



K24U 2751

Reg. No. :

Name :

V Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/ Supplementary/
Improvement) Examination, November 2024
(2019 to 2022 Admissions)
CORE COURSE IN MATHEMATICS
5B06 MAT : Real Analysis – I

Time : 3 Hours

Max. Marks : 48

PART – A

Answer **any 4** questions from this Part. Each question carries 1 mark. (4×1=4)

1. State trichotomy property of \mathbb{R} .
2. Give an example of a nonempty subset of \mathbb{R} which has a supremum but no infimum.
3. Define limit of a sequence.
4. Find the values of p for which $\sum_{n=1}^{\infty} \frac{1}{n^p}$ diverges.
5. State sequential criterion for continuity.

PART – B

Answer **any 8** questions from this Part. Each question carries 2 marks. (8×2=16)

6. Find all real numbers x that satisfy $x^2 > 3x + 4$.
7. If $a, b \in \mathbb{R}$, prove that $|a + b| \leq |a| + |b|$.
8. Let $S = \left\{ 1 - \frac{(-1)^n}{n} : n \in \mathbb{N} \right\}$. Find $\inf S$ and $\sup S$.
9. Prove that a sequence \mathbb{R} can have at most one limit.

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10. Use the definition of the limit of a sequence to prove that $\lim \left(\frac{3n+2}{n+1} \right) = 3$.
11. State and prove Bolzano Weierstrass theorem.
12. State and prove a necessary condition for the convergence of a series.
13. Using comparison test prove that the series $\sum_{n=1}^{\infty} \frac{1}{n^2+n}$ converges.
14. State Raabe's test.
15. Determine the points of continuity of the function $f(x) = [x]$.
16. Let $A \subseteq \mathbb{R}$, let f and g be functions on A to \mathbb{R} . Suppose $c \in A$ and that f and g are continuous at c . Prove that $f g$ is continuous at c .

PART - C

Answer **any 4** questions from this Part. **Each** question carries **4** marks each. **(4×4=16)**

17. State and prove Bernoulli's inequality.
18. Prove that $\lim(n^{1/n}) = 1$
19. If $X = (x_n)$ is a bounded increasing sequence, prove that $\lim(x_n) = \sup\{x_n : n \in \mathbb{N}\}$.
20. State and prove monotone subsequence theorem.
21. State and prove limit comparison test.
22. State integral test. Using this test discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{1}{n^p}$.
23. Prove that Thomae's function is continuous precisely at the irrational points on $A = \{x \in \mathbb{R} : x > 0\}$.

PART - D

Answer **any 2** questions from this Part. **Each** question carries **6** marks. **(2×6=12)**

24. State and prove nested interval property.
 25. Prove that a sequence of real numbers is convergent if and only if it is a Cauchy sequence.
 26. State and prove alternating series test.
 27. State and prove maximum minimum theorem.
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