UNIVERSITÀ DI PAVIA

Anno Accademico 2018/2019

FUNCTIONAL ANALYSIS	
Enrollment year	2018/2019
Academic year	2018/2019
Regulations	DM270
Academic discipline	MAT/05 (MATHEMATICAL ANALYSIS)
Department	DEPARTMENT OF PHYSICS
Course	
Curriculum	Fisica teorica
Year of study	1°
Period	1st semester (01/10/2018 - 18/01/2019)
ECTS	9
Lesson hours	78 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	MORA MARIA GIOVANNA (titolare) - 9 ECTS
Prerequisites	Multivariable differential and integral calculus. Lebesgue measure and integration. Basic notions of linear algebra and topology.
Learning outcomes	At the end of the course students will know the main results and principles of abstract Functional Analysis. Through the exercise sessions students will learn how to apply the theoretical results to explicit problems. Moreover, they will be able to work autonomously on the formulation and the analysis of problems of Mathematical Analysis in spaces of infinite dimension.
Course contents	Norms and scalar products. Normed spaces. Bounded linear operators. Topological dual space. Banach spaces. Hahn-Banach Theorem: analytical and geometrical forms and their consequences. Baire Lemma. Banach-Steinhaus Theorem. Open Mapping Theorem, Closed Graph Theorem, and their

	consequences. Weak* topology, weak topology, and their properties. Banach-Alaoglu Theorem. Reflexive spaces. Separable spaces. L^p spaces. Reflexivity and separability of L^p. Riesz Representation Theorem. Approximation by convolution. Ascoli-Arzelà Theorem. Fréchet-Kolmogorov Theorem. Hilbert spaces. Projection on a convex closed set. Riesz Representation Theorem for the dual space. Lax-Milgram Theorem. Complete orthonormal systems. Compact operators. Adjoint of a bounded operator. The Fredholm Alternative. Spectrum of a compact operator. Spectral decomposition of a compact self-adjoint operator. Integral operators. Application to Sturm-Liouville problems.
Teaching methods	Lectures and exercise sessions. Exercises will be assigned to students a few days in advance, before being discussed in the exercise session. Lecture notes will be provided on the KIRO webpage.
Reccomended or required readings	H. Brézis: Functional analysis, Sobolev spaces and partial differential equations. Springer, 2011. W. Rudin: Real and complex Analysis. McGraw-Hill, 1987.
Assessment methods	The exam consists into a written test and an oral exam. In the written test students will be asked to solve some exercises and to present the statement and proof of a theorem. Students will be admitted to the oral exam only if they obtain a score of at least 15/30 in their written test. The oral exam will concern results, proofs, examples discussed in the course.
Further information	The exam consists into a written test and an oral exam. In the written test students will be asked to solve some exercises and to present the statement and proof of a theorem. Students will be admitted to the oral exam only if they obtain a score of at least 15/30 in their written test. The oral exam will concern results, proofs, examples discussed in the course.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile