

**M. SC. (APPLIED STATISTICS)  
(MSCAST)**

**Term-End Examination**

**June, 2024**

**MST-011 : REAL ANALYSIS, CALCULUS  
AND GEOMETRY**

*Time : 2 Hours*

*Maximum Marks : 25*

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**Note :** (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **two** questions from question nos. 2 to 4.*

(iii) *Non-programmable scientific calculator is allowed.*

(iv) *Symbols have their usual meanings.*

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1. (a) Is the sequence  $\langle \frac{1}{n} \rangle$  a Cauchy sequence? Justify your answer. 2
- (b) Find the equation of a line passing through the points (2, 3) and (4, 7). Also find the coordinates of a point on this line which is 1000 units away from the point (2, 3) in the direction opposite to the point (4, 7). 2

**P. T. O.**

- (c) Are the sets A and B equivalent, where : 1

$$A = \{1, 4, 9, 16, 25, \dots\}$$

$$B = \{10, 20, 30, 40, \dots\}$$

2. (a) If  $\Omega = \{HH, HT, TH, TT\}$ , then what is the smallest  $\sigma$ -field containing the set  $E = \{TH\}$  ? 2

- (b) Define characteristic, simple and step functions. Give *one* example for each. 6

- (c) Test the convergence of the series

$$\sum_{n=1}^{\infty} \sqrt{\frac{3n+5}{2n}}. \quad 1$$

- (d) Find Chebyshev distance between points  $A(5, 2)$  and  $B(2, 7)$ . 1

3. (a) State and prove Cauchy-Schwartz inequality. 3

- (b) Write six unit vectors which are perpendicular to each other, it exists. 1

- (c) Solve the given inequations graphically and represent the solution set by shaded region : 3

$$x + 2y - 2 \geq 0,$$

$$5x - 4y - 10 \leq 0$$

$$2x - 3y + 3 \geq 0.$$

(d) Define each of the following and also give *one* example of each : 3

(i) Linear combination

(ii) Affine combination

(iii) Conic combination

4. (a) Explain graphically whether the function :

$$f : \left[ \frac{\pi}{2}, \frac{5\pi}{2} \right] \rightarrow [-1, 1]$$

$$\text{defined by } f(x) = \cos x, x \in \left[ \frac{\pi}{2}, \frac{5\pi}{2} \right]$$

is convex or concave or both or none of them. 3

(b) Prove that : 2

$$\sqrt{\frac{1}{2}} = \sqrt{\pi}.$$

(c) Using  $\Sigma$  and  $\delta$  definition, show that : 3

$$\lim_{x \rightarrow 5} (4x - 8) = 12.$$

(d) Define each of the following : 2

(i) Minkowski distance

(ii) Manhattan distance

Also, give *one* example of each.