

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

Term-End Examination

June, 2021

**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 questions no. 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 meaning.
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- 1.** State whether the following statements are *True* or *False*. Give reasons in support of your answers. 5×2=10

- (a) The sequence $\log(a)$, $\log\left(\frac{a^2}{b}\right)$, $\log\left(\frac{a^3}{b^2}\right)$, ...
forms an A.P.

(b) If $f(x) = \begin{cases} 2 - x^2, & x \neq 0 \\ 2, & x = 0 \end{cases}$, then $\lim_{x \rightarrow 0} f(x)$ is

zero.

(c) If a researcher collects the data on birth place of Chief Ministers of each State of India, then the data thus obtained comes under ordinal scale.

(d) If various components of a variable are to be presented in a single diagram, then multiple bar diagram is a suitable diagram in this situation.

(e) The number of ways in which 4 students stand in a queue is 24.

2. (a) If $A = \{1, 3, 5, 6, 7\}$, $B = \{5, 6, 7, 8\}$ and $C = \{1, 5, 7, 8\}$ are subsets of the universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$, then verify the De Morgan's laws and Distributive laws. 4

(b) How many different number plates of vehicles are possible using two different letters of the English alphabet followed by four different digits 0 to 9 such that the last digit should be even. 2

- (c) Find the sum of the sequence for first 1001 terms. 2

$$5, 5 + \sqrt{3}, 5 + 2\sqrt{3}, 5 + 3\sqrt{3}, 5 + 4\sqrt{3}, \dots$$

- (d) Derive the formula for the sum of first n terms of a G.P. 2

- 3.** (a) Categorise each of the following as either nominal, ordinal, interval or ratio measurement. Justify your classification. 5

(i) Evaluation of a teacher from a scale of one to ten.

(ii) The number of visitors of 16 local museums were recorded on a given day.

(iii) Ten managers were asked what brand of car they drive.

(iv) Weights of newborn babies.

(v) Categorising people according to their national origin.

- (b) Before admission in Ph.D. programme of Statistics in IGNOU, the students have to take Basic Skills Test in Fundamentals of Statistics. In one such exam, 30 students appeared in the test. Their scores are recorded below out of a total maximum of 30 points.

15	12	15	22	28	30	19	25	24	28
10	15	16	20	26	22	18	20	27	14
12	19	21	18	19	30	13	10	21	24

- (i) Enumerate the steps you would take to convert this data into a frequency distribution. What class interval size would you decide and why?
- (ii) Construct a frequency distribution for the above data with a suitable class interval and suitable number of classes. Also construct less than and more than cumulative frequency distribution.

5

4. (a) If $f(x) = \begin{cases} x & 0 \leq x < \frac{1}{2} \\ \frac{1}{2} & x = \frac{1}{2} \\ 1 - x & \frac{1}{2} < x \leq 1, \end{cases}$

check the continuity of $f(x)$ at $x = \frac{1}{2}$. 3

- (b) Show that

$$\frac{d}{dx} \left[\log \sqrt{\frac{x-1}{x+1}} \right] = \frac{1}{x^2 - 1}. \quad 3$$

- (c) Give an example of a function which is continuous at a point but not differentiable at that point. 4

5. (a) The following data represent the amount of insurance (in 10,000) purchased by 23 people from an insurance company in a given week :
30, 42, 50, 33, 75, 82, 110, 55, 58, 62, 85, 45, 47, 65, 90, 95, 92, 120, 100, 105, 120, 30, 130
Construct a box plot for this data. 5

- (b) A person earns a net salary of ₹ 24,000 per month. His family expenses are budgeted each month as follows :

Item	Expenditure (in ₹)
Rent	6,000
Food	5,000
School Fees	3,000
Clothing	3,000
Others	4,500
Savings	2,500

Construct a suitable diagram for the data. 5

6. (a) Write different methods of collecting primary data. Describe any one of them. 3
- (b) Show that matrix

$$A = \begin{bmatrix} 2 & 5 & 8 \\ 6 & 2 & 4 \\ 8 & 4 & 5 \end{bmatrix} \text{ is not a symmetric matrix. } 1$$

- (c) Solve the following system of equations using technique of matrix : 4

$$x + y + 2z = 4$$

$$x - y + 3z = 3$$

$$2x + 2y + 4z = 7$$

- (d) Without expanding, prove that

$$\begin{vmatrix} ab & 1 & c(a+b) \\ bc & 1 & a(b+c) \\ ca & 1 & b(c+a) \end{vmatrix} = 0. \quad 2$$

7. (a) Evaluate the following : 4

(i) $\lim_{x \rightarrow \infty} \frac{3x^2 + 5x - 10}{8x^2 - 3x + 9}$

(ii) $\lim_{x \rightarrow 2} \frac{\sqrt{3+x} - \sqrt{5}}{x-2}$

- (b) Define one-one and onto functions with examples. 3

- (c) Prove that $2^{1/4} \cdot 2^{1/8} \cdot 2^{1/16} \dots \text{to } \infty = \sqrt{2}$. 1

- (d) Define enumerable set and give one example. 2

