

Lecture Plan

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

Name of Faculty: Brian D'Souza

Subject: Mathematics

Paper code: MAT-5001 Advanced Linear Algebra

Program: M.Sc. Mathematics

Division: -

Academic year: 2026-27

Semester: I

Total Lectures: 60

Course Objectives:

1. Understand fundamental concepts in Linear Algebra.
2. Work with linear functionals, dual spaces, annihilators, and transpose of linear transformations.
3. Study eigenvalues, eigenvectors, and invariant subspaces.
4. Understand the significance and compute rational and Jordan canonical forms.
5. Decomposition of vector spaces.

Expected Course Outcome:

- 1) Display familiarity and knowledge of Vector Spaces, Linear Transformations and associated concepts.
- 2) Demonstrate proofs to establish truths related to Vector Spaces, Linear Transformations and associated concepts.
- 3) Choose the appropriate procedures and modify them if needed to solve method-based problems in Linear Algebra.
- 4) Analyze and solve unseen problems in Linear Algebra and invent mathematically precise arguments to justify their solutions.
- 5) Prove various results in Riemann integration.
- 6) Analyze and compare various number theoretic functions.
- 7) Examine the convergence of improper integrals.

Student Learning Outcome: Student will be able to

- 1) Have a skill of proving theorems specifically in Linear Algebra, including results on linear functionals, canonical forms, and invariant subspaces.
- 2) Apply the theory of canonical forms to decompose and analyze linear transformations on vector spaces.

3) Apply the theory of Riemann integration in evaluating integrals.

Month	Lecture From	Lecture To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/ Assignment	ICT Tools	Reference books
June	22/06/2026	27/06/2026	4	Review: Systems of linear equations; Vector spaces; Basis and Dimension		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
	29/06/2026	04/07/2026	4	Linear Transformations; Matrix of a Linear Transformation		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
	06/07/2026	11/07/2026	2	Polynomial Algebra; Polynomial Ideals; Greatest Common Divisors of Polynomials and Prime Factorization of Polynomials		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
July	13/07/2026	18/07/2026	4	Linear Functionals on Vector Spaces; Dual of Vector Spaces and its Properties		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
	20/07/2026	25/07/2026	4	Double Dual; Annihilator		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
Jul/Aug	27/07/2026	01/08/2026	4	The Transpose of a Linear Transformation and the Matrix		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear

							Algebra, PHI, 2nd Ed., 1997.
August	03/08/2026	08/08/2026	4	Row Rank equal to Column Rank		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
	10/08/2026	15/08/2026	4	Characteristic Values and Characteristic Vectors; Characteristic Spaces		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
	17/08/2026	22/08/2026	4	Annihilating Polynomials; Invariant Subspaces		Smart Board, PPT	S. Kumaresan, Linear Algebra, PHI, 2000.
	24/08/2026	29/08/2026	4	Simultaneous Triangulation; Simultaneous Diagonalization		Smart Board, PPT	S. Kumaresan, Linear Algebra, PHI, 2000.
August/Sep t	31/08/2026	05/09/2026	4	Direct Sum Decompositions; Invariant Direct Sums; The Primary Decomposition Theorem		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
Sep	07/09/2026	12/09/2026	4	Cyclic Subspaces and Annihilators		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
	14/09/2026	19/09/2026	0	Ganesh Chaturthi Break (14–19 Sep)			
	21/09/2026	26/09/2026	4	Cyclic Decompositions and the Rational Form		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.

Sep/Oct	28/09/2026	03/10/2026	4	The Jordan Form		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
Oct	05/10/2026	10/10/2026	4	Computation of Invariant Factors		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.
	12/10/2026	14/10/2026	2	Review and problem solving on Rational and Jordan canonical forms		Smart Board, PPT	Kenneth Hoffman and Ray Kunze, Linear Algebra, PHI, 2nd Ed., 1997.

*** Assessment Rubrics**

Component	Max Marks
ISA 1	15
Mid Point Exam	30
ISA 2	15
Practical	Nil
Project	Nil
Semester End Exam	40