Mathematical Foundation for Data Science

Calculus: Infinite sequences and series, Limit, continuity and differentiability, Maxima/Minima of a function of one and several variable(s), Riemann Integration, Improper integral, Multilpe integrals, Chain rule, Gradient, Directional derivatives.

Linear Algebra: Vector spaces, Linearly independence and independence, Basis, Dimension. , ,Linear transformation, Representation of linear maps by matrices, Inner product space, Eigenvalues and Eigenvectors, Diagonalization of matrices, Specrtal theorem, Singular value decomposition (SVD) – numerical rank determination via SVD, solution of least squares problems, Moore- Penrose inverse, low rank approximations via SVD, , inverse power and Rayleigh quotient iterations, Schur's decomposition, unitary similarity transformation of Hermitian matrices to tridiagonal form, QR algorithm, implementation of explicit QR algorithm for Hermitian matrices.

Textbooks:

- L. N. Trefethen and David Bau, Numerical Linear Algebra, SIAM, Philadelphia, 1997.

- D. S. Watkins, Fundamentals of Matrix Computation, 2nd Edition, Wiley, 2002.

- L. Elden Matrix Methods in Data Mining and Pattern Recognition, SIAM, Philadelphia, 2007.

- D. Kincaid and W. Cheney, Numerical Mathematics and Computing, 7th Edn., Cengage, 2013.

- K. E. Atkinson, Introduction to Numerical Analysis, 2nd Edn., John Wiley, 1989.