PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2023
(Second Semester)

Branch – STATISTICS

LINEAR MODELS AND DESIGN OF EXPERIMENTS

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)
Answer ALL questions
ALL questions carry EQUAL marks   (5 x 1 = 5)

1 Identify the model type of the given linear equation $Y_{ijk} = \mu + a_i + b_j + e_{ijk}$
   (i)   Fixed Effect   (ii) Random Effect
   (iii) Mixed Effect   (iv) Non-linear

2 The ratio of the number of replications required in CRD and RBD for the same amount of information is
   (i)   6: 4   (ii) 10:6
   (iii) 10:8   (iv) 6:10

3 The experiments with various factors having unequal number of levels are called ---factorial experiments.
   (i)   Typical   (ii) Asymmetrical
   (iii) Symmetrical   (iv) Fractional

4 Recall the condition for a BIBD to be resolvable.

   (i) $b > (v+r-1)$ (ii) $b > (v - r-1)$
   (iii) $b \geq (v - r-1)$ (iv) $b \geq (v + r-1)$

5 Slope ratio analysis is one of the categories of---------------
   (i)   Direct Assays   (ii) Indirect Assays
   (iii) Cross Over Design   (iv) Lattice Design

SECTION - B (15 Marks)
Answer ALL Questions
ALL Questions Carry EQUAL Marks   (5 x 3 = 15)

6 a Define linear estimability. Describe the necessary and sufficient condition of linear estimability.

      OR

   b Give a brief note about the types of models in design of experiments with illustration.

7 a In what way the Latin Square Design is efficient than CRD and RBD? – Explain.

      OR

   b State and discuss the principles of Design of Experiments.

8 a Bring out the main effects and interaction effects of factorial experiments with four factors each at two levels with the Yates Table.

      OR

   b Delineate about fractional replicates and its types through an example.

9   a   Define PBIBD. Explain the classification of PBIBD with two associate schemes.

<div align="center">OR</div>

     b   Write a short note about Lattice design and its types.

10   a   What is Bioassay? Describe the Feller's theorem and its significance in the design.

<div align="center">OR</div>

     b   Illustrate and discuss about Weighing design. In what way it is beneficial?

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SECTION -C (30 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** Marks   (5 x 6 = 30)

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11   a   For a general linear model $Y = X\beta + \varepsilon$ of full rank where $\varepsilon \sim N(0, \sigma^2)$ with unknown σ^2 Obtain the MLE of β and σ^2. Examine the unbiasedness of σ^2 and show that the estimator β of β is unbiased.

<div align="center">OR</div>

     b   Derive the analysis of non-orthogonal data with illustration.

12   a   Bring out the analysis of RBD with ANOVA table. Compare with LSD.

<div align="center">OR</div>

     b   With an example explain ANOCOVA for one way classification in CRD Layout.

13   a   Construct a 2^4- factorial design by confounding the interaction effects ABC and AD. Bring out the ANOVA table.

<div align="center">OR</div>

     b   Explain in detail about Asymmetrical factorial experiments with its procedure.

14   a   Define BIBD. Derive the properties of BIBD. When it is said to be symmetrical BIBD and Resolvable?

<div align="center">OR</div>

     b   Describe the procedure to analyze Intra Block BIBD.

15   a   Write brief note about Indirect Bio-assay. When and why the transformations are applied? Describe in detail.

<div align="center">OR</div>

     b   What is Cross Over Design? Analyze the Response surface design for the linear case.

<div align="center">Z-Z-Z   END</div>