

Math 502
Analysis II
SPRING 2010

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About the course: This is an introductory course on "Functional Analysis". I will not use any particular text-book but the material I want to cover is quite standard and there are many well written books available, for example in SU library.

Prerequisites:

Introductory course on mathematical analysis; Metric space theory; Linear Algebra and familiarity with the theory of measure and Lebesgue integration.

Tentative list of topics to be covered

Prologue: Topological Spaces, Hausdorff Spaces, Separability, Convergence: Nets and Filterbases, Compactness, The space $C(X)$, Topologies in function spaces.

- Topological structures on finite dimensional vector spaces compatible with the algebraic structure.
- Seminorms, poly-(semi)normed spaces; Subspaces and Quotient spaces; Convexity, Boundedness; Ways of generating norms on vector spaces; Inner products; Convex sets \leftrightarrow Minkowski functionals \leftrightarrow Seminorms ; Hahn-Banach theorem-first version; Bounded linear operators; Dual spaces; Completion of normed spaces; Banach spaces ; Hilbert spaces: Orthogonality, Orthogonal complements/projections, Minimizing vectors, Examples

- Baire category theorem and the basic principles of linear functional analysis; Open mapping theorem, Closed graph theorem, Banach-Steinhaus theorem (Uniform Boundedness Principle), Alaoglu theorem

- Convexity: Hahn-Banach theorem-second version; Separation of convex sets; Weak topologies revisited ; Compact convex sets ; Krein-Milman theorem, Kakutani fixed point theorem. Some applications

IF TIME PERMITS

- Hilbert Spaces revisited: Orthogonal bases; Operators and their adjoints; Compact

Operators; Spectral theory of compact self adjoint operators. Examples/Applications

Resources:

E. Kreyszig, *Introductory Functional Analysis with Applications* John Wiley

& Sons, Inc. 1978

M. Schencher, *Principles of Functional Analysis* Graduate studies in mathematics
Volume 36 AMS 2002

W. Rudin, *Functional Analysis* McGraw-Hill, Inc. New York. 1973

T. Terzioglu, *Fonksiyonel analizin yöntemleri* Matematik Vakfı, Ankara 1998.

Grading: There will be weekly assignments. Grading will be based on these assignments and a final exam.