21P417 (Pages: 2) Name: ……………………..

Reg. No……………………..

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2023

(CBCSS-PG)

(Regular/Supplementary/Improvement)

CC19P MST4 C14 – MULTIVARIATE ANALYSIS

(Statistics)

(2019 Admission onwards)

Time: Three Hours Maximum: 30 Weightage

PART A

Answer any ***four*** questions. Each question carries 2 weightage.

1. Obtain the characteristic function of a multivariate normal distribution.
2. Show that all principal minors of a Wishart matrix is again Wishart.
3. Explain Mahalanobi's distance.
4. Give the orthogonal factor model with the underlying assumptions.
5. Distinguish between multiple correlation and canonical correlation.
6. State Cochran's theorem.
7. Describe sphericity test.

(4 × 2 = 8 Weightage)

PART B

Answer any ***four*** questions. Each question carries 3 weightage.

8. Establish the necessary and sufficient condition for the independence of two quadratic forms.
9. Derive the characteristic function of a Wishart matrix and hence derive its distribution.
10. Define principal component analysis. Explain how the principal components are extracted from the correlation matrix.
11. Derive Fisher's discriminant function for classification of two multivariate populations and the test for discrimination while discriminating between two populations.
12. Derive the density of the sample dispersion matrix.
13. Define partial correlation. With usual notations prove that $r_{12.3} = \frac{(r_{12} - r_{13}\, r_{23})}{\sqrt{(1-r_{13}^2)(1-r_{23}^2)}}$.
14. Derive the test criterion for testing independence of sets of variates, based on normal population.

(4 × 3 = 12 Weightage)

PART C

Answer any ***two*** questions. Each question carries 5 weightage.

15. (a) Let $X = \begin{pmatrix} X^{(1)} \\ X^{(2)} \end{pmatrix}$ be a p-variate multivariate Normal random vector. Obtain the necessary and sufficient condition for the independence of $X^{(1)}$ and $X^{(2)}$.

    (b) Show that $X \sim N_p(\mu, \sum)$ if and only if $T'X \sim N_1(T'\mu, T' \sum T)$ where T is any real vector.

16. Obtain Hotelling T^2 as a likelihood ratio criterion. Derive its distribution.

17. Obtain the MLE of μ and ∑ of a p-variate normal population. Hence obtain the MLE of the correlation coefficient ρ_{ij}.

18. Explain the problem of classification into one of the several multivariate normal populations with (i) common dispersion matrix and (ii) unequal dispersion matrices.

(2 × 5 = 10 Weightage)

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