Reg. No.															

Question Paper Code	13713

M.E. - DEGREE EXAMINATIONS, APRIL / MAY 2025

First Semester

M.E. - Computer Science and Engineering

24PCSMA104 - APPLIED PROBABILITY AND STATISTICS

Regulations - 2024

(Use of Statistical Table is permitted)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	In a Binomial Distribution , the mean is 4 and variance is 3, find $P(X = 0)$.	2	K2	CO1
2.	If the probability that a communication system will have high fidelity is 0.81 and the probability that it will have high fidelity and selectivity is 0.18. Compute the Probability that a system with high fidelity will also have high selectivity.	2	K2	CO1
3.	If joint density of (X,Y) is given by $P(x, y) = C(x + 2y)$; $x = 0,1,2 \ \ and \ \ y = 1, 2$. Determine the value of C.	2	K2	CO2
4.	Define recursion curve.	2	K1	CO2
5.	Define unbiased estimators.	2	K1	CO3
6.	State the normal equations for fitting a straight line $y = a + bx$.	2	K1	CO3
7.	Define Null and Alternative hypothesis.	2	K1	CO4
8.	Mention any two properties of t –test.	2	K2	CO4
9.	If $\sum = \begin{bmatrix} 16 & 1 & 2 \\ 1 & 4 & -3 \\ 2 & -3 & 9 \end{bmatrix}$, compute the standard deviation matrix $V^{\left(\frac{1}{2}\right)}$.	2	K2	CO5
10.	Define Principle component analysis.	2	K1	CO5

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

			Marks	K – Level	CO
11. a)	(i)	A discrete random variable X has the following probability distribution:	8	K3	CO1

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

(i) Determine the value of a.

(ii) Evaluate P($X < 3$) , P($X \geq 3$).

(ii) The density function of a random variable X is given by $f(x) = kx(2-x), 0 \le x \le 2$. Determine k, mean, variance and r[th] moment. *8 K3 CO1*

OR

b) (i) The atoms of a radioactive element are randomly disintegrative. If every gram of this element, on average emits 3.9 alpha particles per second, Compute the probability that during the next second the number of alpha particles emitted from 1 gram is (i) atleast 3 and atmost 6 (ii) atleast 2. *8 K3 CO1*

(ii) The time in hours required to repair a machine is exponentially distributed with parameter $\lambda = \frac{1}{2}$. *8 K3 CO1*

(i) Compute the probability that the repair time exceeds 2 hours.

(ii) Compute the conditional probability that a repair takes atleast10 hours given that its duration exceeds 9 hours.

12. a) The Joint probability density function of the random variable (X,Y) is given by *16 K3 CO2*

$f(x,y) = kxye^{-(x^2+y^2)}, x > 0, y > 0$

Determine

(i) The value of .

(ii) The conditional distribution of X given $Y = y$.

(iii) Prove that X and Y are independent.

OR

b) The Joint probability density function of the random variable (X,Y) is given by *16 K3 CO2*

$$f(x,y) = 4xye^{-(x^2+y^2)}, x \ge 0, y \ge 0$$
$$= 0 \text{ , elsewhere}$$

Compute the density function of U =$\sqrt{(x^2 + y^2)}$.

13. a) Let $x_1, x_2, \ldots x_n$ be a random sample from the Poisson distribution with parameter λ. Obtain the maximum likelihood estimator of λ. *16 K3 CO3*

OR

b) Fit a parabola, by the method of least squares, to the following data. *16 K3 CO3*

X	1991	1992	1993	1994	1995	1996	1997
Y	125	128	133	135	140	141	143

14. a) (i) The means of two large samples of sizes 2000 and 1000 are 68.0 and 67.5 gm respectively. Determine the sample be regarded as drawn from the same population of standard deviation 2.25 gm. *8 K3 CO4*

(ii) Out of a sample of 1000 persons, 800 persons were found to be coffee drinkers. Subsequently, the excise duty on coffee was increased. After the increase in excise duty of coffee seeds, 800 people were found to take coffee out of a sample 1200. Determine whether there is any *8 K3 CO4*

significant decrease in the consumption of coffee after the increase in excise duty.

OR

b) (i) In one sample of 12 observations, the sum of the squares of the deviations of the sample values from the sample mean was 108 and in another sample of 10 observations it was 90. Determine whether this difference is significant at 5% level of significance. *8 K3 CO4*

(ii) Test whether the association of income level and interest on buying a new model car is significant or spurious from a study conducted from 2000 members randomly selected from an area. *8 K3 CO4*

Income group	Interested	Not interested	Total
Low income	620	380	1000
High income	550	450	1000
Total	1170	830	2000

15. a) Determine the mean matrix, covariance matrix and standard deviation matrix for the two random variables X_1 and X_2 whose joint mass function is given by: *16 K3 CO5*

X_1/X_2	0	1
-1	0.24	0.06
0	0.16	0.14
1	0.40	0.00

OR

b) Let the random variables X_1, X_2 and X_3 have the covariance matrix *16 K3 CO5*

$\sum = \begin{bmatrix} 1 & -2 & 0 \\ -2 & 5 & 0 \\ 0 & 0 & 2 \end{bmatrix}$. Determine the principal components Y_1, Y_2 and Y_3 and hence find the variance and covariance of principal components.