Course Plan

Course Code	:	MA904
Course Title	:	Linear Algebra and Matrix Theory
L-T-P	:	3-0-0
Credits	:	3
Teaching Department	:	Mathematical and Computational Sciences (MACS)
Evaluation Plan	:	10 % weightage for Quiz-I
		25 % weightage for Mid-Semester Exam
		15 % weightage for Quiz-II
		50 % weightage for End-Semester Exam
Attendance	:	Must have at least 75 %
Course Co-ordinator	:	Dr. P. Sam Johnson

Topics

1. **Linear Equations:** Systems of linear equations, elementary matrices, row reduction and echelon forms, matrix multiplication, Gaussian elimination, transposes, finding inverses by elementary row operations, matrix factorizations, partitioned matrices, special matrices and applications, generalized inverses.
2. **Vector spaces:** Definition, examples, subspaces, linear dependence/independence of vectors, spanning set, basis, dimension, rank, direct sum and complement, isomorphism, quotient space, graphs and networks.
3. **Determinants:** Properties and formulas for the determinant, applications of determinant, Cramer's rule, cofactors and expansion theorems, classical adjoint, determinant of a partitioned matrix.
4. **Orthogonality:** Inner product spaces, applications of inner product, norm, orthogonal vectors, orthogonal basis, orthogonal subspaces, orthogonal complement, orthogonal projector, Cauchy Schwartz inequality, Gram-Schmidt process, least-squares problems, fast Fourier transform, orthogonal and unitary matrices.
5. **Linear Transformations:** Definition, algebra of linear transformations, representation of transformations by matrices and vice-versa, null space, range space, few results on linear transfromations and rank-nullity theorem, finding matrix of a linear transformation with respect to given bases, applications to differential equations.
6. **Eigenvalues and Eigenvectors:** The characteristic equation, finding eigenvalues and eigenvectors, properties of eigenvalues, diagonalization, difference equations and powers A^k, differential equations and e^{At}, complex matrices, complex eigenvalues, similarity transformations, discrete dynamical systems, iterative estimates for eigenvectors, Cayley-Hamilton theorem and minimal polynomial, spectral representation of a semi-simple matrix, Jordan canonical form, spectral theorem, singular value decomposition.
7. **Symmetric Matrices and Quadratic Forms:** Diagonalization of symmetric matrices, quadratic forms, classification of quadratic forms, minima, maxima, saddle points, tests for positive definiteness, minimum principles, the finite element method, square-root method.

References

1. A. Ramachandra Rao and P. Bhimasankaram, Linear Algebra, Second edition, Hindustan Book Agency, 2000.
2. G. Hadley, Linear Algebra, Narosa 2000.
3. G. Strang, Linear Algebra and its Applications, Thomson Learning, 2003.
4. David C. Lay, Linear Algebra and its Applications, Pearson, 2008.
5. Ward Cheney and David Kincaid, Linear Algebra - Theory and Applications, Jones & Bartlett, 2007.
6. Kenneth Hoffman and Ray Kunze, Linear Algebra, Prentice-Hall, 1990.