

Devi Ahilya University, Indore, India Institute of Engineering & Technology			MSc – II Year (Applied Mathematics) with Specialization in Computing & Informatics Semester- IV				
Subject Code & Name	Instructions Hours per Week			Credits			
AM4PC3: Functional Analysis	L	T	P	L	T	P	Total
	3	1	-	3	1	-	4
Duration of Theory Paper: 3 Hours							

Learning Objectives:

- To study certain topological-algebraical structures and the methods by which the knowledge of these methods can be applied to analytic problems.
- The objectives of the course is the study of the main properties of bounded operators between Banach and Hilbert spaces, the basic results associated to different types of convergences in normed spaces and the spectral theorem and some of its applications.

Prerequisites: Set theory, algebra of functions.

COURSE OF CONTENTS

UNIT I

Linear Space, Normed linear spaces, Quotient norm spaces, linear transformation, Banach spaces, continuous linear transformations, bounded linear transformation, Linear Functional, Riesz lemma.

UNIT II

Conjugate space, Hahn-Banach theorem and its consequences, the natural embedding of the normed linear space in its second conjugate space, open mapping theorem, closed graph theorem, conjugate of an operator, uniform boundedness principle.

UNIT III

Inner product space, definition and examples of a Hilbert space, simple properties, orthogonal sets, orthonormal sets, Bessel inequality, conjugate space, Riesz representation theorem.

UNIT IV

Adjoint operator, self adjoint operators, Normal and unitary operators, Projections, Eigen values and eigenvectors of an operator on a Hilbert space, determinants and spectrum of an operator, spectral theorem on a finite dimensional Hilbert space.

UNIT V

Definition and example of Algebra, Banach Algebra, sub algebra, Normed Algebra, Regular and Singular elements and their properties, Spectrum, Spectral radius, Commutative Banach algebra, Involution in Banach algebra, Gelfand-Neumark representation theorem.

Learning Outcomes:

Upon completing the course, students will be able to:

- To learn to recognize the fundamental properties of normed spaces and of the transformations between them.
- Understand the notions of dot product and Hilbert space and apply the spectral theorem to the resolution of integral equations.
- Correlate Functional Analysis to problems arising in Partial Differential Equations, Measure Theory and other branches of Mathematics.

BOOKS RECOMMENDED:

- [1] E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons, 1989.
- [2] George F. Simmons, Introduction to topology and modern analysis, McGraw Hill Book Company Inc., 1963.
- [3] B. Chaudhary, S. Nanda, Functional Analysis with applications, Wiley Eastern Ltd., 1989.
- [4] H.L. Royden, Real Analysis, Macmillan Publishing Co. Inc. New York, 4th Edition, 1993.
- [5] Walter Rudin, Functional Analysis, McGraw-Hill Publishing Co., 1973.
- [6] H.K. Pathak, Functional Analysis with applications, Shiksha Sahitya Prakashan, 3rd Edition, 2013.