

Curriculum MAT 232 (Spring 2018)

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Functional Analysis

Reference book: W. Cheney, Analysis for Applied Mathematics, Springer Verlag, 2001.

Lecture Structure

1. Banach spaces (Chapter 1)
 - Normed spaces (Sect. 1.1).
 - Completeness, Banach spaces (Sect. 1.2).
 - Continuous functions, contractions (Sect. 1.3), Banach fix point theorem. Applications (Sect. 4.2).
 - Compactness and finite dimensional spaces (Sect. 1.4).
 - Linear and continuous functions (Sect. 1.5). Applications (Sect. 4.3).
 - Zorn's lemma, Hamel bases and the Hahn-Banach theorem (Sect. 1.6). Quotient spaces.
 - The interior mapping and closed mapping theorems (Sect. 1.7).
 - Baire theorem and uniform boundedness (Sect. 1.8)
 - Weak convergence (Sect. 1.9).
 - Reflexive spaces (Sect. 1.10).
2. Hilbert spaces (Chapter 2)
 - Geometry (Sect. 2.1).
 - Orthogonality and Bases (Sect. 2.2).
 - Linear and continuous functions (Sect. 2.3).
 - Spectral theory (Sect. 2.4).
3. Numerical methods (Sections 4.1-4.5)
 - Discretization (Sect. 4.1).
 - Projections and projection methods (Sect. 4.4).
 - Galerkin method (Sect. 4.5).
4. Additional topics (Sections 5.1, 6.8, 7.1 and 7.4)
 - Distributions.
 - Sobolev spaces.
 - Fixed point theorems.
 - Arzela-Ascoli theorems.