

6th SEMESTER (HONOURS)

STEh – 61 (TH)

Statistical Inference (Theory)

Marks : 75

Lectures : 75

- Unit-I: Point estimation: properties of estimators, mean square error(MSE) and minimum MSE estimation, unbiasedness and minimum variance unbiased estimators (MVUE), Rao-Crammer Lower Bound of variance and related results, relative efficiency of an estimator. Amount of information, consistency of estimators and sufficient conditions for consistency. Sufficient statistic and optimal estimators, idea of sufficient statistics with illustration, Rao-Blackwell theorem. **Lectures : 15**
- Unit-II: Method of Estimation: Method of maximum likelihood, method of moments, statement and properties of MLE. Method of minimum chi-square. Interval estimation - general method of constructing confidence interval, confidence interval for the parameter of binomial, Poisson and normal distributions. **Lectures : 15**
- Unit-III: Testing of Hypotheses: statistical hypotheses-simple and composite, statistical tests, critical region, errors of Type-I and Type-II, size and power of a test, definition of most Powerful (MP), uniformly most powerful (UMP) and unbiased test. **Lectures : 15**
- Unit-IV: Neymann-Pearson Lemma and its application in testing of hypotheses regarding binomial, Poisson, normal and Exponential distributions. Power functions of UMP tests with simple illustrations. Likelihood Ratio tests for parameters of binomial and Poisson. Sequential tests - Walds SPRT with illustrations. Approximate OC and ASN functions for tests regarding parameters of binomial and normal distributions. **Lectures : 15**
- Unit-V: Large Sample Tests: Use of CLT to obtain large sample tests for binomial proportion, difference of two binomial proportions, mean of a population and difference of means of two independent populations. Related confidence intervals. **Lectures : 15**

Text Book :

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|--|---|--|
| Hogg, R.V and Tanis, E. A (2003) | : | Probability and Statistical Inference, Pearson Education, New Delhi |
| Mood, A. M. and Graybill, F. A (1963) | : | Introduction to the theory of Statistics, Mc Graw Hill Book Co. New York. |
| Goon, A. M., Gupta, M. K. and | : | An outline of Statistical theory, Vol. II. The |

- Das Gupta, B. (2003) : World Press Private Limite.
- Hogg, R. V. and Craig, A. T : Introduction to Mathematical Statistics, Mac
(1978) - Millan.
- Kendall, M. G. and Stuart : The advanced Theory of Statistics, Vol. II.
Charles Griffin.

Reference:

- Casella, G. and Berger, R. L. : Statistical Inference, 2nd Edn., Duxbury
(2002)
- Das, Kishore K. and : A Treatise on Statistical Inference and
Bhattacharjee, D (2008) Distribution. Asian Book House, New Delhi.
- Rao, C. R. (1973) : Linear Statistical Inference and its
applications. John Wiley and Sons, New York.
- Rohagi, V. K and Saleh, A.K.M : An Introduction to Probability and Statistics,
(2001) 2nd edn., John Wiley
- Chaudhuri, Salil Kumar and : Statistical Methods, Asian Book House,
Chakrabarty, A. (2010) New Delhi.
- Bhattacharyya, G. K. and : Statistical Concepts and Methods, Wiley
Johnson, R.A. (1977) Series, New York

6th SEMESTER (HONOURS)

STH – 61 (PR)

Statistical Inference (Practical)

- Unit-I: 1. Estimation of parameter by MLE.
2. Estimation of parameter by method of moments.
3. Estimation of parameter by minimum chi-square.
- Unit-II: 4. Construction of confidence interval of binomial distribution.
5. Construction of confidence interval of poison distribution.
6. Construction of confidence interval of normal distribution.
- Unit-III: 7. SPRT for binomial distribution for finding OC and ASN function.
8. SPRT for normal distribution for finding OC and ASN function.

9. Large sample tests & corresponding confidence interval.

Reference:

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|---|---|
| Hogg, R. V. and Tanis, E. A. : (2003) | Probability and Statistical Inference, Pearson Education, New Delhi |
| Bhattacharyya, G. K. and : Johnson, R.A. (1977) | Statistical Concepts and Methods, Wiley Series, New York |
| Das, Kishore K. and : Bhattacharjee, D (2008) | A Treatise on Statistical Inference and Distribution. Asian Book House, New Delhi. |
| Mood, A. M., Graybill, F. A : And Boes, D. C. (1974) | Introduction to the theory of Statistics, Mc Graw Hill Book Co. New York. |
| Hogg, R. V. and Craig, A. T : (1978) | Introduction to Mathematical Statistics, Mac - Millan. |
| Kendall, M. G. and Stuart, A. : | The advanced Theory of Statistics, Vol. 1. Charles Griffin. |
| Chaudhuri, Salil Kumar and : Chakrabarty, A. (2010) | Statistical Methods, Asian Book House, New Delhi. |

