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|  | **P.R.GOVERNMENT COLLEGE(A), KAKINADA** | **Program & Semester****II B.Sc. (III Sem)** |
| **Course****Code****3211** | **TITLE OF THE COURSE****Statistical inference** |
| **Practical** | **Hours Allocated: 30 hrs** | **L** | **T** | **P** | **C** |
| **Pre-requisites:** |  **Basic knowledge in Sampling concept** | **4** | **-** | **-** | **4** |

# Objectives:

* To provide basic knowledge on sampling distributions and applications of chi-square, t, and F
* To enhance the knowledge to find the estimators of parameters keeping in view the properties of estimators
* To give an central idea to apply parametric and non-parametric methods to test hypotheses

# Course Outcomes:

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| On Completion of the course, the students will be able to- |
| **CO1** | **Students would be able to learn about estimation concept** |
| **CO2** | **Students would be able to learn about Hypothesis and its procedure** |
| **CO3** | **Students would be to learn large sample tests and small sample tests** |
| **CO4** | **Students would be able to learn about Non parametric tests** |
| **CO5**  | **Students would be to learn computation part** |

**Course with focus on employability / entrepreneurship / Skill Development modules**

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| Skill Development |  |  | Employability |  |  | Entrepreneurship |  |

#### UNIT*-I (10 Hrs)*

Concepts: Population, Sample, Parameter, statistic, Sampling distribution, Standard error. convergence in probability and convergence in distribution, law of large numbers, central limit theorem (statements only). Student’s t- distribution, F – Distribution, χ2-Distribution: Definitions, properties and their applications, Difference between t and F Distributions.

#### UNIT*-II (10 Hrs)*

Theory of estimation: Estimation of a parameter, criteria of a good estimator – unbiasedness, consistency, efficiency, &sufficiency and. Statement of Neyman's factorization theorem. Estimation of parameters by the method of moments and maximum likelihood (M.L), properties of MLE’s. Estimation of Binomial, Poisson &Normal Population parameters by MLE method. Confidence Intervals for mean and variance in Normal Distribution.

Additional Inputs: Method of least square, confidence limits, Method of estimation

#### UNIT*-III (8 Hrs)*

Testing of Hypothesis:Concepts of statistical hypotheses, null and alternative hypothesis, critical region, two types of errors, level of significance and power of a test. One and two tailed tests. Neyman-Pearson’s lemma. Ump test, uniform most powerful test. Examples in case of Binomial, Poisson, Exponential and Normal distributions.

Additional Inputs: likelihood Ratio test

#### UNIT *– IV (12 Hrs)*

Large sample Tests: Large sample test for single mean and difference of two means, confidence intervals for mean(s). Large sample test for single proportion, difference of proportions. standard deviation(s) and correlation coefficient(s).

SmallSampletests:t-testforsinglemean,differenceofmeansandpairedt-test,testforcorrelation.2-testfor goodness of fit and independence of attributes. F-test for equality of variances, Exact sampling distribution.

#### UNIT *– V (10 Hrs)*

Non-parametrictests- advantages and disadvantages, comparison with parametric tests. Measurement scale- nominal, ordinal, interval and ratio. One sample runs test, sign test and Wilcoxon-signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon –Mann-Whitney U test.

Additional Inputs: Sequentional analysis introduction.

# Textbooks:

1. **B.A/B.Sc II Year statistics-statistical methods and inference-Telugu Academy by A.Mohanrao, N.SrinivasaRao, Dr.R.Sudhakara Reddy,Dr.T.C. Ravichandrakumar**
2. **K.V.S.Sarma Statistics Made simple: Do it yourself on PC, PHI.**
3. **B.A/B.Sc Statistics Descriptive Statistics and Probability, Kalyani Publishers by D.V.L.N. Jogiraju, C. Srikala and L.P. Raj Kumar.**

# Reference books:

1. **V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand&Sons, New Delhi**
2. **Goon AM, Gupta MK,Das Gupta B : Outlines of Statistics , Vol-II, the World Press Pvt.Ltd, Kolkata.**
3. **Hoel P.G: Introduction to matehematical statistics, Asia Publishing house.**

# WebLinks:

 1. <https://conjointly.com/kb/descriptive-statistics/>

 2. <https://en.wikipedia.org/wiki/Descriptive_statistics>

 3. <https://www.scribbr.com/statistics/descriptive-statistics/>

 4. <https://byjus.com/maths/probability-and-statistics/>

# CO-PO Mapping:

**(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High]'-':No Correlation)**

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|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 2 |
| CO2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | 2 | 2 |
| CO3 | 1 | 1 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 1 |
| CO4 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 |

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| **Practical** | **Hours Allocated: 30 hrs** | **L** | **T** | **P** | **C** |
| **Pre-requisites:** |  **Basic knowledge in Sampling concept** | **-** | **-** | **2** | **1** |

Conduct any TEN (MS-Excel mandatory):

1. Large sample test for single mean and difference of means
2. Large sample test for single proportion and difference of proportions
3. Large sample test for difference of standard deviations
4. Large sample test for correlation coefficients
5. Small sample test for single mean and difference of means
6. Small sample test for correlation coefficient
7. Paired t-test.
8. Small sample test for single variance(χ 2 - test)
9. Small sample test for difference of variances(F-test)
10. χ 2 - test for goodness of fit and independence of attributes
11. Nonparametric tests for single sample(run test, sign test and Wilcoxon signed ranktest)
12. Nonparametric tests for related samples (sign test and Wilcoxon signed ranktest)
13. Nonparametric tests for two independent samples (Median test, Wilcoxon –Mann- Whitney - U test )
14. Practicals 5, 6, 7, 8, 9, 10 using MS-Excel

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall be exported to MS word for writing inference.

