

DEPARTMENT OF MATHEMATICS
GOVERNMENT DEGREE COLLEGE BARAMULLA (AUTONOMOUS)

SYLLABUS FOR B.A./B.Sc. MATHEMATICS (HONORS) 7TH & 8TH SEMESTERS
Year 2025 AND ONWARDS

LINEAR ALGEBRA-I

Course Code: MMTC1822M

Semester: 8th

Total Credits: 4+2

Continuous Assessment: Marks 50

Theory: Marks 100

Total Marks: 150

Course hrs: 64+32

Course Learning Outcomes (CLO's): Upon completion of the course, students will be able to:

CLO1. Understand vector spaces, subspaces, bases, dimension, and apply fundamental results such as the Replacement theorem, Existence, Invariance, Extension and Sylvester's theorem.

CLO2. Analyze linear transformations and their matrix representations, study similarity, eigenvalues and eigenvectors, and apply results such as the Cayley-Hamilton theorem and conditions for diagonalizability.

CLO3. Apply concepts of inner product spaces, orthogonality, and Gram-Schmidt process, study adjoint operators, Riesz Representation Theorem, spectral theorems, normal and self-adjoint operators.

CLO4. Investigate bilinear and quadratic forms, change of basis, invariants, and advanced results such as Jordan canonical form, Jordan decomposition, and generalized eigenspace decomposition.

Credit-I Linear spaces: subspaces, algebra of subspaces, quotient spaces, span, linear dependence and independence, basis and dimension, replacement theorem. Existence, Invariance and Extension theorems. Linear transformations, null space and range, rank and nullity. Isomorphism theorems, Sylvester's theorem.

Credit-II Matrix representation of a linear transformation, algebra of linear transformations, invertibility and isomorphism, change of coordinate matrix and its properties, similarity of linear transformations. Eigen values and eigen vectors, eigen spaces. Diagonalizability: necessary and sufficient conditions for diagonalizability, characterization of diagonalizability. Invariant and cyclic subspaces, Caley-Hamilton Theorem.

Members:

1. Prof. Tariq Ahmad Chishti



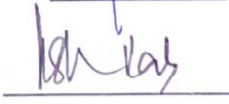
2. Prof Tariq Ahmad Chalkoo



3. Dr. Tariq Ahmad Naikoo



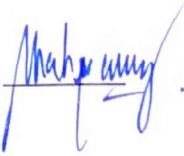
4. Dr. Nisar Ahmad Lone

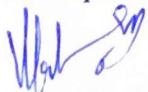


5. Dr. Farooq Ahmad Sheikh



6. Dr. Shahnawaz Ahmad Rather




Dr. Mahnaz Shafi Chishti
(Chairperson/Member)

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Credit-III Inner product spaces, examples and properties. Cauchy-Schwarz inequality and triangle inequality, orthogonality, Gram-Schmidt orthogonalization. Orthogonal complement of a subspace, decomposition of a finite dimensional space. Adjoint of a linear operator, Riesz representation theorem, Spectral theorems. Normal and self adjoint operators, Schur's Lemma. Orthogonal projection, spectral decomposition theorem.

Credit-IV Bilinear forms: symmetric bilinear forms and their invariants, space of bilinear forms and matrix representation of its elements, change of basis. Quadratic forms. Jordan canonical forms, Jordan decomposition theorem. generalized eigen values and generalized eigen spaces, decomposition of a space into generalized eigen spaces.

Tutorials:

Credit-I Exercises on subspaces, linear dependence/independence, basis, dimension, rank-nullity, matrix representations, change of basis, similarity, and computation of eigenvalues and eigenvectors, with emphasis on examples for conceptual clarity.

Credit-II Problems on inner product spaces, orthogonality, Gram-Schmidt process, spectral decomposition, unitary/orthogonal matrices, bilinear and quadratic forms, Jordan canonical form, and generalized eigenspaces.

Recommended Books:

1. Sheldon Axler, Linear algebra done right, Springer, Fourth Edition.
2. Robert A. Beezer, A first course in linear algebra, Organge Grove Books, 2009.
3. John B. Fraleigh and Raymond, Linear Algebra, Pearson Publishers, 3rd Edition, 1995.
4. K. Hoffman and R. Kunze, Linear Algebra, Pearson Education, 2018.
5. S. Lipschutz & M. Lipson, Linear Algebra, Schaum's outline series, Tata McGraw-Hill, 4th Edition 2009.

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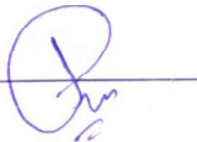
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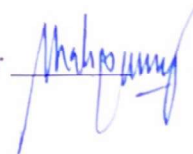
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