6th SEMESTER (HONOURS)

STEh – 62 (TH)

Survey Sampling and Non parametric Inference (Theory)

Marks : 75

Lectures : 75

- Unit-I: Linear Systematic sampling- populations with linear trend, estimation of variance using interpenetrating sub-samples (IPSS). Circular Systematic sampling- estimation of the population mean and population total and their variances, estimation of variance using IPSS , Ratio, difference and Regression methods of estimation under SRSWR and SRSWOR- Bias and MSE and their large sample estimation. **Lectures : 15**
- Unit-II: Cluster sampling: single stage cluster sampling with equal size cluster using SRSWR and SRSWOR , estimation of population mean and total, variance in terms of intraclass correlation. Estimation of variance. **Lectures : 15**
- Unit-III: Two Stage Sampling : with equal size first stage units (FSUs) SRSWR at both stages, SRSWOR at both stages, SRSWR at first and SRSWOR at second stage, SRSWOR at first and SRSWR at second stage – Estimation of population mean per Second Stage Units (SSUs) and its sampling variance. Estimation of sampling variance. Estimation of population total. **Lectures : 15**
- Unit-IV: Definition of order statistics, derivation of the distribution of order statistics from Uniform distribution only, joint distribution of two order statistics, distribution of functions of order statistics- sample median, sample range and sample mid range. **Lectures : 15**
- Unit-V: Parametric versus Non-parametric, distribution free methods, areas of applications, non- parametric tests - sign test for location for univariate and bivariate populations, Wilcoxon rank test, Mann-Whitney tests, Kolmogorov-Smirnov test (one sample and two sample) and Median test. **Lectures : 15**

Text Books:

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|---|---|--|
| Murthy, M. N. (1967) | : | Sampling Theory and Methods Statistical Publishing Society. |
| Sampath, S. (2005) | : | Sampling Theory and Methods, Alpha Science International |
| Cochran, W. G. (1977) | : | Sampling Techniques, John Wiley and Wiley Eastern. |
| David, H. A. (1970) | : | Order Statistics, John Wiley. |
| Gibbons, J. D. and Chakrabarty, S. (1985) | : | Non Parametric Methods for Quantitative Analysis, American Sciences Press. |

Reference :

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|--|---|--|
| Sukhatma, P. V., Sukhatme, B. V., Sukhatma, S. and Asok, C. (1984) | : | Sampling Theory of Surveys with applications, Asia Publishing House. |
| Goon A.M., Gupta, M.K. and Dasgupta, B (1999) | : | Fundamental of Statistics, Vol-II, World Press Kolkata |
| Raj, D, Chandhok (1999) | : | Sample Survey Theory, Narosa Publishing House |
| Mukhopadhyay, P (1998) | : | Theory and Methods of Survey Sampling |
| Siegal, S. (1956) | : | Non Parametric Statistics for the behavioral Sciences, Mc Graw – Hill. |

6th SEMESTER (HONOURS)

STH – 62 (PR)

Survey Sampling and Non parametric Inference (Practical)

- Unit-I
1. Estimation of Population mean and totals and Standard errors by IPSS in LSS and CSS.
 2. Sampling Variance in case CSS in terms of intraclass correlation coefficient and its efficiency w.r.t. SRSWR and SRSWOR
 3. Ratio and Regression methods of Estimation using SRSWR and SRSWOR
- Unit-II:
4. Cluster sampling – with equal size cluster estimation of mean and total and their SEs in SRSWR and SRSWOR and variance in terms of intraclass correlation coefficient
 5. Two Stage Sampling- estimation of mean and total and their SEs with SRSWR and SRSWOR at both the stages and SRSWR at the first and SRSWOR at the 2nd stages and and SRSWOR at the first and SRSWR at the 2nd stages
- Unit-III: Non-parametric tests:
6. Sign test – for univariate and bivariate population (one sample and two sample).
 7. Kolmogorov –Smirnov test (one sample and two sample).
 8. Wilcoxon rank test (one sample and two sample).

9. Mann-Whitney test (one sample and two sample).

10. Median test (one sample and two sample).

Reference:

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|---|---|--|
| Cochran, W. G. (1977) | : | Sampling Techniques, John Wiley and Wiley Eastern. |
| Murthy, M. N. (1967) | : | Sampling Theory and Methods Statistical Publishing Society. |
| Singh, D., Chaudhary (1995) | : | Theory and Analysis of Sample Survey Design, |
| Siegal, S. (1956) | : | Non Parametric Statistics for the behavioral Sciences, Mc Graw – Hill. |
| Gibbons, J. D. and Chakrabarthy, S. (1985) | : | Non Parametric Methods for Quantitative Analysis, American Sciences Press. |