Category VI

> ### COMMON POOL OF GENERIC ELECTIVES (GE) COURSES
> ### OFFERED BY DEPARTMENT OF STATISTICS (Semester-VII)

> ### GENERAL ELECTIVE COURSE – 7A: NONPARAMETRIC METHODS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Nonparametric Methods	4	3	0	1	Class XII pass with Mathematics	Knowledge of hypothesis testing

Learning Objectives
The learning objectives include:

- Utility of Nonparametric/distribution free tests and its role for different type of data
- Quantile and Empirical distributions and their utility
- Test for randomness, location and scales under nonparametric setup
- Test association of bivariate samples

Learning Outcomes:
After completing this course, students should be able to:

- Distinguish between parametric and nonparametric test and appreciate different measurement scales.
- Understand quantile and empirical distribution function and its utility.
- Use nonparametric test for both one/two samples problem, Test for randomness, Kolmogorov- Smirnov one sample and two sample tests, sign test, Wilcoxon signed rank test, run test. Median test, Mann Whitney U test, Kruskal-Wallis one-way analysis of variance by ranks.
- Test association of bivariate samples using Kendall Tau and Spearman's rank correlation.

SYLLABUS OF GE-7A

Theory

UNIT I (15 hours)
Nonparametric Tests:
Introduction and Concept, Non-parametric tests-their advantages and disadvantages, comparison with parametric tests. Measurement scale-nominal, ordinal, interval and ratio. The quantile function, the empirical distribution function, Test for randomness based on total number of runs.

UNIT II (15 hours)

One-Sample, two-sample problem, and Paired-Sample Procedures: the sign test, treatment of ties in rank tests, Wilcoxon signed-rank test, Wald-Wolfowitz runs test, Kolmogorov-Smirnov one and two- sample test, median test, and the Mann-Whitney U test.

UNIT III (15 hours)
Linear Rank Tests for the Location and Scale Problem:
Definition of linear rank statistics, Wilcoxon rank-sum test; Tests of the Equality of k Independent Samples: The Kruskal-Wallis one-way ANOVA test; Measures of Association for Bivariate Samples: definition of measures of association in a bivariate population, Kendall's Tau coefficient, Spearman's coefficient of rank correlation.

PRACTICAL/LAB WORK(30 hours):

List of Practical
1. Obtaining quantile and Empirical Distribution
2. Test for randomness
3. Sign test
4. Wilcoxon Signed rank test
5. Wald-Wolfowitz runs test,
6. Kolmogorov-Smirnov one sample test,
7. median test and the Mann-Whitney U test.
8. Wilcoxon rank-sum test
9. The Kruskal-Wallis one-way ANOVA test
10. Test based on Kendall's Tau coefficient.
11. Spearman's coefficient of rank correlation

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

ESSENTIAL READINGS:
- Gibbons, J. D., and Chakraborti, S. (2021): Nonparametric statistical inference. CRC press.
- Siegel, S. (2014). Nonparametric statistics for the behavioural sciences. McGraw-Hill.

SUGGESTIVE READINGS:
- Kloke, J., and McKean, J. W. (2024) : Nonparametric statistical methods using R. CRC Press.
- Hollander, M., Wolfe, D.A., and Chicken, E.(2013):Nonparametric statistical methods (Vol. 751). John Wiley & Sons.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.