K25U 2367

Reg. No. : ....

Name : ....

V Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, November 2025
(2019 to 2023 Admissions)
CORE COURSE IN STATISTICS
5B06 STA : Mathematical Methods for Statistics – I

Time : 3 Hours Max. Marks : 48

*Instruction : Use of calculator and **Statistical** tables are permitted.*

PART – A

Answer **all** questions. **(6×1=6)**

1. What are monotonic sequences ?
2. Define limit supremum.
3. Evaluate $\lim_{x \to 0} \frac{|x|}{x}$.
4. State Lagrange's mean value theorem.
5. What is Raabe's test for a series ?
6. Define uniform continuity of a function.

PART – B

Answer **any 7** questions. **(7×2=14)**

7. Show that every convergent sequence is bounded.
8. Prove or disprove $f(x) = |x|$ is differentiable at origin.
9. Show that absolutely convergent series is convergent.

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10. Show that the series $\sum_{n=1}^{\infty} \frac{1}{n}$ diverges.
11. Establish every monotonic sequence bounded above converges.
12. Prove that a necessary condition for convergence of infinite series Σu_n is $\lim_{n \to \infty} u_n = 0$.
13. Mention different types of continuity.
14. Show that every real convergent sequence is Cauchy.
15. Define the continuity of a function. Determine whether the function $f(x) = \begin{cases} x^2 - 1, & x < 2 \\ 3, & x = 2 \\ x + 1, & x > 2 \end{cases}$ is continuous at $x = 2$.

PART – C

Answer **any 4** questions. **(4×4=16)**

16. Verify Rolle's theorem for $f(x) = x^2 - 4x + 3$ on the interval [1, 3].
17. Show that the function $f(x) = x^2$ is not uniformly continuous on R. When it is uniformly continuous ?
18. Test the convergence of the following series :

 a) $\sum_{x=1}^{\infty} \frac{1}{x^4 + 1}$

 b) $\sum_{x=1}^{\infty} \frac{1}{e^x}$
19. State comparison test for a series. Show that $0 \le a_n \le b_n$ for all n and Σb_n converges, then Σa_n also converges.
20. Show that the infimum of a non-empty set if exists is unique.
21. What is D'Alembert's ratio test ?

PART – D
(Long Essay)

Answer **any 2** questions. **(2×6=12)**

22. State and prove Taylor's theorem.
23. Define alternating series. State and prove Leibnitz test for convergence of series.
24. Prove that a non-empty subset S of real numbers which is bounded below has a greatest lower bound.
25. Prove that every bounded sequence in R has a convergent subsequence.

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