Seat No. : _____

AR-104

April-2024

B.Com., Sem.-II (As per NEP-2020)

DSC-C-STA-122 : Mathematical Statistics

(Major Statistics)

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

Instructions : (1) Figures to the right indicate the full marks of that question.
(2) Use of simple calculator is allowed.

1. (A) Explain : **4**
   (1) Exponential Function
   (2) Definition of Continuity of function

1. (B) (1) If $f(x) = x^2 - 2^x + x^x$, then find the value of $f(2) + f(0) + f(-2)$ **6**

   (2) Find the value of $\lim_{x \to 1} \frac{\sqrt{x+2} - \sqrt{3}}{x-1}$

OR

1. *(A)* What is calculus ? Also give the definition of a function. **4**

1. (B) (1) Find the values of x for which $f(x) = \frac{8x^2 - x + 3}{x^2 - 7x + 10}$ are discontinuous. **6**

   (2) Find the value of $\lim_{x \to -3} \frac{2x^2 + 9x + 9}{2x^2 + 7x + 3}$

2. (A) State the rules of Differentiation. **4**

2. (B) Find $\frac{dy}{dx}$ for given function : **6**

   (1) $y = \frac{5x^2 + 6x - 3}{2x - 7}$

   (2) $y = \log\left(\frac{3x+1}{5x-1}\right)$

OR

2. (A) Using the definition of derivative, find the derivatives of $f(x) = x^2$. **4**

2. (B) (1) If $y = x^3 - x^2 + 4x - 5$ then for what value of x, $\frac{dy}{dx} = 25$? **6**

   (2) Find $\frac{dy}{dx}$ from $xy + 4x - 7y + 3 = 0$

3. (A) Write down the steps of to obtain maximum and minimum values of a function. 4

3. (B) The supply function of a commodity is $x = 4\left(4+\sqrt{P}\right)$. Find the elasticity of supply when $P = 4$. 6

OR

3. (A) Explain : (1) Marginal cost (2) Elasticity of demand 4

3. (B) The following are demand and total cost function of a commodity for a monopolist : 6

$x = 30 - 2p$, (demand function)

$C = \frac{x^2}{20} + 4x - 300$, (cost function)

Find the production for maximum profit.

4. (A) Give the difference between Determinant and Matrix. 4

4. (B) Solve the following equation using Inverse matrix :

$x - 3y + z = -1$

$2x + y - 4z = -1$

$6x - 7y + 8z = 7$ 6

OR

4. (A) Explain the following terms : (1) Symmetric matrix (2) Null matrix 4

4. (B) If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 \\ 4 & -1 \end{bmatrix}$ then prove that $(A + B)^2 = A^2 + B^2$ 6

5. Answer the following : (any **ten**) 10

(1) Explain the meaning of $x \to 0$

(2) Find the value $\lim_{x \to 0} \frac{4x^2 - 2x + x}{11x^2 - 8x}$

(3) Give the definition of Many-one function.

(4) If $f(x) = x^4$ and $g(x) = 4x^4 - 3x$ and $x \in \{0, 1\}$ then prove that $f = g$

(5) If $f(x) = x^4 - x^3 + x^2 - x + 1$ then find the value of $f'(0)$.

(6) Write the chain rule.

(7) What is meant by Marginal cost ?

(8) Define scalar matrix.

(9) If $y = e^{5x}$, then find the value of $\frac{dy}{dx}$

(10) Define Second Derivation ?

(11) $A \cdot A^{-1} = A^{-1} \cdot A =$ _____.

(12) If $A = \begin{bmatrix} 1 & -2 \\ 3 & -4 \end{bmatrix}$, then find Adjoint of A.