



# MATRIX COMPUTATION AND ITS APPLICATIONS

**PROF. VIVEK K. AGGARWAL**

Department of Mathematics  
IITD

**TYPE OF COURSE** : New | Core | UG/PG

**COURSE DURATION** : 12 Weeks (26-Jul' 21 - 15-Oct' 21)

**EXAM DATE** : 23 Oct 2021

**PRE-REQUISITES** : Some knowledge of matrix theory

**INTENDED AUDIENCE** : UG/PG

**INDUSTRIES APPLICABLE TO** : Any software/financial industry will be interested.

## **COURSE OUTLINE :**

This course deals with applications of matrices to a wide range of areas of engineering and science. Initial some basics of linear algebra is discussed followed by matrix norms and sensitivity and condition number of the matrices.

## **ABOUT INSTRUCTOR :**

Dr. Vivek Kumar Aggarwal is presently working as an Assistant Professor in the dept. of Applied Mathematics, DTU Delhi. He earned his PhD in Mathematics from IIT Kanpur in 2005

## **COURSE PLAN :**

**Week-1:** Some basics of Linear Algebra :- Vector spaces, Linear transformations, eigen values and eigen vectors.

**Week-2:** Matrix norm, Sensitivity analysis and condition numbers, Linear systems, Jacobi, Gauss-Seidel and successive over relaxation methods, LU decompositions, Gaussian elimination with partial pivoting, Banded systems, positive definite systems, Cholesky decomposition – sensitivity analysis, Gram-Schmidt orthonormal process, Householder transformation, QR factorization, stability of QR factorization.

**Week-3:** Solution of linear least squares problems, normal equations, singular value decomposition (SVD), Moore-Penrose inverse, Rank deficient least squares problems, Sensitivity analysis of least-squares problems, Sensitivity of eigenvalues and eigenvectors.

**Week-4:** Reduction to Hessenberg and tridiagonal forms; Power, inverse power and Rayleigh quotient iterations, Explicit and implicit QR algorithms for symmetric and non-symmetric matrices, Reduction to bi diagonal form, Sensitivity analysis of singular values and singular vectors, conjugate gradient method.