Information of the course on **Applied Linear Algebra and Matrix Analysis (MA614)** at IIT Ropar, India

Course instructors

- Dr. A. Sairam Kaliraj
- Dr. Manmohan Vashisth

Course contents:

- Gaussian Elimination, LU Decomposition, LDV Decomposition, Fundamental matrix subspaces, Superposition principle. Graphs & Matrices: Incidence matrix and its properties.
- Inner product spaces, positive definite matrices, Gram matrices, The Cholesky factorization, QR decomposition, Householder methods, Orthogonal projection and orthogonal subspaces.
- Eigenvalues, eigenvectors, diagonalizability, Gerschgorin circle theorem, Spectral theorem for real symmetric matrices and its applications in optimization problem. Schur decomposition, Jordan canonical form, Singular value decomposition and applications.
- Pseudoinverse, Least square solutions via pseudoinverse, principal component analysis.
- Iterations: Power of matrices, stability, Markov processes, solution to linear algebraic systems using Jacobi method, Gauss-Seidel method, Numerical computation of eigenvalues.
- Matrix functions: Matrix functions via Taylor series, Applications of Jordan canonical form in matrix functions. Solving system of linear ODEs, Perron Frobenius theorem and its applications in google page rank algorithm.

Class and tutorial timings for the course:

- Wednesday, 4:00 PM to 4:50 PM
- Thursday, 4:00 PM to 4:50 PM
- Friday, 4:00 PM to 4:50 PM
- Thursday, 6:00 PM to 6:50 PM (Tutorial)

Credit system for the course:

- 10 marks for homework assignments.
- 20 marks for class tests. There will be two class tests of equal marks each.
- 30 marks for mid-sem exam.
- 40 marks for end-Sem exam.

Grading and attendance policy:

1. There will be relative grading with a minimum threshold for D(Marginal) and NP (the Audit pass) grades as per the criteria given below.
   (a) The minimum percentage for the award of "D"grade is 30%.
   (b) The Audit Pass "NP"is awarded if the student's attendance is above 75% in the class and he/she has obtained at least a "C-"grade.
2. Attendance policy is as per institute rules.

Note: Based on circumstances above evaluation scheme may change.

References for the course:

1. P.J. Olver and C. Shakiban; Applied Linear Algebra; Springer, 2nd edition, 2018.
2. C.D. Mayer; Matrix Analysis and Applied Linear Algebra; Cambridge University Press, 2011.
3. H. Dym; Linear Algebra in Action; American Mathematical Society, Indian Edition, 2006.
4. P. Lax; Linear Algebra and Applications; A John Wiley & Sons, Inc., 2nd edition, 2007.
5. K.E. Atkinson; A introduction to numerical analysis, John Wiley and Sons publications, 2nd edition, 1989.
6. N.J. Higham; Functions of Matrices: Theory and Computation, Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA, 2008, xx+425 pp.