(Please write your Roll No. immediately)

END TERM EXAMINATION

SIXTH SEMESTER [B.TECH] MAY 2025

Paper Code: DA-304T	Subject: Statistics, Statistical Modeling & Data Analytics
Time: 3 Hours	Maximum Marks: 75

Note: Attempt five questions in all including question no. 1 which is compulsory. Select one question from each unit.

Q1 Attempt **all** questions **(5x5=25)**

a) Let X be a random variable having binomial distribution B (7, p). If P(X=3) =5P(X=4), then calculate p, mean and the variance of X

b) Compute the sum-of-squares error for the given set of data (0, -1), (1, 3), (4, 6), (5, 0); and linear model y=x+2.

c) State the Gauss-Markov theorem and what are the assumptions of the Gauss-Markov theorem?

d) Compute the Manhattan and Euclidean distances between points A (1,2,3) and B (4,6,8)

e) Given the matrix $\begin{bmatrix} 3 & -1 \\ 4 & 2 \end{bmatrix}$, find its characteristic equation and eigenvalues.

UNIT-I

Q2 a) The ages of employees in a company are given in the following table: **(7)**

Age (Years)	20-25	25-30	30-35	35-40	40-45	45-50
No. of Employees	5	8	15	10	7	5

Calculate the mean income and standard deviation of the above data.

b) Suppose a book of 585 pages contains 43 typographical errors. If these errors arerandomly distributed throughout the book, what is the probability that 10 pages, selected at random, will be free from errors? **(5.5)**

Q3 a) The average score on a test is 80 with a standard deviation of 10. With a new teaching curriculum introduced it is believed that this score will change. On random testing, the score of 38 students, the mean was found to be 88. With a 0.05 significance level, is there any evidence to support this claim? **(7)**

b) A random variable X has the following probability distribution:

X	0	1	2	3	4	5	6	7	8
P(x)	k	3k	5k	7k	9k	11k	13k	15k	17k

i) Determine the value of k **(5.5)**

ii) Find $P(X<4)$, $P(X\geq5)$, and $P(0<X<4)$

UNIT –II

Q4 a) Three different teaching methods A, B, and C were used to teach students. The exam scores of randomly selected students from each method are:

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A	B	C
78	88	75
82	91	80
85	84	78
90	79	85
87	92	82

(The table value of F at a 5% level of significance for $v_1=2$ and $v_2=12$ is 3.89). **(10)**

b) X is a normal variate with mean 30 and standard deviation of 5. Find the probability that $(X \geq 45)$. **(2.5)**

Q5 a) List the assumption of a simple linear regression Model. State the point through which the regression line always passes. **(5.5)**

b) Fit a straight line to the following data by the method of least squares **(7)**

X	1	2	3	4	5
Y	2	3	5	6	8

UNIT-III

Q6 a) Define a metric space and state its properties. **(4)**

b) Is the function $d(x,y) = |x^2 - y^2|$ a metric on R. **(4)**

c) Consider the sequence $a_n = \frac{n}{n+1}$. Show that $\{a_n\}$ is a Cauchy Sequence. **(4.5)**

Q7 a) What is meant by open and closed set? Can a set be both open and closed? **(4)**

b) Is every convergent sequence in a metric space a Cauchy sequence? Justify your answer. **(4.5)**

c) Explain Compactness and Connectedness. **(4)**

UNIT-IV

Q8 a) What is a vector space? How a vector space is different from metric space? **(4)**

b) Find the Eigen values and Eigen vector for the matrix **(8.5)**

$$A = \begin{bmatrix} 5 & -10 & -5 \\ 2 & 14 & 2 \\ -4 & -8 & 6 \end{bmatrix}$$

Q9 a) For the matrix $A = \begin{bmatrix} 5 & -10 & -5 \\ 2 & 14 & 2 \\ -4 & -8 & 6 \end{bmatrix}$

i) Find the inverse of matrix A using Cayley-Hamilton Theorem.

ii) Use the Cayley-Hamilton Theorem to verify that A satisfies its own characteristic equation. **(8.5)**

b) Determine whether the given set of vectors in R^n is linearly dependent or linearly independent:

$v_1 = (1,2,3)$, $v_2 = (1,0,1)$, $v_3 = (1,-1,5)$ **(4)**

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