1002E1574

Candidate's Seat No :_____

IMSc (AIML) (NEP) Sem.-1 Examination

MDC-114T

Mathematical Science Concepts-I

Time : 2-00 Hours] **February-2025** **[Max. Marks : 50**

Instructions: All questions are compulsory. Use of non-programmable scientific calculator is allowed.

Q.1 **(a)** Show that, if A is any subset of universal set U, then $A \cup U = U$. **(05)**

(b) If $f(x) = \frac{1}{1-x}$, find the value of $f[f\{f(x)\}]$. **(05)**

OR

(a) Find the sum of n terms of series $1^2 + 2^2 + 3^2 + \cdots + n^2$. **(05)**

(b) If $A = \{a, b\}$, $B = \{b, c\}$, $C = \{c, d\}$, then evaluate **(05)**
$(i)\ (B \times C)$, $(ii)(A \times B) \cup (A \times C)$, $(iii)(A \times B) \cap (A \times C)$.

Q.2 **(a)** Find $\lim_{x \to \infty} \frac{(3x+4)(4x-5)}{(5x-6)(6x+7)}$. **(05)**

(b) Prove that the function $f(x) = \begin{cases} 3x - 2, & x \leq 0 \\ x + 1, & x > 0 \end{cases}$ is not continuous at $x = 0$ and continuous at $x = 2$. **(05)**

OR

(a) Find $\lim_{x \to a} \frac{x^n - a^n}{x - a}$. **(05)**

(b) Find $\lim_{x \to -\infty} \frac{2^x}{\sin\left(\frac{1}{x}\right)}$, using L'Hospitals rule. **(05)**

Q.3 **(a)** Discuss scales of measurement of data with examples. **(05)**

(b) Complete the following table and draw a bar chart of soft drink purchases. **(05)**

Soft Drink	Frequency	Relative Frequency	Percent Frequency
Coke Classic	19		
Pepsi	13		
Diet Coke	8		
Sprite	5		
Dr. Pepper	5		

OR

(a) The response to a question has three alternatives: A, B, and C. A sample of 120 responses provides 60 A, 24 B, and 36 C. Show the frequency and relative frequency distributions. **(05)**

(b) Monthly starting salaries for a sample of 12 Science School graduates are provided in rupees (Rs.) as: 34500, 35500, 36500, 34800, 33550, 33100, 34900, 37300, 35400, 39250, 35200 and 34800. Compute Mean, Median and Mode for this sample of data. **(05)**

(P.T.O)

Q.4 **(a)** Consider an experiment of rolling a pair of dice; find the sample space of the experiment and probability of an event that the sum of the face values showing on the dice is 8. **(05)**

(b) Discuss briefly about Probability functions: pmf, pdf and cdf. **(05)**

OR

(a) An experiment has four equally likely outcomes: *A*, *B*, *C*, and *D*. **(05)**
a. What is the probability that *B* occurs?
b. What is the probability that any two of the outcomes occur (e.g., *A* or *C*)?
c. What is the probability that any three of the outcomes occur (e.g., *A* or *B* or *D*)?

(b) The Gujarat state adult population by age is as follows (*The Hindustan Times,* 2011). The data are in lakhs of people. **(05)**

Age	Number
18 to 24	29.8
25 to 34	40.0
35 to 44	43.4
45 to 54	43.9
55 to 64	32.7
65 and over	37.8

A person will be randomly chosen from this population.
a. What is the probability the person is 18 to 24 years old?
b. What is the probability the person is 18 to 34 years old?
c. What is the probability the person is 45 or older?

Q.5 Attempt any **TEN** out of **TWELVE:**(Each carry 01 mark) **(10)**

(1) Define Empty Set and Singleton Set.

(2) Let $A = \{1, 2, 3, 4\}$, find the range of function $f: A \to \mathcal{R}, f(x) = 2^x$.

(3) Write the first five terms of sequences $a_n = \frac{n+5}{2}$.

(4) Give definition of limit of function.

(5) $\lim_{x \to \infty} \left(1 + \frac{1}{x}\right)^x =$ _____.

(6) When a function $f(x)$ is said to have mixed discontinuity at point $x = c$?

(7) Briefly discuss Classification of Data.

(8) Write down the formula of Variation.

(9) For some class size data, given sample mean is 44 and sample standard deviation is 8. Calculate coefficient of variation.

(10) What are the types of Random Variable?

(11) Provide addition law of probability.

(12) Explain complement of an event using Venn diagram.

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