K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:IV
Class:SY	Program:B.Tech
Branch Code:ADS/COM/CSD/INT	Pattern:2023
Name of Course:Probability & Statistics	Course Code:2300211A
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 4 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. Use of non programmable scientific calculator is allowed.
6. The last columns indicates the Course Outcome of the Question/sub-question.

Marks CO

Question No. 1

1a) The first four moments about the value 5 are 2, 20, 40 and 50. Find the moments about mean. Also evaluate coefficient of skewness and kurtosis and comment upon the nature of distribution. (6) CO1

Question No. 2

2a) Find the value of k if the probability mass function is given by: (6) CO2

X	0	1	2	3	4
P(X)	2k	$2k^2$	$4k^2$	$3k-k^2$	k^2

Also find $P(X > 1)$ and $P(1 < X \leq 3)$

Question No. 3

3a) A random variable has probability density function $f\left(x\right) = \begin{cases} \frac{1}{2}\left(x - 1\right)e^{\frac{-x}{2}}; X > 0 \\ 0; Otherwise \end{cases}$ (5) CO3

Find

i. E(2X-1)
ii. V(X)
iii. V(3X-2)

OR

3b) Find the moment generating function of the random variable whose probability density function is (5) CO3

$$f(x)=\frac{1}{2}\begin{cases}2-x, & 0<x<2\\ 0, & x>2\end{cases}$$

Also find its mean.

3c) On an average 20% of the employee's login attempts in an IT firm fail due to a server timeout. If 12 login attempts are made, Using Binomial distribution find the probability that (5) CO4

i. Exactly 2 login attempts fail.
ii. At least one login attempt fails.

OR

3d) The number of packets arriving at a router per second follows a Poisson distribution. If $P(X=2) = 2P(X=3)$ (5) CO4

i. Find λ.
ii. $P(X \leq 2)$

3e) The network response times (in milliseconds) of 5000 servers in a data center are found to normally distributed with a mean of 39.5 milliseconds and a standard deviation of 12.5 milliseconds. Determine approximately (6) CO5

i. How many servers have response time less than 60 milliseconds.
ii. How many servers have response time between 55 milliseconds and 65 milliseconds. [Given A(z=1.64)=0.4495, A(z=1.24)=0.3925, A(z=2.04)=0.4793]

OR

3f) If X is normally distributed with mean of X is 15 and standard deviation is 3. Determine (6) CO5

i. $P(6 \leq X \leq 10)$
ii. $P(X \geq 18)$ [Given A(z=1.66)=0.4515, A(z=3)=0.4986, A(z=1)=0.3413]

Question No. 4

4a) The joint probability mass function of (X,Y) is given by (5) CO3

x / Y	-1	0	1
-1	0	0	1/3
0	0	0	0
1	0	1/3	1/3

Find

i. $P(X \leq 1, Y = 1)$
ii. $P(X + Y \leq 2)$

OR

4b) If the joint probability density function of X and Y given by (5) CO3

$f(x,y) = \frac{2}{5}(2x + 3y); 0 \leq X \leq 1; 0 \leq Y \leq 1$

Find

i. $P\left(0 \leq X \leq \frac{3}{4}, \frac{1}{2} < Y < 1\right)$

ii. $P\left(X > \frac{1}{2}\right)$

4c) A two dimensional random variable (X,Y) have a joint probability mass function is $P(x,y) = k(xy+1); x = 0,1,2; y = 0,1,2$ (5) CO3

Find

i. Value of k
ii. Marginal distribution of X and Y.

OR

4d) The joint probability density function of a two dimensional random variable (X,Y) is given by (5) CO3

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

Find

i. Marginal density function of X and Y.
ii. Find whether X and Y are independent.

4e) For the bivariate probability distribution of (X,Y) given below: (6) CO4

X / Y	1	2	3
0	3/28	9/28	3/28
1	3/14	3/14	0
2	1/28	0	0

Find:

i. The conditional distribution of Y given X=3.
ii. The conditional distribution of X given Y=1.

OR

4f) If X and Y have the joint probability density function $f(x,y) = x^2 + \frac{xy}{3}; 0 < X < 1; 0 < Y < 2$ (6) CO4

Find

1. $P\left(X < \frac{1}{3} \middle| Y > 1\right)$
2. $P(X > Y)$

Question No. 5

5a) The table below shows the band width allocation (X) and the corresponding average delay (Y) recorded on an IT network. (5) CO4

X	25	23	26	20	18	13	12	8
y	9	13	15	16	19	22	21	20

Calculate the Karl Pearson's Coefficient of correlation and comment whether increasing bandwidth reduces network delay.

OR

5b) Calculate Spearman's coefficient of correlation for the following data: (5) CO4

Design Quality Score	38	39	37	74	56	53	64	76
Client Rating	43	68	33	38	37	67	71	53

5c) A monitoring team is studying how much usage time (X) influences the number of successful transactions (Y) during peak load conditions: (5) CO4

Server Usage Time X	7	9	8	10	12	13
Successful Transactions Y	6	13	8	4	5	7

Using data set, determine the line of regression Y on X. Also estimate Y for X=11.

OR

5d) Find the lines of regression for the data given: (5) CO4
$n = 20, \sum x = 40, \sum x^2 = 190, \sum y^2 = 200, \sum xy = 150, \sum y = 40$ Also find X when Y=10.

5e) For the tabulated values of X and Y given below. Fit the straight line $y = ax + b$ (6) CO2

X	0	1	2	3	4	5	6
Y	-4	-1	2	5	8	11	14

OR

5f) A cloud system tracks how the server load level (X) changes the response time deviation (Y) (6) CO2

X	1	2	3	4	5	6	7
Y	0	3	10	21	36	55	78

Fir the second degree parabola $y = ax^2 + bx + c$ using least square method.

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