**D4AST2201** **(1 Page)** **Name.....**
**Reg.No.....**

**FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2024**
**(Regular/Improvement/Supplementary)**
**STATISTICS**
**FMST4C13 - MULTIVARIATE ANALYSIS**

**Time: 3 Hours** **Maximum Weightage: 30**

**Part A: Answer any *four* questions. Each carries *two* weightage.**

1. Define the singular multivariate normal distribution.
2. Obtain the characteristic function of a multivariate normal distribution.
3. Define canonical variates and canonical correlation.
4. State and prove the additive property of Wishart distribution.
5. Explain the classification problem with a suitable example.
6. Describe sphericity test.
7. Explain factor rotation.

**(4 × 2 = 8 weightage)**

**Part B: Answer any *four* questions. Each carries *three* weightage.**

8. Establish the necessary and sufficient condition for the independence of two quadratic forms.
9. What is generalized variance? Derive its distribution.
10. Describe Fisher-Behrens problem in the multivariate context and describe how the problem can be tackled.
11. What are principal components? Evaluate the principal components in $X^{'}= (x_1, x_2, x_3)$ with the covariance matrix $A = \begin{pmatrix} 2 & 0 & 1 \\ 0 & 2 & 2 \\ 1 & 2 & 4 \end{pmatrix}$.
12. 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 $G \sim N_m(0, I)$.
13. Derive the null distribution of the sample correlation coefficient.
14. Explain any one of the use of Hotelling's $T^2$ statistics.

**(4 × 3 = 12 weightage)**

**Part C: Answer any *two* questions. Each carries *five* weightage.**

15. State and prove the Cochran's theorem for the independence of quadratic forms and mention its applications.
16. Derive the maximum likelihood estimators of the parameters of a multivariate normal distribution.
17. Obtain likelihood ratio criterion for testing the independence of sub vectors of a multivariate normal vector. Discuss about its invariance property.
18. Explain the problem of classification of one of the two multivariate normal populations when the parameters are known.

**(2 × 5 = 10 weightage)**