

PM 4006 : Functional Analysis (80L, 4C)

Syllabus :

Complete metric spaces: Contraction mapping theorem and Baire's category theorem. Normed linear spaces: Finite and infinite dimensional spaces, convergence, completeness and compactness; Linear operators and bounded linear operators; Uniform boundedness theorem; Hahn Banach theorem (without proof); Compact linear operators, linear functionals and bounded linear functionals; Generalized functions, dual spaces, weak convergence; Spaces of bounded linear operators and bounded linear functionals; Convergence. Inner product spaces: Inner products and properties; Orthogonal complements, direct sums, orthogonal sets and sequences. Hilbert spaces: Properties, closest point theorem and applications; Bounded linear operators and bounded linear functionals on Hilbert spaces; Riesz representation theorem and Lax-Milligram theorem (without proofs); Adjoint, self adjoint, unitary and normal operators. Applications: Differential equations, optimization, approximation theory, etc.

Suggested Textbooks:

Real & Complex Analysis by Walter Rudin (Chapters 3,4, and 5)

Functional Analysis by Walter Rudin (Selected topics from chapters 2,3,4,10,11, and 12)

Assessment : End of semester examination and 5-6 homework sets.