

D 141714**(Pages : 2)****Name.....****Reg. No.....****SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2026****Statistics****STA 2MN 101—PROBABILITY THEORY—I****(2024 Admission onwards)****Time : Two Hours****Maximum Marks : 70****Section A***All questions can be answered.**Each question carries 3 marks. (Ceiling : 24 marks)*

1. Define Probability mass function of a random variable X.
2. If $F_x(x)$ is the distribution function of X, mention any three of its properties.
3. For a random variable X, prove that $E(X^2) \geq [E(X)]^2$.
4. Define moments. What are its uses ?
5. Mean of an exponential random variable X is 2. Obtain $P(X = 2)$.
6. If X is a random variable following normal distribution with mean 5 and variance 4. Find $P(X > 5)$.
7. Define the coefficient of determination.
8. Define the regression coefficients.
9. Define a statistic. Give an example.
10. What is the relation between Chi-square and F distributions ?

Section B*All questions can be answered.**Each question carries 6 marks. (Ceiling : 36 marks)*

11. Define moment generating function. If $M_x(t)$ is the m.g.f., of X, for two real numbers a and b show that $M_{aX+b}(t) = e^{bt} M_x(at)$.
12. Obtain the mean and variance of X following $B(n, p)$.
13. If the mean and variance of a random variable following rectangular distribution are 8 and 12. Find the distribution.

Turn over

14. If X and Y are independent random variables following normal distribution $N(3, 9)$ and $N(4, 16)$ respectively, then find (i) $P(X + Y < 5)$; (ii) $P(X + Y > 8)$.
15. Define simple correlation between two variables X and Y . How is it measured ? Explain.
16. Prove that the point of intersection of the two regression lines is $(\bar{x}, \bar{y})$.
17. Obtain the probability distribution of the mean of the random sample of size n taken from a normal population $N(\mu, \sigma^2)$.
18. Obtain the m.g.f. of X following Chi square distribution with n degrees of freedom.

Section C

*Answer any **one** question.
The question carries 10 marks.*

19. Define Poisson distribution. Obtain the mgf and hence the mean of X following Poisson distribution with parameter λ . For a Poisson random variable X , if $P(X = 1) = P(X = 2)$, obtain $P(X > 3)$.
20. Define (i) Sampling distribution ; (ii) t -distribution ; (iii) covariance between X and Y ; (iv) Obtain the covariance between X and Y using the data $(X, Y) = (4, 7), (5, 9), (6, 11), (7, 14), (8, 18)$.

(1 × 10 = 10 marks)