Course Type	Course Code	Name of the Course	L	T	P	Credits
DC	NMCC530	Linear Algebra and Optimization for Data Analytics	3	1	0	4

Course Objective
The objective of the course will be to give idea about linear algebra, solutions of linear system of equation and some optimization techniques.
Learning Outcomes
Students will learn different aspects of linear algebra and some optimization techniques useful for the data analytics.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Review of linear algebra:** Vector spaces, Basis, Dimension, Rank, Nullity, Inner Product, Norms and projections, orthonormal basis, Gram Schimdt process.	6L+2T	Students will learn basics of Linear Algebra
2	**Linear Systems and Matrix Factorization:** GEPP, GECP, Permutation of Matrices, Numerical Solutions of Linear Systems, LU factorization, QR factorization, Eigenvalues, Diagonalization, SVD, Reduced SVD, Generalized Triangular Decomposition.	9L+3T	Students will learn about solutions of Linear systems, LU factorization, QR factorization and SVD.
3	**Numerical Methods for Linear and Eigenvalue Problems:** Linear Squares Solutions to Linear Systems, Least Square Iterative Refinement, Numerical Matrix, Eigenvalue Problems, Numerical Symmetric Eigenvalue Problems, Generalized, Quadratic Eigenvalue Problems, Iterative Methods for Large and Sparse Problems.	9L+3T	Students will learn about Eigenvalue Problem, Numerical Symmetric Eigen Value Problem, Quadratic Eigen values.
4	**Introduction to constrained optimization:** convex set, convex function and its properties, nonlinear programming, KKT optimality, Lagrange function, Lagrange dual.	9L+3T	Students will learn about constrained optimization
5	**Introduction to unconstrained optimization:** Steepest descent method for unconstrained problem, stochastic gradient descent.	9L+3T	Students will learn about unconstrained optimization.
	Total	42L+14T	

Text Books:

1. Gilbert Strang, Linear Algebra and Learning from Data, Wellesley-Cambridge Press, 2019.
2. B. N. Dutta, Numerical Linear Algebra and Applications, SIAM, 2010
3. S. Boyd and L. Vandenberghe. Convex Optimization. Cambridge university press, 2004.

Reference Books:

1. R. S. Varga, Matrix Iterative Analysis, Springer, 2000.
2. Sebastien Bubeck. Convex optimization: Algorithms and Complexity, Now Publishers Incorporated, 2015