# . - Elements of Higher Analysis

## Prof. Marco Squassina

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

Deliver the basic notions of functional analysis.

At the end of the course, students will possess a rudimentary knowledge of the classical results of Hilbert, Banach, L^p and linear operators.

***COURSE CONTENT***

- Lebesgue spaces. Completeness. The density of continuous functions with compact support. Regularisation by convolution. Compactness. Continuous and periodic functions, the density of trigonometric polynomials.

- Hilbert spaces. Projection over a closed convex set. Characterisation of the topological dual. Complete orthonormal systems. Example in the Lebesgue space of square summable functions.

- Banach spaces. Hahn-Banach theorems, Banach-Steinhaus and open mapping theorems.

- Bounded operators. Compact operators. Riesz-Fredholm theory. Spectrum and resolvent. Spectral properties of compact operators.

Spectral decomposition for compact and normal operators.

***READING LIST***

M. C. Abbati & R. Cirelli, *Metodi matematici per la fisica: operatori lineari negli spazi di Hilbert,* Città Studi Edizioni, Milan, 1997.

H. Brezis, *Analisi funzionale – Teoria e applicazioni,* Liguori, Naples, 1986.

M. Reed & B. Simon, *Methods of modern mathematical physics. I. Functional analysis,*

Academic Press, New York-London, 1980.

W. Rudin, *Analisi reale e complessa,* Boringhieri, Turin, 1974.

Course packs on the various course topics will also be distributed.

***TEACHING METHOD***

Lectures.

***ASSESSMENT METHOD AND CRITERIA***

Oral and written examinations. The written examination will consist of some exercises by which students should show that the basic notions of the theory have been acquired.

The oral examination aims at checking the level of understanding of the basic concepts and procedures that are taught in the course through discussion of some parts of the syllabus, possibly including related background material.

***NOTES AND PREREQUISITES***

The prerequisite is knowledge of basic analysis.

*Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.*