| Course Title: | Multivariate Analysis |
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| Course Code: | STAT-305 |
| Semester: | VI |
| Credit Hours: | 3 Credit Hours |
| Pre-requisites: | STAT-101, STAT-102 |

**Learning Outcomes**
By the end of this course, students will be able to:
1. Learn the objectives and applications of Multivariate techniques.
2. Know the underlying theoretical framework of Multivariate techniques (multivariate normal distribution).
3. Acquire the knowledge of Wishart distribution.

**Course Outline**
**Unit 1**
**1.1 Review of matrix algebra**
Refreshing fundamental concepts in matrix algebra: matrices, vectors, operations (addition, subtraction, multiplication), and properties

**1.2 Multivariate Distributions**
Notions of multivariate distributions. The multivariate normal distribution and its properties. Linear compound and linear combinations. Estimation of the mean vector and the covariance matrix.
**1.3 Wishart Distribution**
Wishart distribution and its properties. The joint distribution of the sample mean vector and the sample covariance matrix. Hotelling's $t^2$ distribution.
**1.4 Conditional Distribution of M.V normal**
Mean and variance of conditional distribution, inferences for multivariate means, confidence regions for multivariate means.
**1.5 Factor Analysis**
Exploratory factor analysis, model specification, and identification. Confirmatory factor analysis.
**1.6 Canonical Correlation Analysis**
Concept of canonical variables, estimation and interpretation.
**1.7 Discriminant Analysis**
Linear discriminant analysis and quadratic discriminant analysis
**1.8 Principal Component Analysis**
The concept and objectives of PCA, Eigenvalues and Eigenvectors. Application of PCA.
- **Teaching-learning Strategies:**
Class Lecture method, which includes seminars, discussions, assignments and projects. (Audio-visual tools are used where necessary)

- **Assignments-Types and Number with calendar:**
According to the choice of respective teacher.

- **Assessment and Examinations:**
According to the University's Semester Rules.

| Sr. No. | Elements | Weightage | Details |
|---|---|---|---|
| 1 | Midterm Assessment | 35% | It takes place at the mid-point of the semester. |
| 2 | Formative Assessment | 25% | It is continuous assessment. It includes: Classroom participation, attendance, assignments, and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc. |
| 3 | Final Assessment | 40% | It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc. |

## Text Book

1. Johnson, R.A., & Wichern, D.W. (2008). *Applied multivariate statistical analysis*. Pearson Education: Singapore.

## Suggested Readings

1. Anderson, T.W. (2003). *An introduction to multivariate statistical analysis* (3rd ed.). John Wiley & Sons: New York.
2. Chatfield, C., & Collins, A.J. (1981). *Introduction to multivariate analysis*. Chapman and Hall: London.
3. Morrison, D.F. (2004). *Multivariate statistical methods* (4th ed.). McGraw Hill Publishing Co, New York.