PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2025
(Second Semester)
Branch- STATISTICS

LINEAR MODELS AND DESIGN OF EXPERIMENTS

Time: Three Hours   Maximum: 75 Marks

SECTION-A (10 Marks)
Answer ALL questions
ALL questions carry EQUAL marks   (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	In the Gauss-Markov setup, what does the term 'linear' refer to? a) Linear relationship between dependent and independent variables b) Linear in parameters c) Linear in residuals d) Linear in correlation between errors	K1	CO1
	2	In a fixed model, the hypothesis about the treatments under test is a) $\sigma^2_\tau = 0$ b) $\tau_i^{2=0}$ c) $\sum \tau_i = 0$ d) $\sum \tau_i^2 = 0$	K2	CO1
2	3	Randomizations in an experiment provides _____. a) The estimate of experimental error b) Impetus to the treatments c) Treatments d) None of the above	K1	CO1
	4	In case of LSD -------- must occurs once and only once in each row and each column. a) each treatment b) observation c) Sampling unit d) experimental maerial	K2	CO1
3	5	A controlled independent variable whose levels are set by the experimenter is called: a) Response b) Factor c) Level d) Treatment	K1	CO1
	6	If the effects of two treatment combinations are confounded, then one effect is said to be the _____ of the other. a) alias b) reciprocal c) implicate d) co-treatment	K2	CO1
4	7	A BIBD is said to be symmetrical if number of blocks = a) Number of factors b) Number of treatments c) Number of levels d) Number of degree of freedom	K1	CO1
	8	Some pair of treatments appears together λ_1 times, some pairs of treatment appear together λ_2 times in -------and the remaining pairs λ_m times. a) BIBD b) PBIBD c) GLSD d) RCBD	K2	CO1
5	9	In a second-order response surface model, which term represents the interaction effect between two variables? a) β_0 b) $\beta_i x_i$ c) $\beta_{ij} x_i x_j$ d) $\beta_{ii} x_i^2$	K1	CO1
	10	Identify the design which is called Indirect Bioassays? a) Feller's theorem b) Parallel line Assay c) Weighing Design d) Nested Design	K2	CO1

SECTION - B (35 Marks)
Answer ALL questions
ALL questions carry EQUAL Marks   (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	What is a linear model? Explain various types of linear model.	K2	CO2
		(OR)		
	11.b.	Consider the model $E(Y_1) = 2\beta_1 + \beta_2$, $E(Y_{21}) = \beta_1 - \beta_2$, $E(Y_3) = \beta_1 - \beta_3$ with usual notations, obtains BLUE of $\beta_1 + 2\beta_2$ and its variance.		
2	12.a.	Describe the statistical analysis of a CRD.	K3	CO3
		(OR)		
	12.b.	What is meant by missing plot technique? Show how to estimate a missing value in a RBD. Calculate the bias involved in the estimated value and hence the ANOVA?		
3	13.a.	What is factorial experiment? Define main and Interaction effects. How to calculate sum of squares of treatment effects of 2^3 experiment? Illustrate.	K3	CO3
		(OR)		
	13.b.	Delineate about Asymmetrical Factorial Experiment. Illustrate. Bring out the procedure to analyze such experiment.		
4	14.a.	Define a BIBD with parameters v, b, r, k and λ. State and prove the relationships among its parameters.	K4	CO4
		(OR)		
	14.b.	Write a brief note about Youden Square and lattice Design.		
5	15.a.	Describe the statistical model used in indirect bioassays. How do indirect assays differ from direct assays in terms of assumptions and data analysis?	K4	CO5
		(OR)		
	15.b.	Define the term: Response Surface". Explain the sequential nature of RSM to obtain optimum operating conditions. State its properties.		

SECTION -C (30 Marks)
Answer ANY THREE questions
ALL questions carry EQUAL Marks   (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Derive the analysis of non-orthogonal data. Illustrate.	K3	CO2
2	17	Bring out the complete analysis of L.S.D. with one missing observation.	K3	CO3
3	18	Construct a 2^5 design in blocks of 8 plots confounding ABC, ADE and BCDE. The analysis of such a design with 'r' replication with its ANOVA.	K4	CO5
4	19	Bring out Intra-Block Analysis of BIBD.	K4	CO4
5	20	What is Bio-assay? State different methods. Bring out the analysis of parallel – line assays with ANOVA table.	K4	CO5

Z-Z-Z   END