



Register Number:

Date:

**ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE – 27**

**M.Sc. STATISTICS – II SEMESTER**

**SEMESTER EXAMINATION – JULY 2022**

**ST 8321: Multivariate Theory**

**Time: 2½hrs**

**Max: 70 Marks**

This question paper has **TWO** printed pages and **TWO** sections

**SECTION – A**

**I Answer any SIX of the following:**

**6x 3= 18**

1. State multivariate normal distribution, with any two properties.
2. What are partial and multiple correlation coefficients? Write their computational formulae.
3. Define Hotelling's  $T^2$  statistic and discuss its application.
4. How discriminant analysis is different from classification analysis? Explain.
5. Find the characteristic function of multivariate normal distribution.
6. Discuss the concept and need of principal components.
7. Describe the steps of the k-means algorithm for clustering.
8. List out the different measures for measuring distances in cluster analysis.

**SECTION – B**

**II Answer any FOUR of the following:**

**4 x 13 = 52**

9. A) If  $X \sim Np(\mu, \Sigma)$ , then find the distribution of  $(X - \mu)' \Sigma^{-1} (X - \mu)$ .  
B) Prove that sample mean vector and sample dispersion matrix are statistically independent. (6+7)
10. A) Describe methods for assessing multivariate normality.  
B) Derive the Bayes criterion in linear discriminant analysis for two populations. (6+7)

11. A) Derive the MLEs of the parameters of multivariate normal distribution.  
B) Develop a test procedure for testing the mean vector of a normal population. (7+6)
12. A) Explain canonical correlation. Derive the expression for the first pair of canonical variates.  
B) Explain the principal component method of estimating the factor loadings. (6+7)
13. A) Explain the method of extracting the common factor loadings.  
B) Prove that the variance of the first principle component corresponds to the largest characteristic root of the dispersion matrix. (7+6)
14. A) Define a multivariate regression model. How do you estimate the parameters of the multivariate regression model?  
B) What is meant by hierarchical clustering? Explain the complete linkage algorithm with reference to it. (7+6)