

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



M.Tech. (First Semester - Regular) Examinations, January - 2026  
**24MCSPC11001 – Mathematical Foundation of Computer Science  
(CSE)**

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 <i>ALL</i> questions  | CO # | Blooms Level |
|---|------|--------------|
| a. What is the expected value of a fair coin toss.  | CO2  | K3           |
| b. Define probability mass function (pmf) and probability density function (pdf). Give one example of each. | CO2  | K3           |
| c. Write the probability mass function (PMF) of a Binomial distribution.                                    | CO4  | K3           |
| d. If $Y=aX+b$ , write the expression for $E[Y]$ .  | CO1  | K3           |
| e. Define Central Limit Theorem in your own words.  | CO4  | K3           |

**PART – B****(10 x 5 = 50 Marks)**Answer *ALL* the questions

- |   | Marks | CO # | Blooms Level |
|---|-------|------|--------------|
| 2. a. If $X$ is normal with mean 2 and standard deviation 3, describe the distribution of $Y = (1/2)X - 1$ and find $P[Y \geq 3/2]$ .   | 05    | CO2  | K5           |
| b. $X$ is a normal variate with mean 30 and S.D 5. Find the probabilities that (i) $26 \leq X \leq 40$ , (ii) $X \geq 45$ , (iii) $ X - 30  > 5$ .  | 05    | CO3  | K4           |
| (OR)  |       |      |              |
| c. $X$ is normally distributed and the mean of $X$ is 12 and standard deviation is 4. Find the probability of following   | 05    | CO1  | K3           |
| a. $X \geq 20$ , $X \leq 20$ , $0 \leq X \leq 12$   |       |      |              |
| b. Find $x'$ , when $P(X > x') = 0.24$  |       |      |              |
| c. Find $x'_0$ and $x'_1$ , when $P(x'_0 < X < x'_1) = 0.50$ , $P(X > x'_1) = 0.25$   |       |      |              |
| 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:              | 05    | CO3  | K4           |
| a. Company A retained 90% of its customers and lost 3% to company B and to company C.   |       |      |              |
| b. Company B retained 70% of its customers and lost 10% to Company A and 20% to company C.  |       |      |              |
| c. Company C retained 80% of its customers and lost 10% to Company A and 10% to company B. Construct the TPM.   |       |      |              |
| 3.a. . . Let $X_1, X_2, X_3, \dots, X_n$ be a random sample from uniform distribution with population density function $f(X, \theta) = \frac{1}{2\theta}$ , $-\theta < X < \theta$ . Obtain the estimator of $\theta$ by the method of moments. | 05    | CO3  | K4           |

- b. A random sample of 700 units from a large consignment and in that 200 were damaged. Find 95% confidence limit for the proportion of damage units in the consignment. 05 CO2 K5

(OR)

- c. Let  $X_1, X_2, X_3, \dots, X_n$  be a random sample from exponential distribution  $f(X, \lambda) = \frac{1}{\lambda} e^{-\lambda x}, x > 0, \lambda < \infty$ . Find the MLE of  $\lambda$ . 05 CO3 K4

- d. The mean and variance of a random sample of 64 observation were computed as 160 and 100 respectively. Compute the 95% confidence limits for population mean. 05 CO3 K4

- 4.a. Given the following bivariate data, compute the covariance and correlation coefficient: 05 CO2 K2

X: 2, 4, 6, 8 Y: 3, 7, 5, 10.

- 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)

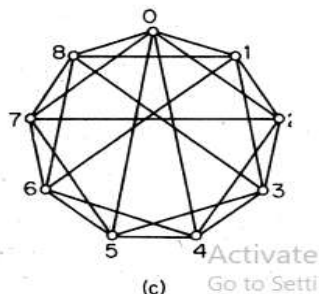
- c. From the following data obtained regression equation, 05 CO3 K4

X	91	97	108	121	67	124	51	73	111	57
y	71	75	69	97	70	91	39	61	80	47

- 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

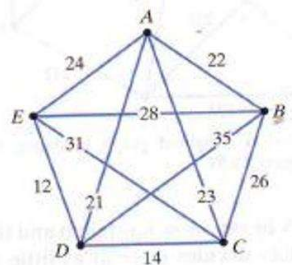
- 5.a. Find a graph with nine vertices and 23 edges that is 5-connected but not isomorphic to the graph  $H_{5,9}$  of given figure c. 05 CO2 K3



- b. Using Euler's formula, find the maximum number of edges in a planar graph with 12 vertices. 05 CO2 K2

(OR)

- c. 8. Use Kruskals' Algorithm to find the minimum spanning tree for the graph shown below. Give the total weight of the minimum spanning tree. 05 CO3 K4



- d. Mary, Erin, Sue, Jane, Katy, and Brenda are friends at college. Mary, Erin, Sue, and Jane are in the same math class. Sue, Jane, and Katy take the same English 05 CO2 K3

composition class.

(a) Draw a graph with vertices representing the six students and edges representing the relation "take a common class."

(b) Is the graph connected or disconnected? How many components does the graph have?

(c) In your graph, identify a subgraph that is a complete graph with four vertices.

(d) In your graph, identify three different subgraphs that are complete graphs with three vertices.

6.a. A graph has 10 vertices and 15 edges. Verify whether it can be planar using Euler's formula. 05 CO1 K1

b. A Markov chain has transition matrix  $P = [[0.5, 0.5], [0.4, 0.6]]$ . Find then probability distribution after two steps. 05 CO1 K2

(OR)

c. Let  $X_1, X_2, X_3, \dots, X_n$  be a random sample from a population with population density function  $f(X, \theta) = \theta X^{\theta-1}; 0 < X < 1, \theta > 0$ . Find the sufficient estimator for  $\theta$ . 05 CO3 K4

d. 1. The probability distribution of a R.V. X is, 05 CO1 K1

$x$	0	1	2	3	4	5	6	7
$p(x)$	0	$k$	$2k$	$2k$	$3k$	$k^2$	$2k^2$	$7k^2 + k$

- Find  $k$ .
- Evaluate  $P(X < 6)$ ,  $P(X \geq 6)$ ,  $P(0 < X < 5)$ .
- $P(X \leq a) > \frac{1}{2}$ , find the minimum value of  $a$ .
- Determine the distribution function.

--- End of Paper ---