Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY
BCA/MCA INTEGRATED - SEMESTER - III EXAMINATION - WINTER 2025

Subject Code: BC03001041   **Date: 05-12-2025**

Subject Name: Mathematical Foundation for AI

Time: 10:30 AM TO 01:00 PM   **Total Marks: 70**

Instructions

1. Attempt all questions.

2. Make suitable assumptions wherever necessary.

3. Figures to the right indicate full marks.

4. Use of simple calculators and non-programmable scientific calculators are permitted.

	Marks

Q.1 (a) Do as directed :   **07**

1) What is Vector ?

2) Full form of SVD

3) What is Unit matrix ?

4) Find the power set of A = {1,2,9}

5) What is Universal set ?

6) What does the Law of Large Numbers state?

7) What is Diagonal matrix ?

(b)   **07**

Find the eigenvalues and the eigenvector for the matrix $A = \begin{bmatrix} 1 & 2 \\ 5 & 4 \end{bmatrix}$

Q.2 (a) Let A and B are two events of an experiment such that p(A)=3/10, p(B) = 1/2,   **07**
p(B/A)=2/5 , then find :

1)   p(A∩B)

2)   p(A/B)

3)   p(AUB)

(b) Find X and Y if 2x-3y=15 and x+5y=-18 using Cramer's rule.   **07**

<p align="center">**OR**</p>

(b)   **07**

If $A = \begin{bmatrix} 3 & 2 & -1 \\ 5 & 4 & -3 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 9 & 3 \\ 0 & 6 & 2 \\ 2 & 2 & 4 \end{bmatrix}$ Compute : 2A + 5B , (B+A)T , A-B.

Q.3 (a) A bag I contains 4 white and 6 black balls while another bag II contains 4 white and 3   **07**
black balls. One ball is drawn at random from one of the bags and it is found to be
black. Find the probability using Baye's theorem that it was drawn from bag I.

(b) The dataset below represents the scores of 5 students in a quiz: {5, 7, 9, 11, 13}.   **07**
Calculate mean and Variance.

OR

(a) Suppose 2 dice are tossed and the number on the top face recorded what is the probability that : **07**

      1) Even number was tossed

      2) Sum of number is less than 5

      3) Prime number was tossed

      4) Sum of number is atleast 7

      5) At least one of the dice shows up a 3

      6) Getting a doublet of even numbers

      7) Getting six as a product

(b) Find the variance and standard deviation of the following data: **07**

X	5	10	15	20	25	30
f(x)	6	7	3	2	1	1

Q.4 (a) $P = \{x \in N / 2 < x \leq 8\}$, $Q = \{x \in N / 0 \leq x < 5\}$, $R = \{x \in N / 1 \leq x \leq 10\}$, $U = \{x \in Z / -2 \leq x < 12\}$ Verify $PU(Q \cap R) = (PUQ) \cap (PUR)$ **07**

(b) Prepare the truthtable of the prepositional statement $(p \wedge (\sim q \vee \sim r) \Rightarrow (p \Rightarrow \sim q)$ **07**

OR

(a) $A = \{2,5,7,18\}$, $B = \{2,3,4,5,10\}$, $R = \{a \leq b\}$. Find graph, matrix and inverse of relation. **07**

(b) If $2x^2 - 4x - 6 = 0$, Evaluate using Quadratic function formula. **07**

Q.5 (a) The probability of a student passing in Science is 4/5 and the student passing in both science and maths is 1/2. What is probability of that student passing in maths knowing that he passed in science ? **07**

(b) Find the value of x if $\log_3{}^x = \log_3{}^4 + \log_3{}^7$. **07**

OR

(a) A fair six-sided die is rolled repeatedly. According to the law of large number what is the expected average value of the outcomes as the number of rolls increases ? **07**

(b) Find the derivative of $x^6 + x^3 + 2$. **07**

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