Reg. No.																

Question Paper Code	14766

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

First Semester

M.E. - Computer Science and Engineering

(Common to M.E. - Computer Science and Engineering (With Specialization in Networks)

20PCSMA104 / 24PCSMA104 - APPLIED PROBABILITY AND STATISTICS

Regulations – 2020 / 2024

(Probability table books – F test, t test, z test, Chi Square test, Normal distribution need to be issued)

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	Compute the variance of the binomial distribution B(5,1/4) a) 4/5 b) 7/8 c) 15/16 d) 4/7	1	K3	CO1
2.	The value of mean and variance in a Poisson distribution are a) Equal b) Unequal c) Independent d) Zero	1	K3	CO1
3.	Median, mode of a normal distribution is a) μ, σ b) μ, σ^2 c) μ, μ d) σ, σ	1	K1	CO1
4.	Two regression lines are perpendicular to each other when a) $\theta = 0$ b) $\theta = \frac{\pi}{4}$ c) $\theta = \frac{\pi}{2}$ d) $\theta = \pi$	1	K3	CO2
5.	When an increase in one variable causes a proportional increase in another, the variables exhibit a) Positive correlation. b) Negative correlation. c) Partial correlation. d) Linear correlation.	1	K2	CO2
6.	The marginal distribution of a variable is obtained by a) Multiplying all probabilities b) Integrating or summing the joint distribution over the other variable c) Taking conditional expectation d) Finding the covariance	1	K2	CO2
7.	An estimator $\hat{\theta}$ is used to be unbiased if a) E(θ)=0 b) E(θ)=θ c) var(θ)=1 d) E(θ)>θ	1	K3	CO3
8.	In the Method of Moments, the parameters are obtained by a) Minimizing variance b) Maximizing likelihood c) Equating sample moments with population moments d) Drawing graphs	1	K2	CO3
9.	The principle of least squares is primarily applied in a) Testing hypotheses b) Curve fitting and regression c) Probability distributions d) Sampling methods	1	K1	CO3

10.	A statement formulated about a population for testing is known as a) Statistic b) Hypothesis c) Level of significance d)Test statistic	1	K1	CO4
11.	Passing a failing student by mistake is an example of a) Sampling error b) Standard error c) Type II error d) Type I error	1	K3	CO4
12.	If χ^2 test for Independence of attributes is used the number of degrees of freedom for m×n contingency table is a) mn-1 b) (m+1)(n+1) c) (m-1)(n-1) d) mn+1	1	K3	CO4
13.	A random vector consists of a) Constants only b) Two or more random variables considered together c) Deterministic variables d) Fixed matrices	1	K1	CO5
14.	The covariance matrix of a multivariate distribution is a) Singular b) Diagonal c) Symmetric d) Rectangular	1	K2	CO5
15.	In a multivariate normal distribution, equal-density contours are generally a) Straight lines b) Circles only c) Ellipsoids d) Parabolas	1	K2	CO5
16.	Principal Component Analysis (PCA) is mainly used for a) Hypothesis testing b) Data reduction c) Sampling d) Classification only	1	K1	CO5

PART – A (ii) (Short Answer Questions)
(8 × 3 = 24 Marks)
Answer ALL Questions

17.	Determine the parameters of a binomial distribution when its mean is 20 and standard deviation is 4.	3	K3	CO1
18.	Calculate $P(15 \leq X \leq 40)$ for a normal distribution with mean $\mu=20$ and standard deviation $\sigma=10$.	3	K3	CO1
19.	If $f(x,y) = k(1-x-y)$, $0 < x,y < \frac{1}{2}$, is a joint density function, then find k.	3	K3	CO2
20.	The two lines of regression are $8x-10y+66=0$, $40x-18y-214=0$. Find mean values of X and Y.	3	K3	CO2
21.	Explain the concept of a mean vector and covariance matrix for a random vector with suitable examples.	3	K4	CO3
22.	Differentiate between Type I error and Type II error in hypothesis testing with appropriate illustrations.	3	K4	CO4
23.	Explain the Chi-square test for Goodness of Fit and discuss its applications.	3	K4	CO4
24.	Interpret the meaning and significance of principal components in multivariate analysis.	3	K3	CO5

PART - B (Descriptive Answer Questions)
(5 × 12 = 60 Marks)
Answer ALL Questions

25. a) A random variable X has the following probability function: *12 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) Evaluate $P(X<6), P(X\geq 6)$ and $P(0<X<5)$
(iii) if $P(X\leq k)>\frac{1}{2}$, find the least value of k.
(v) Find the cumulative distribution function of X.

OR

b) The number of monthly breakdowns of a computer is a random variable having a Poisson distribution with mean equal to 1.8. Find the probability that this computer will function for a month (a) without a breakdown (b) with only one breakdown (c) with atleast one breakdown. *12 K3 CO1*

26. a) 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 all the marginal and conditional probability distributions. *12 K3 CO2*

OR

b) Calculate the correlation coefficient for the following heights in inches of fathers (X) and their sons (y) *12 K3 CO2*

X	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

27. a) Critically examine the Method of Moments for parameter estimation and evaluate its effectiveness by deriving the estimators of the mean and variance for a normal distribution. *12 K4 CO3*

OR

b) Analyze the least squares approach for curve fitting and determine the straight-line equation $y = a+bx$ for the given data set. Also interpret the meaning of the fitted regression line. *12 K4 CO3*

X	1	2	3	4	5
Y	2	4	5	4	6

28. a) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables. *12 K3 CO4*

Sample I	18	13	12	15	12	14	16	14	15
Sample II	16	19	13	16	18	13	15		

Do the estimates of the population variance differ significantly at 5% level?

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? *12 K3 CO4*

29.	a)	Analyze the multivariate normal distribution by deriving its density function and examining any four important properties of the distribution.	*12*	*K4*	*CO5*
		OR			
	b)	Analyze the role of Principal Component Analysis (PCA) in multivariate data reduction and explain the procedure for obtaining population principal components from standardized variables.	*12*	*K4*	*CO5*