Department of Statistics

B.Sc.(H), Statistics Semester-VII

Category I

DISCIPLINE-SPECIFIC CORE COURSE – 19: MULTIVARIATE ANALYSIS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Multivariate Analysis	4	3	0	1	-	Knowledge of Probability Distributions and Statistical Inference.

Learning Objectives
The learning objectives include:

- To study Bivariate Normal Distribution along with their properties.
- To study Multivariate Normal Distribution with their properties along with its applications analysis.
- Concepts of Multiple and partial correlation coefficients along with their interpretation.
- Analysis of multivariate data using discriminant analysis, principal component analysis, factor analysis and cluster analysis.

Learning Outcomes:
After completing this course, students should be able to:

- Understand the basic concepts associated with Multivariate Normal Distributions and their properties with special emphasis on Bivariate Normal Distribution.
- Understand the Multiple and partial correlation coefficients.
- Analyze the multivariate data using dimension reduction techniques like principal component analysis, factor analysis and cluster analysis.
- Apply the classificatory method namely discriminant analysis.

SYLLABUS OF DSC-19

Theory

UNIT 1
Bivariate Normal Distribution (15 hours)
Probability density function of Bivariate Normal Distribution (BVN). Moment generating function, marginal distribution, conditional distribution of BVN and properties of BVN. Introduction of random vector, probability mass function, probability density functions of random vector, distribution function, mean vector, dispersion matrix, marginal distributions and conditional distributions of random vector.

UNIT 2
Multivariate Normal Distribution (15 hours)
Probability density function of Multivariate Normal distribution (MVN). Moment generating function, marginal and conditional distribution of MVN. Properties of MVN. Sampling distribution of sample mean vector and sample variance-covariance matrix. Regression planes. Multiple and partial correlation coefficients with their properties and interpretations.

UNIT 3
Multivariate Data Analysis (15 hours)
Dimension reduction techniques: Eigenvalues and Eigenvectors Principal component analysis and its applications, factor analysis and its applications, cluster analysis and its applications. Classification technique: Discriminant analysis and its applications.

PRACTICAL/LAB WORK: (30 HOURS)

List of Practical:
1. Bivariate Normal Distribution and its properties.
2. Mean vector and dispersion matrix of Multivariate Normal Distribution.
3. Marginal distributions of Multivariate Normal Distribution.
4. Conditional distributions of Multivariate Normal Distribution.
5. Regression plane.
6. Partial Correlation Coefficient.
7. Multiple Correlation Coefficient.
8. Principal Component Analysis.
9. Discriminant Analysis.
10. Factor Analysis.
11. Cluster Analysis

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

ESSENTIAL READINGS:
* Anderson, T.W. (2009). An Introduction to Multivariate Statistical Analysis, 3rd Ed., John Wiley & Sons.
* Johnson, R.A. and Wichern, D.W. (2015). Applied Multivariate Analysis, 6th Ed., Prentice Hall.(** Note publication Pearson Education India)
* Gun, A.M., Gupta, M.K. and Dasgupta, B. (2016). An Outline of Statistical Theory, Volume II, World Press.
* Applied multivariate data analysis, second edition, Brian.S.Everett and Graham Dunn, Oxford University Press, 2001

SUGGESTED READINGS:
* S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 12th Ed., Sultan Chand and Sons, 2020.
* Kshirsagar, A.M. (1972). Multivariate Analysis, 1st Ed., Marcel Dekker.
* Muirhead, R.J. (2005). Aspects of Multivariate Statistical Theory, John Wiley. (**reprint)
* Arora, S.and Bansi, L. (1968). New Mathematical Statistics, 1st Ed., Vanita Printers.
* Rao, C. R. (2009). Linear Statistical Inference, Second Edition , John Wiley & Sons.
* Approaching multivariate analysis -A practical introduction, second edition, Pat Dugard, John Todman and Harry Staines, Routledge,2010.
* An R and S-plus companion to multivariate analysis, Brian Everitt, Springer texts in Statistics, Springer, 2010. (**reprint in 2010)

Note: Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.