DEPARTMENT OF STATISTICS				*CLASS: I PG*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
I	NME – I	21P1SNM1	Introduction to Non – Parametric Statistics	2	2	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives:

1. To explore knowledge in the advanced methods of nonparametric inference.
2. To derive inference for samples drawn from distribution free population.

Unit	Description	Hours	K-level	CLO(s)
I	Introduction - Fundamental statistical concept - Run test for randomness, χ_2 goodness of fit test. Kolmogrov – Smirnov one sample test, Kolmogrov – Smirnov two sample test, Binomial test , Point estimator and confidence interval for probability of success.	8	K2	1
II	One sample location problems – Wilcoxon signed rank test. Fishers sign test. Asymptotic test of symmetry – Estimators and confidence interval.	6	K2	2
III	Two sample problems – Wilcoxon rank sum test for location parameter (Mann – Whitney). Test for dispersion parameter – Rank test, Rank like test (Moses), Millers asymptotic test based on Jackknife.	4	K2	3
IV	One way layout – Kruskal Wallis test - Test for ordered alternatives, Multiple comparison based on Kruskal Wallis rank sums. Two way layout - Friedman's rank sums test. Test for ordered alternatives , multiple comparisons.	6	K2	4
V	Kendals test for independence - Theil's test for regression coefficients - Hollander's test for parallelism of two regression lines.	6	K2	5

Books for References:

1. Gibbons (2003), Non parametric Statistical Inference, McGraw –Hill Kogakusha, Ltd.
2. Hollander Myles & Wolfe D.A.(1973) , Non parametric Statistical Methods, John Wiley & Sons.

Web Pages:

1. Introduction of non-Parametric methods: https://corporatefinanceinstitute.com/resources/knowledge/other/nonparametric-tests/

https://www.yourarticlelibrary.com/statistics-2/non-parametric-tests-concepts-precautions-and-advantages-statistics/92360
https://statisticsbyjim.com/hypothesis-testing/nonparametric-parametric-tests/
https://www.statisticshowto.com/probability-and-statistics/statistics-definitions/parametric-and-non-parametric-data/

2. Theil's test:
   https://www.youtube.com/watch?v=OqBFv_omR1E
3. Hollander's test for parallelism of two regression lines
   https://ufdc.ufl.edu/AA00025285/00001

Rationale for Nature of the course

In this course, the basic non-parametric statistical tests are introduced. Explained when non-parametric test should be used and equivalent non-parametric test for most widely used parametric tests such as t – test, ANOVA, correlation etc., and other useful non-parametric test are demonstrated with practical application for real time data.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

Problem solving sessions with the sample real time data

Pedagogy

Chalk and Talk, PPT, Interaction, Problem solving.

Lecture Schedule

Unit	Topics	Hours	Mode
I	Introduction - Fundamental statistical concept	1	PPT , Chalk and Talk, Problem solving Interaction
	Run test for randomness, χ^2goodness of fit	3	
	Kolmogrov – Smirnov one and two sample test	1	
	Binomial test,	2	
	Point estimator and confidence interval for probability of success.	1	
II	Wilcoxon signed rank test	1	PPT , Chalk and Talk, Problem solving Interaction,
	Fishers sign test	1	
	Asymptotic test of symmetry	2	
	Estimators and confidence interval	2	
III	Wilcoxon rank sum test	1	PPT , Chalk and Talk, Problem solving Interaction
	Rank test, Rank like test	1	
	Millers asymptotic test based on Jackknife	2	
IV	Kruskal Wallis test	2	PPT , Chalk and Talk, Problem solving Interaction,
	Kruskal Wallis rank sums	2	
	Friedman's rank sums test	2	
V	Kendals test for independence	2	PPT , Chalk and Talk, Problem solving
	Theil's test for regression coefficients	2	
	Hollander's test for parallelism of two regression lines	2	

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO's	Course Learning Outcomes	Knowledge Level
CLO-1	Solve hypothesis testing problems where the assumptions for the parametric inferential tools to be applied are not fulfilled. .	Up toK2
CLO-2	Understand the problem associated with skewed data.	Up toK2
CLO-3	Formulate, test and interpret various hypothesis tests for location, scale, and independence problems.	Up toK2
CLO-4	Characterize, compare, and contrast different nonparametric hypothesis tests.	Up toK2
CLO-5	Present and communicate, both orally and in written-form, the results of statistical analyses of nonparametric data	Up toK2

MAPPING CLOs WITH PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO-1	2	2	2	2		2	2
CLO-2	2	2	3	2		2	2
CLO-3	1	2	2	2		2	3
CLO-4	1	1		2	2	2	1
CLO-5	2	1	2	2		2	1

Advance application – 3; Intermediate level – 2; Basic level – 1

CIA-I–BluePrint

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
CLO 1	Up to K2	1	K1	1	K2/K2	1	K1
CLO 2	Up to K2	2	K1	1	K2/K2	2	K1
No. of Questions to be asked		3		2		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		**6**		**14**		**20**	

CIA-I :: Distribution of Section-wise Marks with K levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Total Marks	% of Marks without choice	Consolidated %
K1	6	-	30	**36**	56.25	**100**
K2	-	28	-	**28**	43.75	
K3	-	-	-	**-**	-	**-**
K4	-	-	-	**-**	-	**-**
Total Marks	**6**	**14**	**30**	**64**	**100.00**	**100%**

CIA-II – Blue Print

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
CLO 3	Up to K2	1	K1	1	K2/K2	1	K1
CLO 4	Up to K2	2	K1	1	K2/K2	2	K1
No. of Questions to be asked		3		2		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		**6**		**14**		**20**	

CIA-II :: Distribution of Section wise Marks with K levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Total Marks	% of Marks without choice	Consolidated %
K1	6	-	30	**36**	56.25	**100**
K2	-	28	-	**28**	43.75	
K3	-	-	-	**-**	-	**-**
K4	-	-	-	**-**	-	**-**
Total Marks	**6**	**14**	**30**	**64**	**100.00**	**100%**

CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination -Blue Print

Units	CLOs	K-Level	Section – A		Section – B		Section – C	
			Short Answers		(Either / or Choice)		(Open Choice)	
			No. of Questions	K-Level	No. of Questions	K-Level	No. of Questions	K-Level
1	CLO 1	Up to K2	1	K1	1	K2/K2	1	K1
2	CLO 2	Up to K2	1	K1	1	K2/K2	1	K1
3	CLO 3	Up to K2	1	K1	1	K2/K2	1	K1
4	CLO 4	Up to K2	1	K1	1	K2/K2	1	K1
5	CLO 5	Up to K2	1	K1	1	K2/K2	1	K1
No. of Questions to be asked			5		5		5	
No. of Questions to be answered			5		5		3	
Marks for each question			2		7		10	
Total Marks for each section			10		35		30	

Distribution of Marks with K Level for Summative Examination

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	10	-	50	60	46.15	100
K2	-	70	-	70	53.85	
K3	-	-	-	-	-	-
K4	-	-	-	-	-	-
Total Marks	**10**	**35**	**50**	**130**	**100.00**	**100**

Course Designers:
Dr. R. Madhanagopal