TM211910TR

Reg. No :..............................

Name :..................................

**M. Sc. DEGREE (C.S.S.) EXAMINATION, NOVEMBER 2021**

**[ 2021 Admissions Regular and 2020 Admissions Improvement & Supplementary ]**

**SEMESTER I - CORE COURSE ( APPLIED STATISTICS AND DATA ANALYTICS )**

**ST1C03TM - ANALYTICAL TOOLS FOR STATISTICS**

**Time : 3 Hours** **Maximum Weight : 30**

## Part A

**I. Answer any Eight questions. Each question carries 1 weight** **(8x1=8)**

1. Define basis and dimension of basis.
2. Define norm of a vector.
3. State and prove completion theorem.
4. Explain row and column space of a matrix.
5. Show that every non-singular matrix is a product of elementary matrices.
6. Explain spectral representation of a real symmetric matrix.
7. State Cayley- Hamilton theorem.
8. Explain Moore Penrose inverse of a matrix.
9. Distinguish between unitary similarity and Orthogonal similarity.
10. Distinguish between positive definite matrix and positive semi definite matrix.

## Part B

**II. Answer any Six questions. Each question carries 2 weight** **(6x2=12)**

11. Show that a non-singular matrix is a product of elementary matrices.
12. Examine the linear independence of the vectors ( 2, 1, 4), (0, 1, 4), (6, -1, 14).
13. Solve the linear system of equations, x+y+z = 0, 2x-y+z = 0, 3x+2z = 0.
14. Find the inverse of the matrix by elementary transformation. $A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 1 \\ 2 & 0 & 1 \end{bmatrix}$.
15. Show that if $\lambda$ is a characteristic root of A the $\lambda^k$ is a characteristic root of $A^k$.
16. Using Cayley –Hamilton theorem obtain the inverse of the matrix $\begin{bmatrix} 6 & -2 & 0 \\ -2 & 3 & 0 \\ 0 & 0 & 2 \end{bmatrix}$.
17. If A is a real symmetric matrix, the show that |A| is the product of characteristic root and trace (A) is the sum of characteristic roots.
18. Reduce the quadratic form to the canonical form. Also give the linear transformation. $x^2+2xy+2y^2-xz+z^2$.

## Part C

**III. Answer any Two questions. Each question carries 5 weight** **(2x5=10)**

19. 1. Find the non-singular matrices P and Q such that $PAQ = \begin{bmatrix} I_r & 0 \\ 0 & 0 \end{bmatrix}$ where $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 1 & 1 \\ 1 & 2 & -1 \\ 2 & 3 & 0 \end{bmatrix}$

20. State and prove Rank-Nullity theorem.

21. State and prove Jacobi's theorem.

22. Examine the definiteness of the quadratic form $6x^2 + 3y^2 + 14z^2 + 4yz + 18xz + 4xy$ after reducing it to its canonical form.