

QP CODE: 26019296



Reg No :

Name :

M.Sc DEGREE (CSS) EXAMINATION, MARCH 2026

Fourth Semester

M.Sc STATISTICS (APPLIED)

ELECTIVE - ST830401 - STATISTICAL RELIABILITY MODELING AND ANALYSIS

2019 Admission Onwards

DE0929A2

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. Explain reliability function and its properties.
2. Discuss the shape of Reliability function.
3. Derive an expression for h^{th} percentile life function.
4. Explain the inter relations between IFRA and NBU.
5. Define total time on test statistic.
6. Explain the importance of Weibull distribution in reliability analysis.
7. Describe bathtub shaped failure rate model.
8. What is Structure function of parallel system of n components?
9. When will you say that a component is irrelevant? Give an example.
10. Derive Kaplan- Meier estimate of the reliability function.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Derive the failure rate of one parameter and two parameter Wibull.
12. Explain the importance of exponential distribution in reliability analysis.
13. Explain the importance of Pareto distribution in reliability analysis.
14. Derive the failure rate, reliability function and MRLF of a geometric random variable.





15. Derive the survival function of a (i) parallel system (ii) series system (iii) k out of n system
16. Describe the estimation of parameters when the lifetime follows exponential distribution for failure censored data.
17. Obtain the MLE for the reliability function based on time censored samples from exponential distribution with parameter μ .
18. Obtain the MLE for the reliability function based on failure censored samples from Weibull distribution.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight 5 each.

19. (a) Show that for a non negative random variable X with the MRLF $r(x)$ of the form $r(x) = ax+b$, $b>0$ holds if and only if (i) $X \sim$ exponential, when $a=0$ (ii) $X \sim$ Pareto II, when $a > 0$. (b) If $h(x)$ and $r(x)$ be the hazard rate and MRLF, then show that $h(x) r(x)=k$, a constant if and only if (i) $X \sim$ exponential, when $k=1$ (ii) $X \sim$ Lomax, when $k > 1$.
20. Obtain the MLE for the reliability function based on complete samples from exponential distribution. Show that this MLE is biased. Derive an unbiased estimator for the reliability function.
21. (i) Show that Kaplan -Meier estimate is an MLE of survival function. (ii) Obtain the K- M estimate of the following data: Group 1: 9, 13, 13+, 18, 23, 28+, 31, 34, 45+, 48, 161+ (+ denotes the censored observations).
22. Describe the parametric analysis when the lifetime follows two parameter gamma distribution for (i) Complete Data (ii) failure censored data

(2×5=10 weightage)

