



P.B. SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010

Autonomous -ISO 9001 – 2015 Certified

Statistical Inference

Offered to: BA(EMS) & B.SC (MSCs, MSCA & MSDS) / 22STAT31

Course Type: Core (Theory)

Year of Introduction: 2021

Year of Revision: 2022

Percentage of Revision: 50%

Semester: III

Paper No. : III

Credits: 4

Hours Taught: 60 periods. per Semester

Max. Time: 3 Hours

Course Prerequisites (if any): Student required basic knowledge in Probability and Distribution Theory

Course Description:

This course helps the students to familiarize with the ways in which we talk about uncertainty and estimate their situations in which probability arises. Also this course aims at providing basic knowledge about theoretical and application to test according to situations.

Course Objectives:

- 1) To describe many of the important estimation methods and characteristics of the estimators.
- 2) To understand the problem of statistical inference with specific reference to point estimation and interval estimation.
- 3) To differentiate between large and small samples and apply apt testing procedures.

Learning Outcomes: At the end of the course, the student will

- 1) Students will understand the distinguish between the parametric and Non Parametric situations.
- 3) The parameters describe an underlying physical setting in such a way that their value affects the distribution of the measured data..

S. No	Program Outcomes
PO1.	Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology
PO2.	Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO3.	Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO4.	Environment and Sustainability: Understand the issues of environmental contexts and sustainable development
PO5.	Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO6:	Specialized Skills / Transferable Skills: Acquisition of communication and soft, analytical and technological skills that aid in enhancing
PO7.	Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Course Outcomes:		
Course Outcome	Upon successful completion of this course, students should have the knowledge and skills to:	Program Outcomes Mapping
CO 1	Obtain the knowledge on Exact sampling distributions and their application towards real world examples	PO - 5
CO 2	knowledge of point and interval estimation procedures and different methods of point estimation	PO - 6
CO3	Obtain the knowledge on various testing hypothetical statements and finding Uniformly Most Powerful Test	PO - 6
CO 4	a fundamental understanding of Parametric models for developing relevant inferences on associated parameters large and small samples.	PO - 6
CO 5	To obtain the knowledge and to know the applications of various Non-Randomized tests	PO - 6

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	Exact Sampling Distributions Concepts of Population, Sample, Parameter, Statistic, Sampling distribution, Standard error. law of large numbers, central limit theorem (statements only). Student's t- distribution, F – Distribution, χ^2 - Distribution: Definitions, properties and their applications.	9
II	Theory of estimation Introduction, criteria of a good estimator – unbiasedness, consistency, efficiency, & sufficiency. Statement of Neyman's factorization theorem. Estimation of parameters by the method of moments and maximum likelihood (M.L), properties of MLE's (statements only). Binomial, Poisson & Normal population parameters estimate by MLE method. Interval estimation – construction of confidence intervals for population mean using normal distribution.	15
III	Testing of Hypothesis Concepts of Statistical hypotheses, Null and Alternative hypothesis, Critical region, Type I and II errors, level of significance and Power of a test. One and two tailed tests, p-value. Neyman-Pearson's lemma. Examples in case of Binomial, Poisson, Exponential and Normal distributions.	12
IV	Large sample Tests Test for single mean and difference of two means, test for single proportion and difference of proportions. Simple Problems. Small Sample tests - I t-test for single mean, difference of means and paired t-test. F-test for equality of population variances. Simple Problems.	12
V	Small Sample tests - II χ^2 -test for goodness of fit and independence of attributes Non – Parametric Tests Non-parametric tests- Advantages and Disadvantages, Measurement scales - Nominal, Ordinal, Interval and Ratio. One sample tests – Sign and Run test. Two sample tests - Median test, Wilcoxon–Mann-Whitney U test, Kruskal – Wallis test or H- test, Run test. Simple Problems.	12

Text Book:

Fundamentals of Mathematical Statistics, 11th Edition, 2010, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, New Delhi

Reference Books:

1. B.A/B.Sc. Second Year Statistics(2010) , Telugu Akademi, Hyderabad.
2. Mathematical Statistics with Applications, 2009, K.M.Ramachandran and Chris P.Tsokos Academic Press(Elsevier), Haryana .
3. Probability and Statistics, Volume I & II, D. Biswas, New central book Agency (P) Ltd, NewDelhi.
4. An outline of Statistical theory, Volume II,3rd Edition,2010(with corrections) A.M.Goon,M.K. Gupta, B.Dasgupta ,The World Press Pvt.Ltd., Kolakota.
Sanjay Arora and Bansi Lal:. New Mathematical Statistics, Satya Prakashan , New Delhi.

Model Question Paper Structure for SEE

22STA31

Max.: 70 Marks

Statistical Inference

Min. Pass: 28 Marks

Model Question Paper

Section – A

Answer the following

5 x 4M = 20Marks

1. (a) Write the statements of Weak Law of large numbers and Central limit theorem. (L-1, CO-1)
OR
(b) Define F-distribution and write its applications. (L-1, CO-1)
2. (a) Prove that sample mean is an unbiased estimator of population mean in normal Distribution (L-2, CO-2)
OR
(b) Write the properties of MLE's (L-1, CO-2)
3. (a) Define the following terms: (i) Null hypothesis (ii) Alternative hypothesis (L-1, CO-3)
OR
(b) Explain Type I and Type II errors. (L-2, CO-3)
4. (a) Write the procedure for single mean in large sample tests. (L-1, CO-4)
OR
(b) Write the procedure for single mean in large sample tests (L-1, CO-4)
5. (a) Write the procedure of F-test for equality of population variances. (L-1, CO-5)
OR
(b) Explain the procedure of Sign test for single mean. (L-2, CO-5)

Section – B

Answer the following

5 x 10M = 50Marks

6. a. Define student's t-distribution. Write its applications and their properties. (L-2, CO-1)
(OR)
b. Define chi-square distribution. Write its applications and their properties. (L-2, CO-1)
7. a. Explain the characteristics of a good estimator (L-2, CO-2)
(OR)
b. Find Maximum likelihood estimator for μ and σ^2 in normal population. (L-2, CO-2)
8. a. State and prove Neyman-Pearson's lemma. (L-3, CO-3)
(OR)
b. If $x \geq 1$ is the critical region for testing $H_0: \theta = 2$ vs $H_1: \theta = 1$ on the basis of the single observation from an exponential distribution with probability density function $f(x, \theta) = \theta e^{-\theta x}$. Obtain the value of Type I and Type II errors. (L-3, CO-3)
9. a. In a Survey of buying habits, 400 women shoppers are chosen at random on supermarket 'A' located in a certain section of the city. Their average weekly food expenditure is Rs.250 with a S.D. of Rs. 40. For 400 women shoppers are chosen at random on Supermarket 'B' in another section of the city, the average weekly food expenditure is Rs.220 with a S.D. of Rs 55. Test at 1% level of significance whether the average weekly food expenditure of the populations of shoppers are equal. (L-3, CO-4)
(OR)
b. Explain the procedure of t- test for difference of means. (L-2, CO-4)
10. a. Out of 8,000 graduates in a town 800 are females, out of 1,600 graduate employees 120 are females. Use χ^2 to determine if any distinction is made in appointment the basis of sex. (L-4, CO-5)
(OR)
b. Explain the procedure of Wald-Wolfowitz run test for two samples. (L-2, CO-5)



P.B. SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010

Autonomous -ISO 9001 – 2015 Certified

Statistical Inference

Offered to: BA(EMS) & B.SC (MSCs, MSCA & MSDS) / 22STAL31

Course Type: Core (Practical)

Year of Introduction: 2021

Year of Revision: 2022

Percentage of Revision: 50%

Semester: III

Paper No. III

Credits: 1

Hours Taught: 30 periods. per Semester

Max.Time: 2 Hours

Course Prerequisites (if any): Student required basic knowledge in computers

Course Description:

This course gives a working knowledge of Excel to students with the aim of getting to use data analysis and testing.

Course Objectives

- 1) To train students in SPSS Software
- 2) To expose the students to the analysis of statistical data and comparing data sets.

Learning Outcomes: At the end of the course, the student will

- 1) able to do data analysis using Excel
- 2) known to choose the data to test various types.

S. No	Programme Outcomes
PO1.	Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology
PO2.	Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO3.	Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO4.	Environment and Sustainability: Understand the issues of environmental contexts and sustainable development
PO5.	Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO6:	Specialized Skills / Transferable Skills: Acquisition of communication and soft, analytical and technological skills that aid in enhancing
PO7.	Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Course Outcomes:		
Course Outcome	Upon successful completion of this course, students should have the knowledge and skills to:	Programme Outcomes Mapping
CO 1	To Apply statistical analysis that can test hypotheses under parametric approaches.	PO –6
CO 2	To Apply statistical analysis that can test hypotheses under non-parametric approaches.	PO –6

List of practical's

1. Small sample test (t-test): One Sample, Independent Sample and Paired Sample.
2. Large sample tests: One Sample, Independent Sample, Paired Sample (Using Excel)
3. Small sample test (F-test): Equality of population variances (Using Excel)
4. Chi square Test: Test of Independence
5. Chi square Test: Goodness of fit
6. Chi square Test: Test of Independence, 2X2, 3X3, ..., mXn Cross tabulation (Using Excel)
7. Non Parametric Tests: Mann Whitney U test and Wilcoxon Signed ranks test
8. Non Parametric Tests: Kruskal Wallis Test and Friedman test (Using Excel)

Structure of Practical Paper

Total Marks: 50 Marks

- | | | |
|--|----------|---------------------------------------|
| (i) For Continuous Evaluation | : | 15 marks (Internal Evaluation) |
| (ii) For semester end Practical Examination | : | 35 marks (External Evaluation) |