

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

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

SUBJECT CODE: 1SH205

DATE: 06-01-2026

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 discrete 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: $P(X=0) = P(X=1)$ then the mean is _____	1	R	1
(i) 2			
(ii) 0			
(iii) 1			
(iv) -1			
(c) The mean of binomial distribution is _____	1	A	1
(i) σ			
(ii) σ^2			
(iii) μ			
(iv) npq			
(d) If the null hypothesis is true 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
$P(X = x)$	k	$2k$	$3k$

Find (i) k , (ii) $P(X < 2), P(X \leq 2), P(0 < X < 2)$, and (iii) distribution function of X

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

5 A 1

$$f(x) = \begin{cases} kx^2 & , 0 < x < 3 \\ 0 & , otherwise \end{cases}$$

- (i) Find the value of k (ii) $P(X < 2), P(X \geq 2), P(1 < X < 2)$

- (c) Given the following probability function of a discrete random variable X :

5 A 1

X	0	1	2	3	4	5	6	7
$P(X = x)$	a	$4a$	$3a$	$7a$	$8a$	$10a$	$6a$	$9a$

Find (i) a , (ii) $P(X < 3)$, and (iii) Find m if $P(X \leq m) \geq 0.6$, where k is a positive integer

Q.3 Attempt Any Two

[10]

- (a) Out of 800 families with 5 children each, how many would you expect to have (i) 3 boys, (ii) 5 girls (iii) either 2 or 3 boys (iv) at least one boy? Assume equal probabilities for boys and girls.

5 A 1

- (b) If 2% of lightbulbs are defective, find the probability that (i) at least one is defective, and (ii) exactly 7 are defective. Also find $P(1 < X < 8)$ in a sample of 100.

5 A 1

- (c) Assume that the mean height of Indian soldiers is 68.22 inches with a variance of 10.8 inches. How many soldiers in a regiment of 1000 would you expect to be over 6 feet tall?

5 A 1

Q.4 Attempt Any Two

[10]

- (a) 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 2.262)

- (b) The standard deviations calculated from two random samples of sizes 9 and 13 are 2.1 and 1.8 respectively. Can the samples be regarded as drawn from normal populations with the same SD?

5 A 3

(Hint: The critical value of F at 5% level of significance is 2.85)

- (c) The number of car accidents in a metropolitan city was found to be 20, 17, 12, 6, 7, 15, 8, 5, 16 and 14 per month respectively. Use χ^2 test to check whether these frequencies are in agreement with the belief that the occurrence of accidents was the same during 10 months period. Test at 5% level of significance.

5 A 3

(Hint: The critical value of χ^2 at 5% level of significance is 16.92)

SECTION B

Marks BL CO

Q.5 Multiple-Choice Questions

[05]

(a) The coefficient of correlation lies between _____

1 R 2

(i) 0 and 1

(ii) -1 and 0

(iii) -1 and 1

(iv) 0 and 2

(b) If one of the regression coefficients is greater than one, the other must be less than _____.

1 R 2

(i) 1

(ii) 0

(iii) -1

(iv) 1.5

(c) The sign of correlation is _____ as that of the regression coefficients.

1 R 2

(i) less

(ii) greater

(iii) smaller

(iv) same

(d) For zero transformation $T : V \rightarrow W$ _____.

1 R 5

(i) $\ker(T) \neq \{0\}$

(ii) $\ker(T) = \{0\}$

(iii) $\ker(T) = V$

(iv) $\ker(T)$ is not defined

(e) A linear transformation T is an both one-to-one and onto, then T is called _____.

1 R 5

(i) injective

(ii) bijective

(iii) surjective

(iv) linear operator

Q.6 Attempt Any Two

[10]

(a) Calculate the coefficient of correlation for the following data:

5 A 2

x	9	8	7	6	5	4	3	2	1
y	15	16	14	13	11	12	10	8	9

(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	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

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

x	1	2	3	4
y	1.7	1.8	2.3	3.2

(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)** Define linear transformation in Euclidean vector space. Check the linearity of the following transformations.**5 A 5**(i) $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ defined by $T(x_1, x_2, x_3) = (x_1 + 1, x_2 + 2, x_3 + 4)$ (ii) $T: M_m \rightarrow \mathbb{R}$ defined by $T(A) = \det A$.**(b)** Determine whether the linear transformation $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ defined by $T(x, y, z) = (x + 3y, y, z + 2x)$ is one-to-one, onto, both or neither.**5 A 5****(c)** Let $T: \mathbb{R}^4 \rightarrow \mathbb{R}^3$ 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.
