MATRIX ANALYSIS WITH APPLICATIONS

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INTENDED AUDIENCE: UG and PG students of technical universities/colleges

COURSE OUTLINE

This course is offered to UG and PG students of Engineering/Science background. It contains the concepts related to matrix theory and their applications in various disciplines. It covers a depth understanding of matrix computations involving rank, eigenvalues, eigenvectors, linear transformation, similarity transformations, (diagonalisation, Jordan canonical form, etc). It also involves various iterative methods, including Krylov subspace methods. Finally, topics like positive matrices, non-negative matrices and polar decomposition are discussed in detail with their applications.

ABOUT INSTRUCTOR

Prof. S. K. Gupta is an Associate Professor in the Department of Mathematics, IIT Roorkee. His area of expertise includes nonlinear, non-convex and Fuzzy optimization. He has guided three PhD thesis and have published more than 45 papers in various international journals of repute.

Prof. Sanjeev Kumar is working as an associate professor with Department of Mathematics, IIT Roorkee. Earlier, he worked as a postdoctoral fellow with Department of Mathematics and Computer Science, University of Udine, Italy and assistant professor with IIT Roorkee. He is actively involved in teaching and research in the area of computational algorithms, inverse problems and image processing. He has published more than 55 papers in various international journals conferences of repute. He has completed a couple of sponsored research projects and written several chapters in reputed books published with Springer and CRC press.

COURSE PLAN

Week 1 : Echelon form and Rank of a matrix, Solution of system of linear equations.
Week 2 : Vector spaces and their properties, subspaces, basis and dimension, linear transformations.
Week 3 : Eigen values and eigen vectors, Calyey Haminton theorem, diagonalization.
Week 4 : Special matrices, Gerschgorin theorem, inner product spaces, matrix norms and Gram Schmidt Process
Week 5 : Normal and Positive Definite matrices, Quadratic forms with applications
Week 6 : Evaluation of matrix functions, SVD and its applications
Week 7 : Stationary and non-stationary iterative methods for linear system
Week 8 : Krylov subspace methods, analysis of positive and non-negative matrices, polar decomposition theorem