# Virtual Lab Links:

 1. <https://conjointly.com/kb/descriptive-statistics/>

 2. <https://en.wikipedia.org/wiki/Descriptive_statistics/>

**Model blue print for the Question Paper setter**

**Course-III: STATISTICAL INFERENCE**

**Max. Marks: 50 Time : 2 ½ Hrs.**

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| **Module** | **Short Answer Questions** | **Essay Questions** | **Marks allotted to the Unit/Chapter** |
| **I** | **1** | **1** | **15** |
| **II** | **2** | **1** | **20** |
|  **III** | **1** | **1** | **15** |
| **IV** | **2** | **2** | **30** |
| **V** | **1** | **1** | **15** |
| **Total including choice**  | **7** | **6** | **95** |

**Statistics Course–III: Statistical Inference**

**Question Bank**

**SHORT QUESTIONS:**

1. Define i) Population ii) Parameter iii) Sample iv) Statistic v) Sampling distribution vi) Standard error.
2. Write the applications of t-distribution.
3. Explain method of moments
4. Explain the concept of Interval estimation.
5. Define null hypothesis and alternate hypothesis.
6. Explain one tailed tests and two tailed tests.
7. Explain two types of errors, ump test.
8. Define critical region, level of significance and power of test.
9. Write the procedure for testing of hypothesis.
10. Write the procedure for test for single mean.
11. Explain the procedure for single proportion.
12. Explain randomized tests and non randomized tests.
13. Write the procedure for t- test for sample correlation coefficient.
14. Explain the procedure for t-test for single mean.
15. Explain paired t-test for difference of means.
16. Write the advantages and disadvantages of NP tests over parametric tests.
17. Explain the test for randomness.
18. Write the procedure for one sample sign test.

**ESSAY QUESTIONS:**

1. Define chi square test and write it’s properties.
2. Define t-test and write it’s properties.
3. Define F-test and write it’s properties.
4. Difference between t and F distribution
5. Explain criteria of good estimator.
6. Explain MLE and write it’s properties.
7. Prove that the sample mean is consistent estimator of population mean for normal population
8. Find MLE for the parameter of a Poisson distribution on the basis of random sample of size n.
9. Find MLE for the parameters of a Normal distribution on the basis of random sample of size n.
10. State and prove Neyman Pearson’s Lemma.
11. Obtain the most powerful critical region for testing Ho:µ=µo against H1:µ=µ1, in case of Normal population with known variance, using N-P lemma.
12. Explain large sample test for testing equality of two means and two standard deviation of two normal populations.
13. Random samples drawn from two countries gave the following data relating two heights of men.

Mean heights in inches 67.42 67.25

Standard deviation 2.58 2.5

Sizes of samples 1000 2000

i)Is the difference between means significant at 1% los.

ii) Is the difference between standard deviations significant at 1% los.

1. Explain t-test for difference of means.
2. Explain F-test for equality of variances of two populations.
3. Explain run test for equality of two populations.
4. Explain the chi-square test for i) goodness of fit ii) Independence of attributes.
5. Explain one and paired sample signed rank test.
6. Explain U test for equality of two populations.
7. Explain the procedure for two sample sign test.

**P.R. Government College (Autonomous), Kakinada**

**II year B.Sc., Degree Examinations - III Semester (w.e.f 2021-22)**

**For 2021-20 batch**

**Statistics Course–III: Statistical Inference**

**Model Paper**

**Time: 2 ½ Hrs. Max. Marks: 50**

**Section – A**

 **Answer Any Four of the following questions. 4x5 = 20 M**

1. Define 1) standard error 2) Parameter 3) Sampling distribution
2. Write the concept of Interval estimation
3. Define null hypothèses, alternative hypothèses ,simple and composite hypothèses
4. Write procedure of test for single mean for large sample.
5. Advantages and disadvantages of non-parametric methods over parametric methods.
6. Explain run test for randomness?
7. Define F-Statistic.state its properties.

**Section – B**

**3x10 = 30 M**

**Answer Any Three of the following questions.**

1. Define chi square distribution and write its properties..
2. Explain the criteria of a good estimator
3. Explain the Method of Maximum Likelihood Estimation. And state the properties of MLE
4. State and prove Neyman- Pearson Lemma.
5. Explain the large sample test for testing the difference of two means.
6. Explain the small sample test for testing the difference of two means
7. Explain Mann Whitney Wilcoxon U test.

**Note: Provide Statistical table values wherever necessary.**