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(February)

STATISTICS

(Honours)

**(Linear Models, Regression and Operations
Research, Design of Experiments)**

[STEH-52 (TH)]

Marks : 56

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*Answer **five** questions, taking **one** from each Unit

UNIT—I

1. (a) Stating all the assumptions, write down the Gauss-Markov linear model. 6
- (b) Explain the following terms : 6
- (i) Best linear unbiased estimator
- (ii) Error function
- (iii) Estimable parametric function

2. (a) In the case of Gauss-Markov linear model, $E(y) = AB$ and $D(y) = \sigma^2 I$, obtain least squares estimators of the parameter vector, where $D(y)$ is the dispersion matrix and I , the identity matrix of order n . 6
- (b) Prove the necessary and sufficient condition for a parametric function to be estimable and that for a linear function of the variable to belong to error. 6

UNIT—II

3. What do you mean by multiple regression? Obtain the equation of the plane of regression of X_1 on X_2 and X_3 of the form

$$\frac{X_1}{\sigma_1} \omega_{11} + \frac{X_2}{\sigma_2} \omega_{12} + \frac{X_3}{\sigma_3} \omega_{13} = 0$$

where the symbols have their usual meanings. 2+9=11

4. Write notes on the following : 3+3+5=11
- (a) Correlation ratio
- (b) Correlation index
- (c) Violation of usual assumptions concerning normality, colinearity and homoscedasticity in a regression model

(3)

UNIT—III

5. (a) Write notes on the following : $2+3+2=7$
- (i) Factorial experiment
 - (ii) Complete and partial confounding
 - (iii) Different main effects and interaction effects in a 2^3 -factorial experiment
- (b) Write in brief about analysis of covariance mentioning the mathematical model for one-way classification with a single concomitant variable in CRD. 4
6. Give the complete analysis of two-way classified data with m observations per cell under fixed effect model stating clearly the assumptions used, hypothesis to be tested, test statistic to be used along with ANOVA table. 11

UNIT—IV

7. (a) What is a linear programming problem? 2
- (b) Define the following : $3+3=6$
- (i) General linear programming problem
 - (ii) Feasible solution, basic solution and basic feasible solution

(4)

- (c) Write down all the assumptions of a linear programming problem. 3
8. (a) What are the conditions that need to be fulfilled to solve linear programming problems for optimization? 3
- (b) Write a short note on slack and surplus variables. 4
- (c) Write a note on graphical method of solution of LPP and applications of LPP. 4

UNIT—V

9. What do you mean by transportation problem? Write the different steps to solve transportation problem by—
- (a) North-West corner rule;
 - (b) matrix minima method or Vogel's approximation method. $5+3+3=11$
10. Write a note on assignment problem and give its mathematical formulation. Write the algorithm to solve an assignment problem by Hungarian method. $3+3+5=11$

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