Functional Analysis - Video course

COURSE OUTLINE

It is a first level course on Functional Analysis. The motto is to familiarize the students with basic concepts, principles and methods of Functional analysis and its applications.

CONTENTS : Metric spaces with example, Complete metric spaces , Separable Metric Space , Compact sets, Normed & Banach spaces , Convergence , Bounded linear functionals and operators , Dual spaces , Refexive Spaces,Adjoint Operator, Inner Product Space and Hilbert Spaces with example, Projection theorem , Orthonormal sets and sequences ,Total Orthonormal Sets , Riesz Representation theorem, Self adjoint, Unitary and Normal operators, Hilbert -Adjoint Operator,The Hahn Banach Extension theorem, Uniform boundedness theorem (The Banach Steinhaus theorem), Open mapping theorem and Closed graph theorem .

COURSE DETAIL

Module No.	Topic/s	Lectures
1	**Metric Spaces** 1. Metric spaces with examples 2. Holder inequality & Minkowski inequality 3. Various concepts in a metric space 4. Separable metric space with examples 5. Convergence, Cauchy sequence , Completeness 6. Examples of Complete & Incomplete metric spaces 7. Completion of Metric spaces +Tutorial 8. Vector spaces with examples	2
2	**Normed / Banach Spaces** 9. Normed Spaces with examples 10. Banach Spaces & Schauder Basis 11. Finite Dimensional Normed Spaces & Subspaces 12. Compactness of Metric/Normed spaces 13. Linear Operators-definition & examples 14. Bounded linear operators in a Normed Space 15. Bounded linear Functionals in a Normed space 16. Concept of Algebraic Dual & Reflexive space 17. Dual Basis & Algebraic Reflexive Space	10

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Mathematics

Pre-requisites:

Calculus & Linear Algebra

Additional Reading:

1. Yosida, K.- Functional analysis, Springer
2. Wilansky, A.-Functional Analysis,Blaisdell Pub. Co.,London

Coordinators:

Prof. P.D. Srivastava
Department of MathematicsIIT Kharagpur

	18. Dual spaces with examples 19. Tutorial 20. Tutorial	
3	**Inner-Product Space & Hilbert Space** 21. Inner Product & Hilbert space 22. Further properties of Inner product spaces 23. Projection Theorem & Orthonormal Sets & Sequences 24. Representation of functionals on a Hilbert Spaces 25. Hilbert Adjoint Operator 26. Self Adjoint, Unitary & normal Operators 27. Tutorial 28. Annihilator in an IPS 29. Total Orthonormal Sets & Sequences	15
4	**Fundamental Theorems for Normed & Banach Spaces** 30. Partially Ordered Set & Zorn's Lemma 31. Hahn Banach Theorem for Real Vector Spaces 32. Hahn Banach Theorem for Complex V.S. & Normed Spaces 33. Baire's Category & Uniform Boundedness Theorems 34. Open Mapping Theorem 35. Closed Graph Theorem 36. Adjoint Operator 37. Strong & Weak Convergence 38. Convergence of Sequence of Operators & Functionals 39. Tutorial 40. Banach Fixed Point Theorem	5
5	**Questions & Worked out answers** 41. Problems on Metric Spaces 42. Problems on Normed & Banach Spaces 43. Problems on IPS & Hilbert Spaces ** Assignment Sheet & Cumulative Question Papers	8

References:

1. Erwin Kreyszig : - Introdutory Functional Analysis with Applications , John Wiley& Sons, New York

2. W.Rudin :- Functional Analysis , Tata McGraw-Hill Pub.Co.
3. I.J.Maddox :- Elements of Functional Analysis, Cambridge university Press
4. B.Limaye :- Functional Analysis , New age international Ltd,pub.