

R.N.G.PATEL INSTITUTE OF TECHNOLOGY-RNGPIT
(An Autonomous College U/s UGC Act 1956)

B. Tech. SEMESTER-II, SEMESTER END EXAMINATION – SUMMER 2025

Subject Code: 1SH205

Date: 17-05-2025

Subject Name: STATISTICS AND LINEAR ALGEBRA

Time: 11:00 AM to 02:00 PM

Total Marks:70

Instructions

1. It is **compulsory** for students to write **Enrolment No. /Seat No.** on the question paper.
2. Write answers of **Section A** and **Section B** in **separate answer books**.
3. Attempt all questions from both **Section A** and **Section B**.
4. Each section carries **35 marks**, with a total of **70 marks** for the examination.
5. The figures to the right of each question indicate full marks, make suitable assumptions with justification.
6. BL - Bloom's Taxonomy Levels (R-Remember, U-Understanding, A –Application, N –Analyze, E – Evaluate, C -Create), CO - Course Outcomes.

SECTION A

		Marks	BL	CO
Q.1 Multiple-Choice Questions		[05]		
(a) In a continuous probability distribution the sum of all the probabilities is always equal to_____		1	R	1
(i) Zero	(ii) One			
(iii) Minimum	(iv) Maximum			
(b) For a Poisson variate: $P(X=1) = P(X=2)$ then the mean is _____		1	R	1
(i) 2	(ii) 0			
(iii) 1	(iv) -1			
(c) The mean of Normal distribution is _____		1	A	1
(i) σ	(ii) σ^2			
(iii) μ	(iv) npq			
(d) If the null hypothesis is false then which of the following is accepted _____		1	R	3
(i) Null Hypothesis	(ii) Positive Hypothesis			
(iii) Negative Hypothesis	(iv) Alternative Hypothesis			

- (e) Which of the following is classified as unknown or exact value that represents the whole population? 1 R 3
- (i) predictor (ii) guider
- (iii) parameter (iv) estimator

Q.2 Attempt Any Two [10]

- (a) A random variable X has the following probability function: 5 A 1

x	0	1	2	3	4
$P(X = x)$	k	$3k$	$5k$	$7k$	$9k$

Find (i) k , (ii) $P(X < 3), P(X \geq 3), P(0 < X < 4)$, and (iii) distribution function of X

- (b) If the probability density function of a random variable is given by 5 A 1

$$f(x) = \begin{cases} k(1-x^2) & , 0 < x < 1 \\ 0 & , \text{otherwise} \end{cases}$$

Find the value of k and the probabilities that a random variable having this probability density will take on a value (i) between 0.1 and 0.2, (ii) greater than 0.5.

- (c) The mean lifetime of a sample of 25 bulbs is found as 1550 hours with a SD of 120 hours. The company manufacturing the bulbs claims that the average life of their bulbs is 1600 hours. Is the claim acceptance at 5 % level of significance? 5 A 3
- (Hint: The critical value of t at 5% level of significance is 1.711)

Q.3 Attempt Any Two [10]

- (a) 4 coins are tossed simultaneously. What is the probability of getting (i) 2 heads? (ii) at least 2 heads? (iii) at most 2 heads? 5 A 1
- (b) The number of accidents in a year attributed to taxi drivers in a city follows Poisson distribution with a mean of 3. Out of 1000 taxi drivers, find approximately the number of drivers with (i) no accidents in a year and (ii) more than 3 accidents in a year. 5 A 1
- (c) If the weights of 300 students are normally distributed with a mean of 68 kg and a standard deviation of 3 kg. How many students have weight (i) greater than 72 kg? (ii) Less than or equal to 64 kg? 5 A 1
- (Hint: $P(0 \leq Z \leq 1.33) = 0.4082$)

Q.4 Attempt Any Two [10]

- (a) The means of two random samples of size 9 and 7 are 196.42 and 198.82 respectively. The sums of squares of the deviation from the mean are 26.94 and 18.73 respectively. Can the sample be considered to have been drawn from the same population? 5 A 3
- (Hint: The critical value of t at 5% level of significance is 2.145)
- (b) In a test given to two groups of students drawn from two normal populations, the marks obtained were as follows: 5 A 3

- (b) Ten participants in a contest are ranked by two judges as follows: 5 A 2

x	1	3	7	5	4	6	2	10	9	8
y	3	1	4	5	6	9	7	8	10	2

Calculate the rank correlation coefficient.

- (c) Obtain the two regression lines from the following data and hence, find the correlation coefficients 5 A 2

x	6	2	10	4	8
y	9	11	5	8	7

Q.7 Attempt Any Two [10]

- (a) Fit a straight line $y = a + bx$ to the following data: 5 A 4

x	1	2	3	4	6	8
y	2.4	3	3.6	4	5	6

- (b) Fit a parabola $y = a + bx + cx^2$ to the following data: 5 A 4

x	1	2	3	4	5
y	5	12	26	60	97

- (c) Fit a curve of the form $y = ae^{bx}$ to the following data: 5 A 4

x	1	3	5	7	9
y	115	105	95	85	80

Q.8 Attempt Any Two [10]

- (a) Determine whether the function is a linear transformation. Justify your answer. 5 A 5

(i) $T : R^2 \rightarrow R^2$, where $T(x, y) = (x + 2y, 3x - y)$

(ii) $T : R^3 \rightarrow R^2$, where $T(x, y, z) = (2x - y + z, y - 4z)$

- (b) Let $T : R^4 \rightarrow R^3$ be the linear transformation defined by 5 A 5

$$T(x_1, x_2, x_3, x_4) = (4x_1 + x_2 - 2x_3 - 3x_4, 2x_1 + x_2 + x_3 - 4x_4, 6x_1 - 9x_3 + 9x_4)$$

(i) Find a basis and the dimension for $\ker(T)$.

(ii) Find a basis and the dimension for the $R(T)$.

(iii) Verify the dimension theorem.

- (c) Determine whether the linear transformation $T : R^3 \rightarrow R^3$ defined by 5 A 5

$$T(x, y, z) = (x + 3y, y, z + 2x)$$

is one-to-one, onto, both or neither.
