D 123298 **(Pages : 2)** **Name.......................................**

Reg. No...................................

SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2025

Statistics

STA2MN101—PROBABILITY THEORY I

(2024 Admission onwards)

Time : Two Hours Maximum : 70 Marks

Section A

All Questions can be answered.
Each Question carries 3 marks.
(Ceiling: 24 marks)

1. Mention any three properties of a probability mass function.
2. If the pmf, $f(x) = kx(x-1)$, for $x = 2,3,4$ and 5. Obtain the value of k.
3. For two constants a and b, prove that for a random variable X, E $(a\mathrm{X} + b) = a\mathrm{E}(\mathrm{X}) + b$.
4. Define raw moments and central moments of a random variable X.
5. Mean of a Poisson random variable X is 4. Find P(X = 2).
6. Mean and variance of a normal random variable X is 10 and 9. Obtain P (X > 13).
7. Define the coefficient of determination.
8. Define regression analysis.
9. Define a parameter. Give an example.
10. Define standard error.

(Ceiling 24 marks)

Section B

All Questions can be answered.
Each Question carries 6 marks.
Ceiling 36 marks.

11 Identify the probability distribution of a random variable with its distribution function given as, $\mathrm{F}_x(x) = 0$, if $x < 0, 0.3$, if $0 \le x < 2$, 0.7, if $2 \le x < 3$ and 1, if $x \ge 3$. Also sketch the graph of the distribution function.

12 Ten unbiased coins are tossed simultaneously. Find the probability of getting (i) exactly 5 heads (ii) at most 4 heads.

Turn over

13 Define rectangular distribution. Explain why it is called so.

14 If X and Y are independent random variables following normal distribution N (2,9) and N(3,16) respectively, then find the probability distribution of (i) X + Y and (ii) X – Y.

15 Define Pearson's coefficient of correlation. Calculate Pearson's coefficient of correlation between X and Y using the data (X,Y) = (4, 9), (5, 12), (6, 15), (7, 18), (8, 20) and (9, 24).

16 Define regression coefficients and establish that the two regression coefficients are always of same sign.

17 Define sampling distribution. If $\bar{x}$ is the mean of the random sample of size 12 taken from N (2, 9), obtain $P(\bar{x} > 0)$.

18 Define F distribution. State its properties and relation with chi square distribution.

(Ceiling 36 marks)

Section C

Answer any **One**.
Each Question carries 10 marks.

19 Define a normal distribution. Obtain the mean of X following $N(\mu, \sigma^2)$ Mention any five of the properties of normal distribution.

20. Define (i) chi-square distribution (ii) *t*-distribution (iii) Obtain the variance of X following Chi square distribution with n degrees of freedom.

(1 × 10 = 10 marks)