

Department of Mathematics

Faculty of Science

MATH 734 (206734) Function Analysis

3(3-0-6)

Prerequisite Consent of the instructor

Course Description

Normed spaces and Banach spaces. Inner product spaces. Hilbert spaces. Representation of functional on Hilbert spaces. Hahn-Banach theorem. Uniform boundedness theorem. Open mapping theorem. Closed graph theorem. Spectral theory of linear operators in normed spaces.

Objectives

1. To provide basic knowledge in functional analysis.
2. To provide relevant materials for students who are interested in doing research in functional analysis

Course Contents

No.of Lecture Hours.

1. Normed Spaces and Banach Spaces	10
1.1 Normed Space and Banach Space.	
1.2 Finite dimensional normed spaces and subspaces.	
1.3 Compactness and finite dimension.	
1.4 Bounded and continuous linear operators.	
1.5 Linear operators and functionals on finite dimensional spaces	
1.6 Normed spaces of operators and dual space.	
2. Inner Product Spaces and Hilbert Spaces.	12
2.1 Inner product spaces and Hilbert Spaces.	
2.2 Orthogonal complements and direct sums.	
2.3 Orthonormal sets and sequences.	
2.4 Representation of functional on Hilbert spaces.	
2.5 Hilbert-adjoint operator, self-adjoint, unitary and normal operators.	
3. Fundamental Theorems for Normed and Banach Spaces.	12
3.1 Hahn-Banach theorem for complex vector spaces and normed spaces.	
3.2 Adjoint operator.	
3.3 Reflexive spaces.	

3.4 Uniform boundedness theorem and Banach Steinhaus theorem.	
3.5 Strong and weak convergence.	
3.6 Convergence of sequence of operators and functionals.	
3.7 Application to summability of sequences.	
3.8 Open mapping theorem.	
3.9 Closed linear operators and closed graph theorem.	
4. Spectral Theory of Linear Operators in Normed Spaces.	11
4.1 Spectral theory in finite dimensional normed spaces.	
4.2 Spectral properties of bounded linear operators.	
4.3 Further properties of resolvent and spectrum.	
4.4 Spectral theorem for Hermitian operators.	
4.5 Spectral theorem for normal operators.	
4.6 Resolvent and spectrum in Banach algebras.	
Total	45