MAT 613 – Functional Analysis

Course Code & Number	Course Name	Credit Hours	Lec.	Lab.	Tut.	Prerequisites
MAT 613	Functional Analysis	4	3	0	1	

Syllabus:

Normed and Banach Spaces: Review of metric spaces, Completeness and Compactness, Normed spaces, Banach spaces, Embedding of a normed space in a Banach space, Equivalence of norms on finite dimensional normed spaces, Closeness and compactness in finite Banach spaces, Functional on normed spaces and the dual spaces, The normed space of linear operators. Sublinear and subadditive functional, The Hahn-Banach Theorem (Real and Complex) and its Corollaries, The separability theorem, Baire's category theorem , The uniform boundedness theorem, The open mapping theorem, Close graph theorem, The closed linear operator Theorem.

Hilbert spaces: Inner product and Hilbert spaces and their properties, Schwarz and triangle inequalities, Embedding of an inner Space in a Hilbert space, Subspaces of Hilbert spaces, Orthogonal complements and direct sums , The null space lemma , Orthonormal sets and sequences, Bessel inequality, Total sets and Total Orthonormal sets, Separable Hilbert spaces, Isomorphic property of the dimension, Functional on Hilbert spaces and Riesz's theorem, Hilbert's adjoint operator and its properties, Self-adjoint, unitary and normal operators.

Weak convergence and Sobolev spaces: weak convergence, weak derivatives, The Sobolev Space H^1, density of smooth functions, traces, Green's formula, H_0^1 space, imbedding theorems.

References:

1. E. Kreyszig; ***Introductory Functional Analysis***; 1st Edition, Wiley, 1989. **(Main Reference)**
2. J. P. Aubin; ***Applied Functional Analysis***; Wiley-Interscience, 2000.
3. J. Oden and, L. Demkowicz; ***Applied Functional Analysis***; 2nd Edition, Chapman & Hall, 2009.
4. Y. Eidelman, V. Milman and A. Tsolomitis; ***Functional Analysis: An Introduction***; 1st Edition, American Mathematical Society, 2004.