Bachelors with Mathematics as Major
7th Semester
MMT722J1: Mathematics/Applied Mathematics: LINEAR ALGEBRA

Credits: 3 THEORY + 1 TUTORIAL   Theory: 45 Hours & Tutorial: 15 Hours

Objective: To help the students in finding real life applications using operators and vector spaces. This course will introduce a student, the basics of linear algebra and some of its application

Expected Outcomes: The student will use this knowledge wherever he/she goes after undergraduate program. It has applications in computer science, finance mathematics, industrial mathematics, and bio-mathematics.

Theory: 3 Credits

Unit- I

Vector spaces, algebra of subspaces, quotient and product spaces, linear dependence and independence of vectors, bases and dimension of vector spaces. Linear transformations, null space and range, rank and nullity of a linear transformation. Isomorphism theorems, Sylvester's theorem.

Unit – II

Matrix representation of a linear transformation, algebra of linear transformations, change of coordinate matrix. Dual spaces, dual basis, annihilators. Similarity and invertibility of linear transformations. Invariant subspaces. Eigen values and eigenspaces, diagonalizability.

Unit – III

Inner product spaces, orthonormal bases and orthogonal projections, Gram- Schmidt orthogonalization, orthogonal complements. Normal and self-adjoint operators. The spectral theorems. Primary decomposition, generalized eigen vectors and eigen spaces. Jordan decomposition.

Tutorials: 1 Credits

Unit – IV

Problems and applications of linear transformations. Problems on dual spaces, basis and annihilators. Examples and applications of characteristic polynomials, minimal polynomials, Gram-Schmidt orthogonalization, normal and self-adjoint operators. Some applications of spectral theorem.

Books Recommended

1. K. Hoffman and R. Kunze, Linear Algebra, Pearson Education, 2018.
2. D. C Lay, S.R. Lay and J.J. AcDonald, Linear Algebra and Its Applications, Pearson, 5th Edition, 2023.
3. Sheldon Axler, Linear Algebra Done Right, Springer, 2nd edition.
4. S. Lipschutz & M. Lipson, Linear Algebra, Schaum's outline series, Tata McGraw-Hill, 4th Edition 2009.
5. Robert A. Beezer, A first course in linear algebra, Congruent Press; 3rd edition, 2012.
6. John B. Fraleigh and Raymond, Linear Algebra, Addison Wesley Pub. Com. 3rd Edition, 1995