C 21556 **(Pages : 2)** **Name.......................................**

Reg. No..................................

FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION APRIL 2022

Statistics

STA 4C 04—STATISTICAL INFERENCE AND QUALITY CONTROL

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Use of calculator and Statistical table are permitted.

Section A (Short Answer Type Questions)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Distinguish between parameter and statistic.
2. Define Cramer-Rao Lower Bound (CRLB).
3. Define a moment estimator and point out any *two* of its properties.
4. Define null and alternative hypothesis.
5. Define size of a test.
6. State Neyman-Pearson Lemma
7. What are the test statistic used and its distribution in large sample test of equality of means of two populations when population variances are known ?
8. State the assumptions underlying in ANOVA.
9. Define run test and state the null hypothesis.
10. Write the importance of Kruskal Wallis test.
11. Define random cause and preventable cause acting on the quality of a product.
12. Define control chart.

($8 \times 3 = 24$ marks)

Turn over

Section B (Short Essay/Paragraph Type Questions)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. State Fisher-Neyman factorization theorem. Prove that sample mean is a sufficient estimator of population mean when a random sample of size n is taken from a Poisson population.

14. Define confidence co-efficient. Derive a 95 % confidence interval for the mean of a normal population $N(\mu, \sigma^2)$ based on a random sample of size n, with sample mean $\bar{x}$ when population variance is unknown.

15. Find the probabilities of type I and type II errors if $x \geq 1$ is the critical region for testing $H_0 : \theta = 2$ against $H_1 : \theta = 1$ based on a single observation from the population with p.d.f. $f(x, \theta) = \theta e^{-\theta x}, x \geq 0$.

16. Explain the large sample test of equality of the means of two populations.

17. The following are the average rain fall in mms over 40 consecutive days in a moderate rainy season 12, 15,18, 20, 26, 24, 28, 32, 38, 48, 30, 28, 20, 36, 38, 40, 46, 50, 42, 40, 30, 22, 18, 16, 28, 30, 36, 44, 40, 52, 48, 38, 40, 26, 38, 42, 48, 38, 32, 30. Use one sample sign test to test whether the median rain fall is 40 mms against it is less than 40 at 5 % level of significance.

18. Explain x-bar control chart and the control limits for x-bar when process mean and SD are known.

19. Write a short note on p-chart.

(5 × 5 = 25 marks)

Section C (Essay type Questions)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Explain the method of Maximum Likelihood Estimation. Obtain the MLEs of mean and variance of a normal population based on a sample of size n taken from that population. Also verify whether these MLEs are unbiased for the respective parameters.

21. Explain Chi-square test of goodness of fit. The theory predicts the proportion of beans in the four groups A, B, C, and D should be 9 : 3 : 3 : 1. In an experiment among 1600 beans, the members in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory at 5 % level of significance ?

(1 × 11 = 11 marks)