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MST-001

**POST GRADUATE DIPLOMA IN
APPLIED STATISTICS (PGDAST)**

Term-End Examination

June, 2024

**MST-001 : FOUNDATION IN MATHEMATICS AND
STATISTICS**

Time : 3 Hours

Maximum Marks : 50

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

(ii) *Attempt any **four** questions from the remaining Question Nos. 2 to 7.*

(iii) *Use of scientific calculator (non-programmable) is allowed.*

(iv) *Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.*

(v) *Symbols have their usual meanings.*

P. T. O.

1. State whether the following statements are true *or* false. Give reasons in support of your answer : 5×2=10

(a) If $A = \{a, b, c\}$, then possible subsets of A are $\phi, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}$.

(b) The sequence $e^{x/y}, e^{2x/y}, e^{3x/y}, e^{4x/y}$ form an Arithmetic Progression.

(c) The function $f(x) = x^3 + x^4$ is an odd function.

(d) $\int_3^4 x^a dx = [4^{a+1} - 3^{a+1}] / (a+1)$.

(e) The data published by Central Statistical Organization and National Sample Survey Organization are sources of the primary data.

2. (a) Show the the set $\{4, 16, 64, 256, \dots\}$ is an enumerable set. 2

(b) Find the value of : 4

$$8^{1/3} \cdot 8^{1/6} \cdot 8^{1/12} \cdot 8^{1/24} \dots \dots \dots \text{to } \infty$$

(c) Explain $\left(x^2 + \frac{1}{x^2}\right)^4$ by binomial theorem. 4

3. (a) Solve the following system of equations using Cramer's rule : 4

$$x - 2y = -4$$

$$3x - 6y = -12$$

- (b) Prove that : 4

$$\begin{vmatrix} bc & 1 & a(b+c) \\ ca & 1 & b(c+a) \\ ab & 1 & c(a+b) \end{vmatrix} = 0$$

- (c) If : 2

$$A = \begin{bmatrix} 3 & 5 \\ -2 & 4 \end{bmatrix},$$

show that $\frac{1}{2}(A - A')$ is skew-symmetric.

4. (a) Define primary data. Also, discuss *four* techniques commonly used to collect it.

4

- (b) Find the derivative of the exponential function $f(x) = e^{bx+c}$ by using first principle. 4

- (c) Evaluate : 2

$$\int \frac{2x}{(1+x^2) \log(1+x^2)} dx.$$

5. (a) Find the values of a and b , if the following function f is continuous at $x=3$: 4

$$f(x) = \begin{cases} 5 & ; \quad x < 3 \\ ax + b & ; \quad x > 3 \\ a + 3 & ; \quad x = 3 \end{cases}$$

- (b) Find local maximum and minimum values of the function : 4

$$g(x) = 4x^3 - 21x^2 + 18x + 9$$

- (c) Draw a stem-and-leaf plot for the following data : 2

51, 52, 32, 37, 23, 48, 56, 47, 69, 33, 65, 64, 35, 26, 36, 71

6. (a) Represent the following data with the help of suitable diagram : 4

		Year		
		2017-18	2018-19	2019-20
Category	Gross Income (₹)	430	460	420
	Gross Expenditure (₹)	400	430	390
	Net Income (₹)	150	160	165
	Tax (₹)	170	145	180

- (b) Prove that : 3

$${}^n C_r + {}^n C_{r-1} = {}^{n+1} C_r.$$

- (c) Draw a frequency polygon for the following frequency data : 3

Class Interval	Frequency
40—50	5
50—60	10
60—70	13
70—80	20
80—90	14
90—100	11
100—110	4

7. (a) The following data represents the number of hospital's visits in a year by 10 employees of a company in 10 years. Draw a box plot for this hospital visits data : 5

7, 5, 7, 12, 13, 5, 1, 9, 8, 5

- (b) Identify and give reasons, which scale is to be used in the classification of doctors of India based on their : 5

- (i) Gender
- (ii) Designation
- (iii) Weight
- (iv) Age
- (v) Performance