UNIVERSITÀ DI PAVIA

Anno Accademico 2017/2018

FUNCTIONAL ANALYSIS

Enrollment year	2017/2018
Academic year	2017/2018
Regulations	DM270
Academic discipline	MAT/05 (MATHEMATICAL ANALYSIS)
Department	DEPARTMENT OF MATHEMATICS "FELICE CASORATI"
Course	MATHEMATICS
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	1st semester (02/10/2017 - 13/01/2018)
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.
Learning outcomes	The aim of the course is to introduce the appropriate tools to formulate problems of Mathematical Analysis in spaces of infinite dimension. The fundamental results of Functional Analysis will be discussed, with a focus on the theory of Banach and Hilbert spaces.
Course contents	Norms and scalar products. Topological vector spaces. 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. Elementary properties. 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. Stampacchia Theorem. 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
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	Written and oral exam
Further information	Written and oral exam
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile