D3AST2402 (2 Pages) Name.............................

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

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2025
(Regular/Improvement/Supplementary)

STATISTICS
FMST3C12 - TESTING OF STATISTICAL HYPOTHESES

Time: 3 Hours **Maximum Weightage: 30**

Part A: Answer any *four* questions. Each carries *two* weightage.

1. a) Define critical region, test function and level of significance.
   b) Define p-value and Power of the test.
2. a) Define most powerful test and UMP test.
   b) Show that Neyman-Pearson MP test is a function of sufficient statistic.
3. Define median test. Find the null distribution of the test statistic.
4. Explain locally most powerful tests and α-similar tests.
5. Describe Wilcoxon signed rank test for one sample problem.
6. Define SPRT. What are the merits and demerits of SPRT over fixed sample size tests?
7. In usual notation, show that ES_N = EN . EX.

(4 × 2 = 8 weightage)

Part B: Answer any *four* questions. Each carries *three* weightage.

8. Obtain the MP size α test for testing $H_0: \theta = \theta_0$ against $H_1: \theta = \theta_1 (> \theta_0)$, based on a sample of size n from $f_\theta(x) = e^{-(x-\theta)}, x \geq \theta$.
9. State and prove Neyman-Pearson lemma.
10. Define invariant test. To test $H_0: X \sim N(\theta, 1)$, against $H_1: X \sim C(1, \theta)$, a sample of size two is available on X . Find a UMP invariant test of H_0 against H_1.
11. Show that UMP unbiased test exists even if UMP test does not exist.
12. a) Describe Kendall's fair test for independence.
    b) Compare Chi-square test with Kolmogorov Smirnov test for goodness of fit.
13. Define OC function of SPRT. Derive an approximate expression for OC function of SPRT.
14. Define ASN function. Let $X \sim P(\lambda)$, Consider $H_0: \lambda = \lambda_0$ against $H_1: \lambda = \lambda_1 (\lambda > 0)$. Derive SPRT and find ASN function of the test.

(4 × 3 = 12 weightage)

(P.T.O.)

Part C: Answer any *two* questions. Each carries *five* weightage.

15. a) State and Prove Karlin-Rubin theorem.
    b) Obtain UMP test for testing $H_0: \theta < \theta_0$ against $H_1: \theta \geq \theta_0$, based on a sample of size n from $U(0, \theta)$.

16. Let a random sample of size n drawn from a normal population with mean μ and variance σ^2. Obtain likelihood ratio test of $H_0: \sigma^2 = {\sigma_0}^2$ against $H_1: \sigma^2 \neq {\sigma_0}^2$ when population mean μ is known.

17. a) Explain Mann-Whitney-Wilcoxon test for the two sample problem.
    b) Explain Spearman's rank correlation test.

18. a) Determine the expressions for the boundary values A and B of SPRT with strengths (α, β).
    b) Show that SPRT terminates with probability one.

(2 × 5 = 10 weightage)