Department of Liberal Education
Era University, Lucknow
Course Outline
Effective From: 2023-24

Name of the Program	**B.A. / B.Sc. (LIBERAL EDUCATION)**			**Year/ Semester:**	**3rd / 6th**		
Course Name	**Multivariate Analysis**	**Course Code:**	**ST306**	**Type:**	**Theory**		
Credits	**04**			**Total Sessions Hours:**	**60 Hours**		
Evaluation Spread	**Internal Continuous Assessment:**	**50 Marks**		**End Term Exam:**	**50 Marks**		
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill		
Course Objectives	1. This course attempts to teach students a few simple statistical tools that will enhance their ability to deal with more complex, real-world problems. 2. It will teach students to have an understanding of multivariate normal distributions and its practical applications. 3. It will cover concepts such as Multivariate data and its estimation, Principal components Analysis and Factor Analysis.						
Course Outcomes (CO): ***After the successful course completion, learners will develop following attributes:***							
Course Outcome (CO)	**Attributes**						
CO1	Learn the basic concepts of vector spaces and matrices to implement its use in understanding multivariate analysis.						
CO2	Student will learn about the multivariate data and enhance the knowledge of the applications of multivariate normal distribution.						
CO3	Ability to perform Maximum Likelihood estimation to obtain estimates of mean vector and dispersion matrix.						
CO4	Students will have the knowledge of the concept of Principal Component Analysis, Factor Analysis and their practical applications.						
Pedagogy	Interactive, discussion-bases, student-centered, presentation.						
Internal Evaluation Mode	Mid-term Examination: 20 Marks Activity: 10 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks						
Session Details	**Topic**				**Hours**	**Mapped CO**	
Unit 1	Vector Space, Subspace, Linear Combination, Span, Linear Independence, Inner Product, Norm, Orthogonality, Dimension of Vector Space. **Activity:** Assignment based activity.				15	CO1	

Unit 2	Row and Column Rank, Rank of Matrix, Elementary operations on Matrices, Inverse of a matrix. Partition Matrices, Symmetric Matrices, Idempotent Matrices, Quadratic Matrices. **Activity:** Assignment based activity.	16	CO1
Unit 3	Multivariate Normal Distribution, Marginal and Conditional Distributions, Moment Generating and Characteristics functions. Maximum Likelihood Estimation of Mean vector and Dispersion matrix, Independence and point sufficiency of these estimates. **Activity:** Assignment based activity.	14	CO2, CO3
Unit 4	Applications of Multivariate Analysis: Principal Components Analysis and Factor Analysis (Application Oriented discussion, derivations not required). Multiple and Partial correlations and Multiple Regressions. **Activity:** Assignment based activity.	15	CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1		1			1	2				1			
CO2		2				1	2			2		1	2	
CO3							1							
CO4	1	2				1	1			2	1			

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books	1. Anderson, T.W. (2003): An Introduction to Multivariate Statistical Analysis, 3rdEdn., John Wiley 2. Johnson, R.A. And Wichern, D.W. (2007): Applied Multivariate Analysis, 6thEdn., Pearson & Prentice Hall
Reference Books	1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002): Fundamentals of Statistics, Vol. I, 8th Edn. The World Press, Kolkata. 2. Kshirsagar, A.M. (1972): Multivariate Analysis, 1stEdn. Marcel Dekker.
Para Text	**Unit 1:** 1. https://www.youtube.com/watch?v=XDvSsDsLVLs 2. **Unit 2:** 1. https://www.youtube.com/watch?v=4lAyqscuTc8 2. https://www.youtube.com/watch?v=JUgrBkPteTg **Unit 3:** 1. https://www.youtube.com/watch?v=h4jvu8PW8YE 2. https://www.youtube.com/watch?v=pNRrqbJI2SY **Unit4:** 1. 2. https://www.youtube.com/watch?v=Jkf-pGDdy7k

Recapitulation & Examination Pattern		
Internal Continuous Assessment:		
Component	**Marks**	**Pattern**
Mid Semester	20	**Section A:** Contains **10** MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries **0.5 mark.** **Section B:** Contains **07** descriptive questions out of which **05** questions are to be attempted. Each question carries **03 marks**.
Activity	10	Will be decided by subject teacher
Class Test	05	Contains **05 descriptive questions.** Each question carries **01** mark.
Online Test/ Objective Test	05	Contains **10 multiple choice questions.** Each question carries **0.5** mark.
Assignment/ Presentation	05	Assignment to be made on topics and instruction given by subject teacher
Attendance	05	As per policy
Total Marks	**50**	

Course created by: **Dr. Nazia Naqvi**
Dr. Abdul Quddoos

Signature:

Approved by: Prof. Shashi Bhushan

Shashi Bhushan

Signature: