



QP CODE: 25022333



25022333

Reg No : .....

Name : .....

**M.Sc DEGREE (CSS) SPECIAL REAPPEARANCE EXAMINATION, APRIL 2025**

**Third Semester**

M.Sc BIOSTATISTICS

**CORE - ST020303 - APPLIED MULTIVARIATE ANALYSIS**

2019 ADMISSION ONWARDS

977FB397

Time: 3 Hours

Weightage: 30

**Part A (Short Answer Questions)**

*Answer any **eight** questions.*

*Weight 1 each.*

1. What do you mean by multivariate analysis ? Give the advantages of multivariate analyses over univariate analyses.
2. Define the characteristic function of multivariate normal distribution.
3. State the characterisation of multivariate normal distribution.
4. Briefly explain Mahalanobis distances.
5. Explain Wishart matrix. What is the pdf of Wishart distribution?
6. Discuss the sampling distribution of SP matrix A.
7. Write a short note on dimension reduction.
8. One of the use of principal component is dimension reduction. Justify.
9. What is dendrogram?
10. Write a short note on k-means clustering.

(8×1=8 weightage)

**Part B (Short Essay/Problems)**

*Answer any **six** questions.*

*Weight 2 each.*

11. Discuss covariance matrix and correlation matrix. Derive the relationship between covariance matrix and correlation matrix.
12. Derive the formulae for regression line of  $X^{(2)}$  on  $X^{(1)}$
13. Discuss the relationship between Mahalanobis  $D^2$  and  $T^2$





14. Explain the problem of several independent multivariate normal populations.
15. State and establish the invariance property of two sample Hotellings  $T^2$  statistics.
16. Illustrate Hotellings iterative method for finding canonical correlations and canonical variables.
17. Explain Bayesian approach in discriminant analysis.
18. Given that  $Y = a^1 X$  be an assigned discriminant function. How to test the assigned discriminant function is sufficient or not for discriminating the population. Justify your answer

(6×2=12 weightage)

### Part C (Essay Type Questions)

Answer any **two** questions.

Weight **5** each.

19. (a ) Obtain the maximum likelihood estimate for the mean vector  $\mu$  of  $N_p(\mu, \Sigma)$  (b) Let  $Y_1, Y_2, \dots, Y_n$  be a random sample from a multivariate normal distribution  $N_p(\mu, \Sigma)$ . Derive the distribution of sample mean vector  $\bar{Y}$
20. Describe test for equality of mean components. How is it related to one sample Hotellings  $T^2$
21. With the help of an example explain two way MANOVA.
22. Explain Cluster analysis. Write a short note on distance matrix and dendrogram used in cluster analysis.

(2×5=10 weightage)

