Reg. No.																

Question Paper Code	13342

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024 (JAN - 2025)

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

(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.	If $P(X=x)=\begin{cases}\frac{x}{15}, & x=1,2,3,4,5\\ 0, & otherwise\end{cases}$. Determine $P\left\{\frac{1}{2}<X<\frac{5}{2}/\ X>1\right\}$.	2	K2	CO1
2.	Write the probability mass function of geometric distribution.	2	K1	CO1
3.	Calculate the value of k if $f(x,y) = k(1-x)(1-y);\ 0< x < y <1$ to be the joint density function of (x,y).	2	K2	CO2
4.	Given the joint pdf of (X,Y) $is\ f(x,y)=\begin{cases}e^{-(x+y)}, & x>0, y>0\\ 0 & , elsewhere\end{cases}$. Check whether X and Y are independent random variables?	2	K2	CO2
5.	Mention the properties of good estimator.	2	K1	CO3
6.	State the normal equations for fitting a straight line $y = a+bx$.	2	K1	CO3
7.	Define Type I and Type II error.	2	K1	CO4
8.	List out any two applications of F test.	2	K1	CO4
9.	If $X=\begin{bmatrix}42 & 4\\ 52 & 5\\ 48 & 4\end{bmatrix}$ Calculate $\overline{X}$.	2	K2	CO5
10.	If $\sum=\begin{bmatrix}4 & 1 & 2\\ 1 & 9 & -3\\ 2 & -3 & 25\end{bmatrix}$ Compute the standard deviation matrix $V^{\frac{1}{2}}$.	2	K2	CO5

PART - B (5 × 16 = 80 Marks)
Answer ALL Questions

11.	a)	i)	A discrete random variable X has the probability function given below:	8	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

Determine
(i) The value of k.
(ii) $P(x < 6), P(x \geq 6)$.

ii) In a company the monthly break down of a machine is a random variable with Poisson distribution, with an average 1.8. Compute the probability that the machine for a month (i) without break down (ii) With exactly one break down. — 8 K3 CO1

OR

b) i) In a test of 2000 electric bulbs it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S.D of 60 hours. Estimate the number of bulbs likely to burn for — 8 K3 CO1
(i) More than 2150 hours.
(ii) Less than 1950 hours.

ii) Buses arrive at a specified stop at 15 minute intervals starting at 7 a.m. That is they arrive at 7, 7.15, 7.30 and so on. If a passenger arrives at the stop at a random time that is uniformly distributed between 7 and 7.30 a.m., Determine the probability that he waits — 8 K3 CO1
(i) Less than 5 minutes for a bus.
(ii) At least 12 minutes for a bus.

12. a) The joint probability function (x, y) is given — 16 K3 CO2
$P(x, y) = k(2x + 3y);\ x = 0, 1, 2;\ y = 1, 2, 3.$
Compute
(i) The marginal distributions.
(ii) the probability distribution of $(x + y)$
(iii) All conditional probability distributions.

OR

b) The joint pdf of the two dimensional random variable(x, y) is — 16 K3 CO2

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

Determine the correlation coefficient between x and y.

13. a) Let $x_1, x_2, \dots x_n$ 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	1929	1930	1931	1932	1933	1934	1935
Y	352	356	357	358	360	361	361

14. a) i) Before an increase in excise duty on tea, 800 persons out of a sample of 1000 persons were found to be drinkers. After an increase in duty, 800 people were tea drinkers in a sample of 1200 people. Determine whether there is a significant decrease in the consumption of tea after the increase in excise duty. *8 K3 CO4*

ii) A simple sample of heights of 6400 English men has a mean of 170 cm and a S.D of 6.4 cm. While a simple sample of heights of 1600 Americans has a mean of 172 cm and a S.D of 6.3 cm. Determine whether the data indicate that Americans are on the average taller than English men. *8 K3 CO4*

OR

b) Two researchers A and B adopted different techniques while rating the student's level. Using chi-square test, can you say that the techniques adopted by them are significant? *16 K3 CO4*

Researchers	Below average	Average	Above average	Genius	Total
A	40	33	25	2	100
B	86	60	44	10	200
Total	126	93	69	12	300

15. a) *16 K3 CO5*

Let x be $N_3(\mu, \sum)$ with $\mu' = (2, -3, 1)$ and $\sum = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 3 & 2 \\ 1 & 2 & 2 \end{bmatrix}$.

Compute the distribution of $3x_1 - 2x_2 + x_3$.

OR

b) Compute the principal component of the following matrix *16 K3 CO5*

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