Seat No. : _____

FH-102

February-2025

B.B.A., Sem.-I

MDC-BMT-114 : Business Mathematics

Time : 2:00 Hours] **[Max. Marks : 50**

Instructions : (1) Figures on right indicate marks.
(2) Use of simple calculator is allowed.

1. (A) Define the following terms with example : **5**
   (1) Finite Set
   (2) Equivalent Sets
   (3) Power Set
   (4) Null Set
   (5) Singleton Set

   (B) If P = {a, b}, Q = {b, c}, R = {c, d} and S = {d, e}, then verify that
   $(P \cap Q) \times (R \cap S) = (P \times R) \cap (Q \times S)$ **5**

OR

1. (A) If U = $\{x/x \in N, x \leq 10\}$; **5**
   A = $\{x/x \in N, x^2 < 10\}$;
   B = {2, 4, 6};
   C = $\{x/x^3 - 3x^2 - 4x = 0\}$; then
   find $(A \cap B) - (A \cap C)$ and A' – B'

   (B) In a cultural festival, there are 120 participants showcasing their language skills. 50 participants can speak Haryanvi, 45 can speak Gujarati, 70 can speak Punjabi, 12 participants can speak both Haryanvi and Gujarati, 20 can speak both Gujarati and Punjabi, 18 can speak both Haryanvi and Punjabi, 8 participants can speak all three languages: Haryanvi, Gujarati, and Punjabi. Find (1) How many participants can speak only one language ? (2) How many participants can speak two or more languages ? **5**

2. (A) Solve the following : (Any **two**) **5**

(1) $\lim_{x \to 2} \frac{x^2 + 3x + 9}{x^2 + 9x + 3}$

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

(3) $\lim_{x \to \infty} \left(1 + \frac{1}{3x}\right)^x$

(B) A bakery produces customized cakes, and the cost of producing x cakes is given by $C(x) = 15x + 120$, where x is the number of cakes. If it is known that 8 cakes can be sold daily, what price per cake should be charged to ensure no loss ? **5**

OR

2. (A) Solve the following : (Any **two**) **5**

(1) $\lim_{x \to 0} \left[\frac{1}{x}\left(\frac{2x+9}{x+3} - 3\right)\right]$

(2) $\lim_{n \to \infty} \frac{n^2 + 5n + 6}{(n+4)(n+9)}$

(3) $\lim_{x \to 0} \frac{a^{5x} + a^{2x} - 2}{x}$

(B) A factory manufactures handcrafted wooden tables. The fixed costs (e.g., rent, salaries, and equipment) are ₹ 80,000, and the variable cost for producing each table (e.g., wood, polish, and labour) is ₹ 100. Each table is sold for ₹ 150. Determine the cost function, revenue function, and find the break-even point, i.e., the number of tables that need to be sold for no profit or loss. **5**

3. (A) Explain the rules of differentiation for addition, subtraction, multiplication, and division, and include a discussion on the chain rule. **5**

(B) Do as directed : (Any **Two**) **5**

(1) If $y = x^7 + 7x^3 - 5x + 7$, find $\frac{dy}{dx}$

(2) If $y = x.\ \log x$, find $\frac{d^2y}{dx^2}$

(3) If $y = \log (e^x . e^e)$, find $\frac{dy}{dx}$

OR

3. (A) Using definition find the derivative of $y = \frac{1}{x}$. **5**

(B) Do as directed : (Any **two**) **5**

(1) If $y = \frac{3x+5}{5x+3}$, find $\frac{dy}{dx}$

(2) If $y = e^x . a^3$, find $\frac{d^2y}{dx^2}$

(3) $y = 4^{3x^3 + 5x + 2}$, find $\frac{dy}{dx}$

4. (A) Prove that Elasticity of Demand $\eta = \frac{AR}{AR - MR}$. **5**

(B) If the cost function for producing x units is $C = \frac{1}{50}x^2 - 8x + 8$, prove that the cost is minimum when 200 units are produced. **5**

OR

4. (A) The following are demand and cost function of a commodity for a monopolist. **5**

$x = \frac{100 - p}{3}$ (demand function)

$C = 5x^2 + 4x$ (cost function)

find the production for maximum profit.

(B) The demand law of a commodity is $x = 38 - \sqrt{p}$. Find elasticity of demand when price is 169 units. **5**

5. State whether the statement is **True** or **False** : (Any **Ten**) **10**

(1) A set can have duplicate elements.

(2) If A = {1, 2} and B = {a, b}, then A × B = {(1, a), (2, b)}.

(3) The intersection of two sets in a Venn Diagram is represented by the region outside the circles.

(4) Set A is having name of students and Set B is having their roll number; is an example of Many One Function.

(5) $\sum n^3 = \frac{n^4 + 2n^3 + n^2}{4}$

(6) $h(x) = 5, x \in N$; is a constant function.

(7) If $y = \sqrt{x}$; then $\frac{dy}{dx} = \frac{x^{-\frac{1}{2}}}{2}$

(8) If $y = x^{-1}$; then $\frac{dy}{dx} = -\frac{1}{x^2}$

(9) The aim of a monopolist is to get maximum profit.

(10) By definition, derivative of any constant term is 1.

(11) Derivative of a demand function is positive.

(12) Demand function and Average Revenue are always equal.