Reg. No.																

Question Paper Code	14187

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Third Semester

Computer Science and Engineering

(Common to Information Technology)

20BSMA304 – STATISTICS AND LINEAR ALGEBRA

Regulations - 2020

(Use of Statistical table is permitted)

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	The kurtosis of the normal distribution is (a) 0 (b) 1 (c) 2 (d) 3	1	K1	CO1
2.	The variance of the binomial distribution B(5,1/4) is (a) 4/5 (b) 7/8 (c) 15/16 (d) 4/7	1	K2	CO1
3.	If χ^2 test for independence of attributes is used then the number of degrees of freedom for $m \times n$ contingency table is _______________ (a) mn-1 (b) (m+1)(n+1) (c) (m-1)(n-1) (d) mn+1	1	K1	CO2
4.	*'t'* test for paired observations with n dependent samples of size n will have degrees of freedom is _________ (a) n-1 (b) n-2 (c) n-3 (d) n-4	1	K1	CO2
5.	The dimension of $M_{2x3}(R)$ is (a) 2 (b) 3 (c) 6 (d) 5	1	K1	CO3
6.	The dimension of R^n is (a) M (b) n (c) 2 (d) 1	1	K1	CO3
7.	Let $T: V \to W$ be a linear transformation and T is one-to-one. Then $nullity\ (T) =$ (a) {0} (b) {1} (c) V (d) W	1	K1	CO4
8.	If T is linear, then $T(0) =$ (a) 0 (b) 1 (c) 2 (d) 3	1	K1	CO4
9.	Let $T: V \to W$ be a linear transformation, where V has finite dimension. Then nullity(T)+rank(T) is (a) dim W (b) dim V (c) 0 (d) V	1	K1	CO5
10.	Let V be an inner product space over a field F, for any $u, v \in V$ and $\alpha, \beta \in F$, then $\|cu\| =$ (a) $\|u\|$ (b) $c\ \|u\|$ (c) $\|c\|\|u\|$ (d) $\langle u, v \rangle = 0$	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Define correlation with example.	2	K1	CO1
12.	A discrete random variable X has moment generating function $M_X(t) = \left(\frac{1}{4} + \frac{3}{4}e^t\right)^5$ Find E(X) and Var(X).	2	K2	CO1
13.	Write the formula for Karl person's measure of skewness.	2	K1	CO1
14.	State the purpose of test of goodness of fit.	2	K1	CO2
15.	Define Type I and Type II errors.	2	K1	CO2
16.	Write any two applications of χ^2 distribution.	2	K1	CO2
17.	Determine whether the vector $(2, -1, 1)$ is in the span of $\{(1,0,2), (-1,1,1)\}$.	2	K2	CO3
18.	Test whether v_1 = (1, -2,3), v_2 = (5,6, -1) and v_3 = (3,2,1) form a linear independence or not.	2	K2	CO3

19.		Test whether the map $T: R \to R$ defined by $T(x) = x + 3, \forall\, x \in R$ is a linear transformation or not.	2	K2	CO4
20.		Test the matrix $\begin{pmatrix} 1 & 3 \\ 3 & 1 \end{pmatrix}$ is diagonalizable or not.	2	K2	CO4
21.		Define Frobenius inner product.	2	K1	CO5
22.		Prove that in an inner product space V(F), $< u, \alpha v + \beta w > \; = \bar{\alpha} < u, v > + \bar{\beta} < u, w >$.	2	K2	CO5

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Find the moment generating function of Binomial distribution and hence find it is mean and variance.	11	K3	CO1
		OR			
	b)	The two lines of regression are $4X - 5Y + 33 = 0$ & $20X - 9Y = 107$. Calculate the means of X and Y and the coefficient of correlation between X and Y. Also find σ_Y if $\sigma_X = 2$ and σ_X if $\sigma_Y = 3$.	11	K3	CO1
24.	a)	The mean breaking strength of the cables supplied by a manufacturer is 1800 with standard deviation of 100. By a new technique in the manufacturing process, it is claimed that the breaking strength of the cable has increased. To test this claim a sample of 50 cables is tested and is found that the mean breaking strength is 1850. Can we support the claim at 1% level of significance?	11	K3	CO2
		OR			
	b)	The theory predicts that the proportion of beans in the four groups A,B,C and D should be 9:3:3:1.In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Do the experimental results support the theory?	11	K3	CO2
25.	a)	The vectors $u_1 = (2, -3, 1)$, $u_2 = (1, 4, -2)$, $u_3 = (-8, 12, -4)$, $u_4 = (1, 37, -17)$, $u_5 = (-3, -3, 8)$ generate R^3. Find a subset of the set $\{u_1, u_2, u_3, u_4, u_5\}$ that forms a basis for R^3.	11	K3	CO3
		OR			
	b)	Check whether the set $S = \{1 + 2x - x^2, 4 - 2x + x^2, -1 + 18x - 9x^2\}$ forms a basis for $P_2(R)$?	11	K3	CO3
26.	a)	If $T: R^2 \to R^3$ be defined by $T(x, y) = (2x - y, 3x + 4y, x)$. Compute the matrix of T in the standard basis of R^2 and R^3. Find N(T) and R(T). Is T one-to-one and onto?	11	K3	CO4
		OR			
	b)	Find the linear operator $T: P_2(R) \to P_2(R)$ defined as $T[f(x)] = f(1) + x\, f'(0) + \left(f'(0) + f''(0)\right) x^2$. Find the eigen values of T of an ordered basis B for $P_2(R)$ such that the matrix of the given transformation with respect to the new resultant basis B is a diagonal matrix.	11	K3	CO4
27.	a)	In an inner product space $R^3(R)$ with the standard inner product, $B = \{(1,0,1), (1,0,-1), (0,3,4)\}$ is a basis. By Gram-Schmidt Orthogonalisation process, find an orthogonal basis. Hence find an orthonormal basis.	11	K3	CO5
		OR			
	b)	Find the least square solution of $AX = b$, where $A = \begin{pmatrix} 1 & -3 & -3 \\ 1 & 5 & 1 \\ 1 & 7 & 2 \end{pmatrix}$, $b = \begin{pmatrix} 5 \\ -3 \\ -5 \end{pmatrix}$. Also find the least square error.	11	K3	CO5

28. a) (i)	Let $T: R^2 \rightarrow R^3$ defined by $T(a,b) = (a-b, b-a, -a), \forall a, b \in R$ be a linear transformation. Find the rank (T).	*6*	*K3*	*CO4*
(ii)	If u and v are any two vectors in an inner product space, then prove that $\|u+v\|^2 + \|u-v\|^2 = 2(\|u\|^2 + \|v\|^2)$.	*5*	*K3*	*CO5*
	OR			
b) (i)	Let $T: R^3 \rightarrow R^2$ defined by $T(a_1, a_2, a_3) = (a_1 - a_2, 2a_3)$. Find the basis for N(T) and compute the nullity of T.	*6*	*K3*	*CO4*
(ii)	State and prove Triangle inequality for Inner product spaces.	*5*	*K3*	*CO5*