constituted by a number of exercises. Some of the exercises will have a theoretical character (proofs of simple properties or construction of examples or counterexamples); other ones will be aimed at verifying the acquisition of the basic computational techniques developed in the course (explicit resolution of differential equations or calculus of some integral by complex variable methods). The oral exam will be aimed at verifying the comprehension of the main results of the theory and the capacity to illustrate them by means of concrete examples.
Further information	Written and oral test. The written test will be constituted by a number of exercises. Some of the exercises will have a theoretical character (proofs of simple

	properties or construction of examples or counterexamples); other ones will be aimed at verifying the acquisition of the basic computational techniques developed in the course (explicit resolution of differential equations or calculus of some integral by complex variable methods). The oral exam will be aimed at verifying the comprehension of the main results of the theory and the capacity to illustrate them by means of concrete examples.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile