K25U 2951

Reg. No. : ....

Name : ....

III Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Supplementary/Improvement) Examination, November 2025
(2019 to 2023 Admissions)
CORE COURSE IN STATISTICS
3B03STA – Probability Distributions and Limit Theorems

Time : 3 Hours Max. Marks : 48

Instruction : *Use of calculators and statistical tables are* ***permitted.***

PART – A
(Short Answer)

Answer **all** questions : **(6×1=6)**

1. Give the p.g.f of a Bernoulli's distribution.
2. Give the mode of a Poisson distribution with mean λ.
3. What is the variance of continuous uniform distribution over (a, b).
4. If $X \sim N(\mu, \sigma^2)$. Then what is the density of $Y = aX + b$?
5. Name the continuous distribution which has lack of memory property.
6. Define beta distribution of first kind.

PART – B
(Short Essay)

Answer **any 7** questions : **(7×2=14)**

7. Find the mean and variance of a degenerate random variable.
8. Determine the binomial distribution for which mean is 4 and variance is 3.
9. If a random variable X is uniformly distributed with mean 1 and variance $4/3$. Find $P(X < 0)$.
10. Let X be random variable with continuous distribution function F(x). Find the distribution of $Y = F(X)$.

11. Derive the m.g.f. of an exponential distribution with mean θ.

12. Obtain the c.d.f. of standard Cauchy distribution.

13. Give any two uses of Chebyshev's Inequaliy.

14. A random variable X has mean 5 and variance 3. Find the value of h such that $P\{|X-5|<h\} \geq 0.99$?

15. Define De Moivers Laplace Central Limit Theorem.

PART – C
(Essay)

Answer **any 4** questions. **(4×4=16)**

16. Define negative binomial distribution. Find its mean and variance.

17. Derive the recurrence relation for central moment of a Poisson distribution.

18. Define Log-normal distribution. Find its mean and variance.

19. Let X has beta distribution of second kind with parameters p and q. Find the distribution of $Y = \frac{1}{1+x}$.

20. State and prove Chebyshev's inequality.

21. An unbiased coin is tossed 100 times. Show that the probability that the number of heads will be between 30 and 70 is greater than 0.93.

PART – D
(Long Essay)

Answer **any 2** questions. **(2×6=12)**

22. Let X and Y are two independent Poisson variates. Find the conditional distribution of X given X + Y.

23. Derive the m.g.f. of $N(\mu, \sigma^2)$.

24. A continuous random variable X has pdf $f(x) = \frac{\beta^{\alpha}}{\Gamma(\alpha)} e^{-\beta x} x^{\alpha-1}$, $0 < x < \infty$, $\alpha, \beta > 0$.

    Find its m.g.f. Obtain its mean and variance from m.g.f.

25. Let $\{X_n\}$ be a sequence of independent and identically distributed Poisson random variables with mean 2. Using CLT find $P(120 \leq S_n \leq 160)$, where $S_n = X_1 + X_2 + \ldots + X_n$ and n = 75.