Lecture Plan

Name of the college: Government College of Arts, Science and Commerce, Sanquelim - Goa

Name of Faculty: Mr. Vishal Vinayak Gawas	**Subject: Functional Analysis**	
Paper code: MAT 507	**Program: MSc**	**Division:**
Academic year: 2024 - 2025	**Semester: II**	**Total Lectures: 60**

Course Objectives:

Starting with the basics this course will cover the foundations of Functional Analysis such as normed spaces, inner product spaces, Banach spaces, Hilbert spaces, bounded linear operators and bounded functional, and the four fundamental theorems: Hahn-Banach Theorem, Uniform Boundedness Principle, Open

Mapping Theorem and Closed Graph Theorem.

Expected Course Outcome:

1. Un derstand the basic concepts and fundamental theorems of Functional Analysis

2. Appreciate Functional Analysis as an important field for application oriented Mathematics.

Student Learning Outcome: On completion of the course the student will have

- Understanding of the basic concepts and fundamental theorems of Functional Analysis
- Appreciation of Functional Analysis as an important field for application oriented Mathematics.
- Ability to relate and apply the concepts learnt in the course to problems.

• Foundation for higher courses in Functional analysis, Operator Theory, PDE etc.							
Month	**Lecture From**	**Lecture To**	**No. of lectures allotted**	**Topic, Subtopic to be covered**	**Exercise/ Assignment**	**ICT Tools**	**Reference books**
December	**Week 1** **04/12/24**	**07/12/24**	04	Definition of the standard sequence spaces: s, c, c_0, c_{00}, l^p, standard function spaces C[a,b] and B[a,b]			Introductory Functional Analysis with Applications, Ervin Kreyszig,
December	**Week 2** **09/12/24**	**14/12/24**	04	Completeness properties of these standard spaces			
December	**Week 3** **16/12/24**	**21/12/24**	04 Liberation Day	Separability properties of these standard spaces			
January	**Week 4** **02/01/25**	**04/01/25**	04	Normed spaces- Properties and Banach spaces, Standard normed spaces –Sequence spaces, Function spaces and subspaces			Introductory Functional Analysis with Applications, Ervin Kreyszig,

January	**Week 5** **06/01/25**	**11/01/25**	04	Finite dimensional normed spaces and subspaces, Equivalence of norms, Compactness, and finite dimension,			
January	**Week 6** **13/01/25**	**18/01/25**	04	Linear Operators Boundedness and Continuity. Linear functional. Normed spaces of Operators			
January	**Week 7** **20/01/25**	**25/01/25**	04	Dual space-Algebraic and Topological duals. Inner Product Spaces- Properties			
January-February	**Week 8** **27/01/25**	**01/02/25**	04	Hilbert spaces, Orthogonal Complement and Direct Sums			Introductory Functional Analysis with Applications, Ervin Kreyszig,
February	**Week 9** **03/02/25**	**08/02/25**	04	Orthonormal Sets and Sequences Total Orthonormal Sets and Sequences			

February	**Week 10** **10/02/25**	**15/02/25**	04	Representation of Functional on Hilbert Spaces, Hilbert -Adjoint Operator, Self Adjoint, Unitary and Normal Operators			
February	**Week 11** **17/02/25**	**22/02/25**	04	Hahn-Banach Theorem **(**Statements and idea of proof for the case of vector spaces, statement and proof for normed spaces**),** Applications to Existence of Functionals			
February -March	**Week 12** **24/02/25**	**01/03/25**	04	Adjoint Operators			
March	**Week 13** **03/03/25**	**08/03/25**	04	Reflexivity of Spaces, Baire Category Theorem **(**Statement only**)**, Uniform Boundedness Theorem			Introductory Functional Analysis with Applications, Ervin Kreyszig
March	**Week 14** **10/03/25**	**15/03/25**	04 Holi	Open Mapping Theorem, Closed Graph Theorem.			

March	**Week 15** **17/03/25**	**22/03/25**	04	Revision			
March	**Week 16** **24/03/25**	**29/03/25**	04	Revision			
March-April	**Week 17** **31/03/25**	**05/04/25**	04 Gudi Padva, Id				

*** Assessment Rubrics**

Component	Max Marks
ISA 1	20
ISA 2	20
ISA 3	20
Practical	-
Project	-
Semester End Exam	40