**20P439** (Pages: 2) Name: ……………………..…...

Reg. No……………………..

**FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2022**

(CBCSS-PG)

(Regular/Supplementary/Improvement)

**CC19P MST4 C14 - MULTIVARIATE ANALYSIS**

(Statistics - Core Course)

(2019 Admission onwards)

Time: Three Hours Maximum: 30 Weightage

**PART A**

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

1. Derive the characteristic function of a non-singular multivariate normal distribution.
2. If $X \sim N_p(\mu, \Sigma)$ and if $\Sigma = \Delta$, a diagonal matrix then show that the components of $X$ are independently Normally distributed and conversely.
3. Distinguish between partial and multiple correlation.
4. Outline test of symmetry.
5. Obtain the relation between Mahalanobis$D^2$ and discriminant function.
6. Compare principal component analysis with factor analysis.
7. Explain Fisher linear discriminant function in the problem of classification.

**(4 × 2 = 8 Weightage)**

**PART B**

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

8. Derive the characteristic of the Wishart distribution and hence show that it is a matrix variate generalization of the $\chi^2$ distribution.
9. Derive the null distribution of the multiple correlation coefficient.
10. State and prove Cochran's theorem on quadratic forms.
11. If $X \sim N_p(0, I)$, then show that a quadratic form $X'AX$ and the linear form $B'X$ are independent if and only if $AB = 0$.
12. Show that $\bar{X}$ and A is independently distributed when sampling from a multivariate normal population.
13. Define canonical correlation. Obtain it as the roots of certain detrimental equation associated with covariance matrix.
14. Explain how do you classify an observation to one of two multivariate normal populations when the parameters are known.

**(4 × 3 = 12 Weightage)**

## PART C

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

15. Show that $X \sim N_p(\mu, \sum)$ if and only if $X = \mu + BG$ where $BB' = \sum$ and the rank of $B$ is m where $G \sim N_m(0, I)$.
16. What is generalized variance? Derive its distribution.
17. Describe Fisher- Behrens problem in the multivariate context and describe how the problem can be tackled.
18. What are principal components? Obtain the relation between principal components and eigen structure of the variance covariance matrix of multivariate normal vector.

**(2 × 5 = 10 Weightage)**

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