Reg. No.												

Question Paper Code	12656

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

First Semester

M.E - Computer Science Engineering

(Common To Computer Science and Engineering (with Specialization in Networks)

20PCSMA104 – APPLIED PROBABILITY AND STATISTICS

Regulations - 2020

(Use of Statistical Table is Permitted)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

	Question	*Marks*	*K – Level*	*CO*
1.	Find the Binomial distribution for which the mean is 4 and variance is 3.	*2*	*K2*	*CO1*
2.	Obtain the moment generating function of Geometric distribution.	*2*	*K1*	*CO1*
3.	The joint pdf of (X, Y) is given by $(x, y) = e^{-(x+y)}$ $,0 \leq x, y < \infty$. Find the marginal density function of X.	*2*	*K3*	*CO2*
4.	Write the acute angle between the two lines of regression.	*2*	*K1*	*CO2*
5.	Mention the properties of a good estimator.	*2*	*K1*	*CO3*
6.	Discuss the properties of maximum likelihood estimation.	*2*	*K2*	*CO3*
7.	Define Type-I error and Type-II error.	*2*	*K1*	*CO4*
8.	Compare small sample and large sample.	*2*	*K2*	*CO4*
9.	State the properties of multivariate normal density.	*2*	*K1*	*CO5*
10.	What is the formula to compute the population variance due to k^{th} principal component?	*2*	*K2*	*CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11\. a) A random variables X has the following probability function: *16* *K3* *CO1*

X	0	1	2	3	4	5	6	7
$P(X)$	0	K	$2K$	$2K$	$3K$	K^2	$2K^2$	$7K^2 + K$

(i) Find K.

(ii) Find the distribution function of X.

(iii) If $P[X \leq C] > 1/2$ Find the minimum value of C.

Evaluate$P[1.5 < X < 4.5 / X > 2]$.

OR

b) i) Find MGF, Mean, Variance of Exponential Distribution. *8* *K3* *CO1*

ii) In an intelligence test administered on 1000 children the average score is 42 and standard deviation 24. Assuming the normal distribution , *8* *K3* *CO1*

1) Find the number of children exceeding the score 50 and
2) Find the number of children with score lying between 30 and 54.

12. a) i) The joint probability mass function of (X, Y) is given by $P(x, y) = k(2x + 3y)$, $x = 0, 1, 2, y = 1, 2, 3$. Find the marginal and conditional probability distribution of $P(X/Y = 1)$. *8 K3 CO2*

ii) Find the correlation co-efficient for the following data *8 K3 CO2*

X	10	14	18	22	26	30
Y	18	12	24	6	30	36

OR

b) Find the correlation coefficient between X and Y, if the random variable (X, Y) has the joint p.d.f *16 K3 CO2*

$$f(x,y) = \begin{cases} 2 - x - y; & 0 \le x \le 1, 0 \le y \le 1 \\ 0, & otherwise \end{cases}$$

13. a) Fit a straight line trend of the form $y = a + bx$ to the data given below by the method of least squares and predict the value of y when x = 70 *16 K3 CO3*

x	71	68	73	69	67	65	66	67
y	69	72	70	70	68	67	68	64

OR

b) i) In a random sampling from normal population $N(\mu, \sigma^2)$, find the maximum likelihood estimators for (i) μ when σ^2 is known, (ii) σ^2 when μ is known, (iii) the simultaneous estimation of μ and σ^2 *8 K3 CO3*

ii) Marks obtained by 10 students in Mathematics (x) and Statistics (y) are given below: *8 K3 CO3*

x	25	28	35	32	31	36	29	38	34	32
y	43	46	49	41	36	32	31	30	33	39

Find (1) The two regression lines. (2) marks in Statistics when marks in Mathematics is 30

14. a) i) The means of two large samples of 1000 and 2000 members are 67.5 and 68.0 inches respectively. Can the samples be regarded as drawn from the same populations of standard deviation 2.5 inches? *8 K3 CO4*

ii) A group of 10 rats fed on diet A and another group of 8 rats fed on diet B recorded the following increase in weight (gms). *8 K3 CO4*

Diet A: 5 6 8 1 12 4 3 9 6 10
Diet B: 2 3 6 8 10 1 2 8

Are the mean values of Diet A and Diet B significant or not?

OR

b) i) The table below gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week. *8 K3 CO4*

Days	:	Mon	Tue	Wed	Thu	Fri	Sat
No. of Accidents	:	14	18	12	11	15	14

ii) A random sample of 10 boys had the following I.Q's: 70, 120, 110,101, 88, 83, 95, 98, 107, 100. Do those data support the assumption of a population mean I.Q of 100? Find a reasonable range in which most of the mean I.Q values of samples of 10 boys lie. *8 K3 CO4*

15. a) i) Compute the principal components to the following matrices *8 K3 CO5*

$$A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$

ii) Explain the mean vector and covariance matrix for linear combination of random variables. *8 K2 CO5*

OR

b) For the covariance matrix $\Sigma = \begin{pmatrix} 1 & 4 \\ 4 & 100 \end{pmatrix}$ the derived correlation matrix $P = \begin{pmatrix} 1 & 0.4 \\ 0.4 & 1 \end{pmatrix}$, Show that the principal components obtained from covariance and correlation matrices are different. *16 K2 CO5*