



QP CODE: 25050629



25050629

Reg No :

Name :

MSc DEGREE (CSS) EXAMINATION DECEMBER 2025

First Semester

Core Courses - ST500101 - DISTRIBUTION THEORY

M Sc STATISTICS, MSc APPLIED STATISTICS

2019 Admission Onwards

4781D4D1

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. Obtain the probability generating function of geometric random variable having pmf $P(X = k) = pq^{k-1}$; $k=1,2,\dots$
2. What is the mode of logarithmic series distribution?
3. Explain triangular distribution.
4. Obtain the CDF of standard Cauchy distribution.
5. Define inverse Gaussian distribution.
6. Establish the relation between standard uniform distribution and any continuous distribution having CDF $F(x)$.
7. Define a truncated random variable. Write the p.m.f. of zero truncated Poisson distribution.
8. Define noncentral chi-square.
9. Define order statistics.
10. Write down the CDF of r^{th} order statistics.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Examine the additive property of binomial distribution.
12. Explain power series distribution. Obtain the moment generating function of power series distribution.
13. If X and Y are independent standard normal random variables then show that $X+Y$ and $X-Y$ are independent.





14. Define Pareto distribution. What are the important characteristics of a Pareto distribution?
15. Define k- parameter exponential family of distributions. Examine whether the gamma distribution belongs to exponential family of distributions.
16. Let $X_1, \dots, X_n$ is a random sample from standard uniform distribution and let $Y = \prod_{i=1}^n X_i$. Then obtain the distribution of $Z = -2 \ln(Y)$.
17. Obtain the cumulant generating function of chi-square distribution and obtain the expression for its s-th cumulant.
18. Obtain the pdf of sample range in a random sample of size n from $U(-1,1)$.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight **5** each.

19. If X and Y are independent negative binomial random variables with parameters (r_1, p) and (r_2, p) respectively then obtain the conditional distribution of X given $X+Y=n$.
20. (a) Obtain the distribution of the sample mean if a random sample of size n is taken from a gamma distribution with parameters m and p.
(b) If X and Y are independent chi-square random variables with n_1 and n_2 degrees of freedom respectively then obtain the pdf of $\frac{X}{Y}$.
21. (a) If X and Y are independent gamma random variables then show that $U=X+Y$ and $V=\frac{X}{X+Y}$ are independent.
(b) If X and Y are independent gamma random variables then show that $U=X+Y$ and $V=\frac{X}{Y}$ are independent. Identify the distributions of U and V in each case.
22. If $X_1, \dots, X_n$ is a random sample from a normal distribution with mean μ and variance σ^2 then show that the sample mean $\bar{X}$ is independent of the sample variance S^2 .

(2×5=10 weightage)

