CLASS: IMSC   SEMESTER : 1ST
BRANCH: MATHEMATICS & COMPUTING   SESSION : MO/2024

SUBJECT: MA102 REAL ANALYSIS

TIME: 02 Hours   FULL MARKS: 25

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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			CO	BL
Q.1(a)	State Completeness property of $\mathbb{R}$. Give one example.	[2]	CO1	1
Q.1(b)	Let A be a non-empty subset of $\mathbb{R}$, bounded above and $B = \{-x : x \in A\}$. Prove that the set B is bounded below and $\inf B = -\sup A$.	[3]	CO1	2
Q.2(a)	Find the limit point/points of the set $S = \left\{\frac{(-1)^m}{m} + \frac{1}{n} : m, n \in \mathbb{N}\right\}$. Justify.	[2]	CO1	2
Q.2(b)	Prove that the set $S = \{x \in \mathbb{R} : 2x^2 - 5x + 2 > 0\}$ is an open set.	[3]	CO1	2
Q.3(a)	Prove that the sequence $a_n = \frac{1}{\sqrt{n+1} + \sqrt{n}}$ is monotonic.	[2]	CO2	2
Q.3(b)	Prove that a monotone decreasing sequence, if bounded below, is convergent and converges to its greatest lower bound.	[3]	CO2	3
Q.4(a)	Examine the convergence/divergence of the sequence $\left\{\frac{n}{3^n}\right\}$.	[2]	CO2	2
Q.4(b)	Prove that every convergent sequence is a Cauchy sequence.	[3]	CO2	3
Q.5(a)	State D'Alembert ratio test.	[2]	CO3	1
Q.5(b)	Using the limit comparison test, check whether the series $\sum \left(\frac{1}{n^3 + 5n + 4}\right)$ is convergent or divergent.	[3]	CO3	2

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