Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)

M.Sc. (Third Semester – Regular) Examinations, December – 2025

24MPCMA23001 - Probability and Stochastic Processes

(Mathematics)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. How would you deal with the assignment problems when some assignments are prohibited?	CO1	K1
b. If X and Y are independent random variables with variance 2 and 3, then find the variance of $3X + 4Y$.	CO3	K2
c. If the correlation between X and Y is 0.3, then what is the correlation coefficient between 2X and 3Y?	CO1	K1
d. Define Type I and Type II error.	CO1	K1
e. Define WSS process.	CO4	K3

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. Let X be a continuous random variable with probability density function, $$f(x) = \begin{cases} kx\,, & 0 \le x < 1 \\ k\,, & 1 \le x < 2 \\ -kx + 3x\,, & 2 \le x < 3 \\ 0\,, & otherwise \end{cases}$$	5	CO2	K5
b. Define Binomial distribution. Also derive its mean and variance.	5	CO3	K4
(OR)			
c. The probability distribution of a random variable X is	05	CO1	K3

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 $P(X < 6)$, $P(X \ge 6)$, $P(0 < X < 5)$.
iii. $P(X \le a) > \frac{1}{2}$, find the minimum value of a.
iv. Determine the distribution function f(x).

d. If $p = \frac{1}{Q}$, $q = \frac{P}{Q}$, find the moment generating function of negative binomial distribution.	05	CO3	K4
3.a. The joint PDF of two r.v. x & y is given by	05	CO3	K4

$$F_{XY}(xy) = \begin{cases} k, & x^2 \le y \le x, 0 < x < 1 \\ 0, & otherwise \end{cases}$$

Find

i. k
ii. The marginal p.d.f of X & Y.
iii. The conditional p.d.f of X is given Y=y and if y given X=x.

b. Explain the concept of independence of random variables. Show that independence implies $f_{\{X,Y\}}(x,y) = f_X(x)f_Y(y)$. 05 CO2 K5

(OR)

c. From the following Joint Probability distribution find the marginal distribution? 05 CO3 K4

X / Y	0	1	2
0	3/28	9/18	3/28
1	3/14	3/14	0
2	1/28	0	0

d. Explain the method of transformation of random vectors using the Jacobian. 5 CO3 K4

4.a. Calculate the regression coefficient and obtain the lines of regression for the following data 05 CO2 K2

X	1	2	3	4	5	6	7
Y	9	8	10	12	11	13	14

b. Find the correlations between this two independent variable. 05 CO3 K4

X	39	65	62	90	82	75	25	98	36	78
Y	47	53	58	86	62	68	60	91	51	84

(OR)

c. Find the rank correlation coefficient for the following data, 05 CO3 K4

Sl no.	1	2	3	4	5	6	7	8	9	10
X	50	33	40	10	15	15	65	24	15	57
Y	12	12	24	6	15	4	20	9	6	18

d. Find the correlations between this two independent variable. 05 CO3 K4

X	2	3	4	5	6	7	8
Y	4	7	8	9	10	14	18

5.a. A stenographer claims that she can take decision at the rate of 120 wpm. Can we reject her claim on the basis of 100 trails in which she demonstrates a mean of words with standard deviation of α=5%. 05 CO2 K3

b. In a test given to two groups of students drawn from two normal populations, the groups obtained were as follows: 05 CO2 K2

Group A: 18, 20, 36, 50, 49, 36, 34, 49, 41
Group B: 29, 28, 26, 35, 30, 44, 46

Examine at 5% level whether the two populations have the same variance.

(OR)

c. The dice was thrown 900 times, of these 3220 is 3 or 4. Can it be regarded as unbiased. Level of significance is 5%. 05 CO3 K4

d. One thousand girl in a college were graded according to their I.Q. and the economic conditions of their homes. Use χ^2-test to find out whether there is any association between economic conditions at home and I.Q. of girls: 05 CO2 K3

	I.Q.		
Economic condition	High	low	Total
Rich	100	300	400
Poor	350	250	600
Total	450	550	1000

Given for $\lambda = 1, \chi^2_{0.05} = 3.84$

6.a. State and prove arrival distribution theorem (Birth process). 07 CO1 K1

b. Given that a person last cola purchase was COKE, there is a 90% chance that his next cola purchase will also be COKE. If a person last cola purchase was PEPSI, there is a 80% chance that his next cola purchase will also be PEPSI. Construct the TPM. 03 CO1 K2

(OR)

c. State and prove Infinitesimal description of Poisson process 06 CO3 K4

d. Suppose that new razor blades were introduced in the market by three companies at the same time. When they were introduced, each company has an equal share of the market, but during the year the following changes took place: 04 CO1 K1

i. Company A retained 90% of its customers and lost 3% to company B and to company C.
ii. Company B retained 70% of its customers and lost 10% to Company A and 20% to company C.
iii. Company C retained 80% of its customers and lost 10% to Company A and 10% to company B.

Construct the TPM.

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