ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU -27
B. Sc (STATISTICS) – III SEMESTER
SEMESTER EXAMINATION: OCTOBER 2022
(Examination conducted in December 2022)
ST 322 – CALCULUS AND PROBABILITY DISTRIBUTIONS

Time: 2 Hours   **Max Marks: 60**
This paper contains TWO printed pages and THREE parts

PART-A

I.   Answer any FIVE questions: **5x3=15**

1. Define Null set and Power set with an example.

2. Define polynomial function and identity function with an example.

3. State Lagrange Mean value theorem with an example.

4. Define proper and improper integrals. Give an example for each.

5. Define convergent and divergent series with an example.

6. Define Hypergeometric distribution. Give the limiting form of this distribution to Binomial distribution.

7. Define standard error of a statistic? Mention any two uses of it.

PART-B

II.   Answer any FIVE questions: **5x5=25**

8. A) Mention any two properties of Cauchy distribution.   (1)

   B) Find the maximum and minimum value of the function $x^3 - 3x^2 - 9x + 12$.   (4)

9. A) Define geometric series. Write the formula for finding the nth term and sum of the nth term of this series.   (2)

   B) Evaluate the following using L'Hopital's rule. $\lim_{x \to -\infty} \frac{x^2}{e^{1-x}}$ (3)

10. Define D'Alembert's Ratio test and Raabe's Test. Check whether the series $\sum_{n=1}^{\infty} \frac{2^n}{n^3}$ converge or diverge?   (5)

11. Derive mean and variance of Chi-square distribution.   (5)

12. Derive the mean and variance of Beta Distribution of first kind.

13. Describe the concept of sampling distribution of sample mean and sample variance in exact sampling distributions.

14. Derive the MGF of Negative Binomial Distribution and hence obtain its mean.

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PART- C

III. **Answer any TWO questions:** **10x2=20**

15. A). Test for the convergence of the following series using Raabe's test. (5)

$$\sum_{n=1}^{\infty} \frac{3 \times 6 \times 9 \times \ldots \ldots \ldots \times 3n}{7 \times 10 \times 13 \times \ldots \ldots (3n+4)} x^n, \quad x > 0$$

    B). Obtain the recurrence relation of Hypergeometric distribution. (3)

    C). Define parameter and statistic with an example. (2)

16. A). Write a short note on sampling distribution of t and F statistic under normality assumption. (6)

    B). Define Beta distribution of second kind and hence derive its mean. (4)

17. Derive the MGF of two parameter Gamma distribution and hence obtain its mean and variance. (10)

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