MSc DEGREE EXAMINATION MAY 2026
(First Semester)

Branch- **STATISTICS**

REAL ANALYSIS AND LINEAR ALGEBRA

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Question No.	Question	K Level	CO
1	The infimum of the set $\{1/n : n \in N\}$ is: (a) 0 (b) 1 (c) ∞ (d) -1	K1	CO1
2	Every convergent sequence is: (a) Bounded (b) Divergent (c) Monotonic (d) not monotonic	K2	CO1
3	If $f(x) = \sin x$, then $f'(x) = ?$ (a) $\cos x$ (b) $-\cos x$ (c) $-\sin x$ (d) 1	K1	CO2
4	A function f(x) is continuous at x = a if: (a) f(a) = 0 (b) lim f(x) = f(a) (c) f(x) → ∞ (d) f(x) = 0	K2	CO2
5	The Riemann integral of f(x)=1 on [0,1] is: (a) 0 (b) ½ (c) 1 (d) ∞	K1	CO3
6	If $f(x) = x^2$, then the Riemann integral of f(x) over [0,2] is: (a) 2 (b) 8/3 (c) 4 (d) 2/3	K2	CO3
7	The null space of a linear transformation T consists of all vectors: (a) Mapped to zero (b) Mapped to identity c) Mapped to non-zero (d) mapped to one	K1	CO4
8	The Gram-Schmidt process is used to: (a) Find determinant (b) Orthogonalize vectors c) Find eigenvalues (d) Invert matrix	K2	CO4
9	If A is a 2X2 matrix with determinant ≠0, then A is: (a) Not invertible (b) Invertible c) Singular (d) Nilpotent	K1	CO5
10	A quadratic form is positive definite if: (a) All eigenvalues positive (b) All eigenvalues negative c) At least one eigenvalue zero (d) both positive & negative	K2	CO5

Cont…

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Question No.	Question	K Level	CO
11.a.	State and prove the Bolzano–Weierstrass theorem.	K2	CO1
	(OR)		
11.b.	Explain the properties of uniform convergence.		
12.a.	State and prove Mean Value Theorem for differentiable functions.	K3	CO2
	(OR)		
12.b.	Find local maxima and minima of $f(x,y) = x^2 + y^2 - 4x - 2y + 6$.		
13.a.	Explain Riemann integral. Also state its properties.	K5	CO3
	(OR)		
13.b.	Explain the properties of Riemann – Stieltjes integral.		
14.a.	Apply Gram–Schmidt process to orthogonalize $\{(1,1,1), (1,1,-1)\}$ in $\mathbb{R}^3$.	K3	CO4
	(OR)		
14.b.	Define vector space. Show that the set of all 2×2 matrices forms a vector space under matrix addition and scalar multiplication.		
15.a.	Determine the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$.	K5	CO5
	(OR)		
15.b.	State the properties of G-inverse.		

SECTION –C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Question No.	Question	K Level	CO
16	Explain point-wise and uniform convergence of a sequence of functions. Also prove that uniform limit of continuous functions is continuous.	K2	CO1
17	State and prove the Mean Value Theorem for two variables and illustrate with an example.	K3	CO2
18	State and prove the Fundamental Theorem of Integral Calculus.	K4	CO3
19	Explain linear transformation. Find the matrix linear transformation $T:R^2 \to R^2$ given by $T(x,y) = (X+2y, 3x+y)$.	K5	CO4
20	Reduce the quadratic form $2x_1^2 + x_2^2 + x_3^2 + 2x_1x_2 - 2x_1x_3 - 4x_2x_3$ to canonical form through an orthogonal transformation.	K5	CO5

Z-Z-Z END