



**ST JOSEPH'S UNIVERSITY, BENGALURU -27**

**B. Sc. (STATISTICS) – III SEMESTER**

**SEMESTER EXAMINATION: OCTOBER 2023**

(Examination conducted in November /December 2023)

**ST 322 – CALCULUS AND PROBABILITY DISTRIBUTIONS**

**Time: 2 Hours**

**Max Marks: 60**

This paper contains ONE printed page and THREE parts.

**PART-A**

**I. Answer any FIVE questions: 5 x 3 = 15**

1. Define function, domain of a function, co-domain, and range of a function.
2. State Cauchy's Mean Value theorem.
3. Define Geometric Progression (G.P). If its first term is 'a' and common ratio is 'r', write the standard form of it.
4. Write a short note on chi-square distribution under normality assumption.
5. Describe any two sampling methods with an example for each.
6. What is population and sample? Give an example for each.
7. State the applications of Gamma distribution.

**PART-B**

**II. Answer any FIVE questions: 5 x 5 = 25**

8. Verify the Lagrange's Mean value theorem for the following function.  
 $f(x) = x^2 + 5x + 10$ , in  $[0, 2]$
9. Define Cauchy's root test. Show that the series  $\sum_{n=1}^{\infty} \frac{n^2}{2^n}$  converges.
10. A) If  $y = 3e^x + 10x^3 \log x + \frac{e^{x^2}}{2x}$ , find  $\frac{dy}{dx}$ .  
 B) Find the sum up to 'n' terms of the series  $4 + 44 + 444 + 4444 + \dots$  (3+2)
11. Write a short note on sampling distribution of t and F statistic under normality assumption.
12. Define Beta distribution. State the properties and applications of this distribution.
13. Define Chi-square distribution? Derive the mean of this distribution.
14. Derive the  $r^{\text{th}}$  moment and hence obtain the variance of one parameter Gamma distribution.

**PART- C**

**III. Answer any TWO questions: 10 x 2 = 20**

15. Derive mean and variance of Hyper-Geometric distribution.
16. A) Obtain the recurrence relation for Negative Binomial distribution.  
 B) Explain the concept of sampling distribution of sample mean and sample variance with an example. (5+5)
17. A) In a G.P series, the first term 'a = 7', and the last term 'L = 448' and their sum is 889. Find the common ratio 'r'.  
 B) Show that  $\int_{-\infty}^{\infty} \frac{1}{1+x^2} dx = \pi$ . (5+5)

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