Course Code	Name of Course	L	T	P	Credit
NMCD515	Advanced Multivariate Analysis	3	0	0	3

Prerequisite
• Basic concepts of Probability and Statistics, Linear Algebra
Course Objective
• This course will demonstrate the properties of multivariate distributions and their applications in multivariate data analysis. Concepts of principal component analysis, multivariate analysis of variance, cluster analysis, discriminant analysis and classification, factor analysis, and canonical correlations analysis shall be covered.
Learning Outcomes
• Students will learn about the application of Multivariate Statistical Analysis techniques in Data Analytics.

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
1	Review of multivariate normal distribution and its properties, distributions of linear and quadratic forms, tests for partial and multiple correlation coefficients and regression coefficients and their associated confidence regions. Wishart distribution.	7	Demonstrate the properties of multivariate distributions such as multivariate normal, Wishart distribution etc. and their applications
2	Construction of tests: likelihood ratio principles, inference on mean vectors, Hotelling's T^2. Multivariate Analysis of Variance (MANOVA). Inference on covariance matrices. Multivariate regression	10	Inference on parameters of the multivariate normal distributions and constructions of different tests. Students will learn to apply the multivariate regression and MANOVA for multivariate data.
3	Discriminant analysis. Principal component analysis, factor analysis and clustering.	12	Understanding discriminant analysis and principal component analysis for analyzing multivariate data.
4	Dimension reduction techniques: Principal component and generalized canonical variable analysis – constructions and related inference problems.	6	Use principal component analysis effectively for data exploration and data dimension reduction for high dimensional data
5	Large p–small n problems in testing of multi parameter hypotheses: Tests for the mean vector in $\boldsymbol{N}\boldsymbol{p}(\mu,\Sigma)$, null and non-null asymptotic distributions of their test statistics.	7	Students will learn the theory of statistical inference for high dimensional data analysis.
Total		**42**	

Text Books:

1. R. A. Johnson and D. W. Wichern (2013), Applied Multivariate Statistical Analysis. 6th Ed. Pearson.
2. T. W. Anderson (2003), An Introduction to Multivariate Statistical Analysis. 3nd Ed. John Wiley.

Reference Books:

1. M. S. Srivastava and C. G. Khatri (1979), An Introduction to Multivariate Statistics, Elsevier North Holland, Inc., New York.
2. R. J. Muirhead (2009). Aspects of Multivariate Statistical Theory. 2nd Ed. Wiley-Interscience