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	**Analysis of Variance & Design of Experiments**	**Course Code:**	**ST307**	**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. To enhance their ability to carry out the application of ANOVA to deal with complex, real-world problems. 2. It will teach students to review the fundamentals of design of experiment and identify the design that is most apt and suitable in a situation by utilizing the basic principles of the experimental design. 3. This paper will cover concepts such as CRD, RBD, LSD and factorials and their relative efficiencies.				

Course Outcomes (CO): *After the successful course completion, learners will develop following attributes:*

Course Outcome (CO)	**Attributes**
CO1	Learn the concept of analysis of variance, assumptions related to it and their uses.
CO2	Student will learn about the concept of Design of experiment and role its basic principles when applying CRD or RBD in a real situation.
CO3	Ability to perform the basic Latin square design and to compare efficiencies between CRD, RBD and LSD with and without missing observations.
CO4	Students will have the knowledge of the concept of factorial experiments 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	Definition of Analysis of Variance, Assumptions and Limitations of ANOVA, One way classification. Two way classification with equal number of observations per cell. **Activity:** Assignment based activity.	15	CO1

Unit 2	Principles of Design of Experiment: Randomization, Replication and Local Control, Completely Randomized Design (CRD) Randomized Block Design (RBD), Concept and definition of efficiency of design, Comparison of efficiency between CRD and RBD. **Activity:** Assignment based activity.	16	CO2
Unit 3	Latin Square Design (LSD), Lay-out, ANOVA table, Comparison of efficiencies between LSD and RBD; LSD and CRD. Missing plot technique: Estimation of missing plots by minimizing error sum of squares in RBD and LSD with one missing observations. **Activity:** Assignment based activity.	14	CO3
Unit 4	Factorial Experiments: General description of factorial experiments, 22, 23 and 2n factorial experiments arranged in RBD, Definition of Main effects and Interactions in 22 and 23 factorial experiments, Preparation of ANOVA by Yates procedure, Estimates and tests for main and interaction effects (Analysis without confounding). **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. Cochran, W. G. and Cox, G. M. (1957). Experimental Design. John Wiley & Sons, New York. 2. Das, M. N. and Giri, N. S. (1986). Design and Analysis of Experiments (2nd Edition). Wiley.
Reference Books	1. Montgomery, D.C. (2017). Design and analysis of Experiments, 9Th Edition. John Wiley & Sons. 2. Joshi, D.D. (1987). Linear Estimation and Design of Experiments. New Age International (P) Ltd. New Delhi.
Para Text	**Unit 1:** 1. https://www.youtube.com/watch?v=0NwA9xxxtHw 2. https://www.youtube.com/watch?v=r1ueoHA_KCQ **Unit 2:** 1. https://www.youtube.com/watch?v=lGeBIc-3st0 2. https://www.youtube.com/watch?v=lqEnXp93HTQ **Unit 3:** 1. https://www.youtube.com/watch?v=WwbZsMrmVpo 2. https://www.youtube.com/watch?v=U3UunoGG6zU **Unit4:** 1. https://www.youtube.com/watch?v=IGxPHLW6Ja4 2. https://www.youtube.com/watch?v=l3A045UdZhU

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**
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Signature:

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Shashi Bhushan

Signature: