Reg. No .... Name **25U562**

B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2025

SEMESTER 5 : COMPUTER APPLICATION

COURSE : 19U5CRCMT6 : MATHEMATICAL ANALYSIS

(For Regular 2023 Admission and Supplementary 2022/ 2021/ 2020 / 2019 Admissions)

Time : Three Hours Max. Marks: 75

PART A

Answer any 10 (2 marks each)

1. Find the inverse of $\left(-8-\mathrm{i}8\sqrt{3}\right)$
2. Give examples of sets which are (i) bounded (ii) unbounded.
3. a) Define monotonic sequence with an example
   b) Define Cauchy sequence.
4. a) Define deleted neighbourhood of a point with an example.
   b) Give an example of a set which is neither open nor closed.
5. Find the multiplicative inverse of $2+i\sqrt{3}$.
6. Define the derived set of a set S. Obtain the derived set of the open interval (a,b).
7. Find the infimum and supremum of the set $\left\{2+\frac{1}{n};\ n\in\mathbb{N}\right\}$.
8. Find the limit inferior and limit superior of the sequence $\{a_n\}$ where $a_n=Sin\frac{n\pi}{3};n\in\mathbb{N}$.
9. Verify that 3+i3-i15+i110=2+i.
10. Show that the sequence $\{S_n\}$, where
    $S_n=1+\frac{1}{2}+\frac{1}{3}+\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots+\frac{1}{n}$ cannot converge.
11. Show that $(0,1)$ is open not closed
12. Prove that a set cannot have more than one supremum.

(2 x 10 = 20)

PART B

Answer any 5 (5 marks each)

13. Show that the sequence $\{S_n\}$, where
    $S_n=\left(1+\frac{1}{n}\right)^n,\ is\ convergent\ and\ that\ the\ lim\ \left(1+\frac{1}{n}\right)^n\ lies\ between\ 2\ and\ 3.$
14. Prove that the intersection of any finite number of open sets is open.
15. Show that if a set S is bounded then so is its closure $\widetilde{S}$.
16. Find the principal argument of
    (a) $\frac{\mathrm{i}}{-2-2\mathrm{i}}$
    (b) $\left(\sqrt{3}-\mathrm{i}\right)^6$
17. State and prove Cauchy's second theorem on limits.
18. Prove that the order completeness property of real numbers implies Dedekind's property.
19. Find $(1)^{1/6}$.
20. Let A,B ⊆ **R** such that A ⊆ B. Show that Sup A ≤ Sup B

(5 x 5 = 25)

PART C
Answer any 3 (10 marks each)

21. Prove that every infinite bounded set has a limit point

22. a) If $\{a_n\}$ be a sequence, such that $lim \frac{a_{n+1}}{a_n} = l,\ where\ |l| < 1,\ then\ prove\ that\ lim\ a_n = 0.$

    b) Prove that a monotonic sequence is convergent if and only if it is bounded.

23. Prove that a sequence is convergent if and only if it is bounded and has a unique limitpoint.

24. (a) Show that the real number field is Archimedean.

    (b) Prove that every open interval (a,b) contains a rational number.

(10 x 3 = 30)