No. of Printed Pages : 2

MST–011

M. SC. (APPLIED STATISTICS)
(MSCAST)
Term-End Examination
June, 2025

MST-011 : REAL ANALYSIS, CALCULUS AND GEOMETRY

Time : 2 Hours *Maximum Marks : 25*

Note : *Question No.* ***1*** *is compulsory. Attempt any* ***two*** *questions from the remaining Question Nos.* ***2*** *to* ***4****. Non-programmable/scientific calculator is allowed. Symbols have their usual meanings.*

1. (a) If directional cosines of a line in 3-D are $<\frac{2}{7},\frac{3}{7},\frac{6}{7}>$, then how much distance will be travelled along the direction of first axis when you move one unit distance from origin along this line ? 2

(b) Write *one* application of sigmoid logistic function. 1

(c) Discuss the convergence of the sequence $< \frac{n}{n+1} >$. 2

2. If $f : [0,5] \to \mathbf{R}$ be a function defined by $f(x) = x^2 + x + 1$, $x \in [0,5]$, then using definition 1 and definition 2, show that f is Riemann integrable and $\int_0^5 f(x)\,dx = \frac{355}{6}$. 10

3. If $S \subseteq \mathbf{R}^n$ is a convex set and $f : S \to \mathbf{R}$, then f is a convex function on S if and only if epigraph of the function f is a convex set. 10

4. (a) Change the order of the summations. 5

$$\sum_{\substack{i=1 \\ i \geq j}}^{\infty} \sum_{j=1}^{i} a_{ij}$$

Give proper explanation of the steps used by you in this process.

(b) Test the convergence of the series : 5

$$\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n}$$

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