

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

**Term-End Examination
December, 2025**

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

Time : 2 Hours

Maximum Marks : 25

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.*

1. (a) If we have two sets A and B, where $n(A) = 10$ and $n(B) = 12$, then how many functions from set A to set B are possible ? 1

- (b) Is the sequence $\left\langle \frac{n}{n+1} \right\rangle$ bounded? 1
- (c) Solve for $x : 7 - 5x \geq -5, x \in \mathbf{R}$. 2
- (d) Find the value of $B(4, 5)$, where $B(m, n)$ represents beta function with parameters m and n . 1
2. (a) State and prove the relation between beta and gamma functions. 5
- (b) Evaluate the following integral : 5
- $$\int_0^8 \left(\int_0^{\frac{40-5x}{8}} (2x+2y) dy \right) dx$$
- using change of order of integration.
3. (a) Test the convergence of the series : 5
- $$\frac{x}{4.5} + \frac{x^2}{7.10} + \frac{x^3}{10.15} + \frac{x^4}{13.20} + \dots$$
- (b) State and prove fundamental theorem of calculus. 5
4. (a) Prove that the square formed by four lines $x + y = 1, x - y = 1, -x + y = 1, x + y = -1$ is not a convex set. 2

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- (b) Evaluate the following integral using properties of beta and gamma functions :

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$$\int_0^{\infty} \frac{1}{1+x^4} dx$$

- (c) If $f : [0,5] \rightarrow \mathbf{R}$ be a function defined by $f(x) = 2x + 3$, $x \in [0,5]$, show that f is Riemann integrable.

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