



Seat No. : \_\_\_\_\_

# NF-125

November-2025

B.Sc., Sem.-V

**DSC-C-MAT-351 (Major) : Mathematics**

**(Real Analysis-01)**

**(As per NEP 2020)**

**Time : 2:00 Hours]**

**[Max. Marks : 50**

- Instructions :** (1) All questions are compulsory and carry equal marks.  
(2) Figures to the right indicate marks of the questions / sub-questions.

1. (a) State and prove first Archimedean Property. **5**

1. (b) If  $\emptyset \neq A \subset \mathbb{R}$  is finite, then an upper bound of A belongs to A. **5**

**OR**

1. (a) State and prove Triangle Inequality for Real Numbers. **5**

1. (b) Prove that  $A = \{x \in \mathbb{R} : |x - a| = |x - b|\}$  (where  $a \neq b$ ) =  $\{\frac{a+b}{2}\}$ . **5**

2. (a) State and prove Sandwich Lemma. **5**

2. (b) Discuss the convergence of sequence  $(n^{\frac{1}{n}})$ . **5**

**OR**

2. (a) Prove that a Real sequence is Cauchy iff it is Convergent. **5**

2. (b) Discuss the convergence of sequence  $a_n = \sqrt{n+1} - \sqrt{n}$ . **5**

3. (a) Let g be continuous at c and f be continuous at g(c). Then  $f \circ g$  is Continuous at c. **5**

3. (b) Verify the function  $f(x) = \frac{x-1}{x-2}$  is Uniform Continuous on  $[0, \infty)$ . **5**

**OR**

3. (a) State and prove Intermediate Value Theorem. 5  
3. (b) Determine whether the following function is Continuous :

$$f(x) = \begin{cases} x, & x \text{ is rational} \\ \frac{1}{x}, & x \text{ is irrational} \end{cases} \quad 5$$

4. (a) State and prove Comparison test. 5  
4. (b) Prove the series  $\sum \frac{1}{(n+2) \log (n+2)}$  is convergent. 5

**OR**

4. (a) State and prove Cauchy Condensation Test. 5  
4. (b) Find the sum of  $\sum_1^{\infty} \frac{n}{n^4 + n^2 + 1}$ . 5

5. Answer any **ten** in short : 10

- (1) Define : Least Upper bound of a set.
  - (2) Define : Interval of a set.
  - (3) Define : Monotone Sequence.
  - (4) Define : Sub Sequence.
  - (5) Define : Cauchy Sequence.
  - (6) State Nested Interval theorem.
  - (7) Define : Absolute convergent series.
  - (8) State Cauchy Root test.
  - (9) State Integral test.
  - (10) Define : Uniformly Continuous function.
  - (11) State Extreme Value Theorem.
  - (12) Define Bounded Above set.
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