

**U.G. 4<sup>th</sup> SEMESTER SYLLABUS**  
**DEPARTMENT OF STATISTICS**  
**COTTON UNIVERSITY**

---

**PAPER: STA401C**

**STATISTICAL INFERENCE**

**(Credits: 4+0+1=5)**

**UNIT I (Lectures: 16)**

Estimation: Concepts of estimation, unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Complete statistic, Minimum variance unbiased estimator (MVUE), Rao-Blackwell and Lehmann-Scheffe theorems and their applications. Cramer-Rao inequality and MVB estimators (statement and applications).

**UNIT II (Lectures: 14)**

Methods of Estimation: Method of moments, method of maximum likelihood estimation, method of minimum Chi-square, basic idea of Bayesian Inference.

**UNIT III (Lectures: 18)**

Principles of test of significance: Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test, Neyman Pearson Lemma (statement and applications to construct most powerful test). Likelihood ratio test, properties of likelihood ratio tests (without proof).

**UNIT IV (Lectures: 16)**

Interval estimation - Confidence interval for the parameters of various distributions, difference of mean, Ratio of variances, Confidence interval for Binomial proportion, Confidence interval for population correlation coefficient for Bivariate Normal distribution, Pivotal quantity method of constructing confidence interval, Large sample confidence intervals.

**PRACTICAL/LABWORK: (Credit:1)**

**List of Practical**

1. Estimation of parameters of Binomial, Poisson, Exponential and Normal distribution by method of MLE.
2. Calculation of standard error of the Maximum Likelihood Estimates.
3. Estimation of parameters of Binomial, Poisson, Exponential and Normal distribution by method of Moments.
4. Construction of critical region and drawing of power curves for Binomial, Poisson, Exponential and Normal distribution (for mean and variance).
5. Construction of confidence intervals for mean and variance in case of Normal distribution.

**SUGGESTED READINGS:**

1. Bhat, B.R, Srivenkatramana T and Rao Madhava K.S. (1997): Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
2. Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
3. Goon A.M., Gupta M.K.: Das Gupta.B. (2005): Fundamentals of Statistics, Vol. I, World Press, Calcutta.

**U.G. 4<sup>th</sup> SEMESTER SYLLABUS**  
**DEPARTMENT OF STATISTICS**  
**COTTON UNIVERSITY**

---

4. Miller, I. and Miller, M. (2002): John E. Freund's Mathematical Statistics (6<sup>th</sup> addition, low price edition), Prentice Hall of India.
5. Mood A.M, Graybill F.A. and Boes D.C, Introduction to the Theory of Statistics, McGraw Hill.
6. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.
7. Snedecor G.W and Cochran W.G. (1967): Statistical Methods. Iowa State University Press.

\*\*\*\*\*

**PAPER: STA402C**

**LINEAR MODELS**

**(Credits: 4+0+1=5)**

**UNIT I (Lectures: 16)**

Gauss-Markov set-up: Theory of linear estimation, Estimability of linear parametric functions, Method of least squares, Gauss-Markov theorem, Estimation of error variance.

**UNIT II (Lectures: 16)**

Regression analysis: Simple regression analysis, Estimation and hypothesis testing in case of simple and multiple regression models, Concept of model matrix and its use in estimation.

**UNIT III (Lectures: 18)**

Analysis of variance: Definitions of fixed, random and mixed effect models, analysis of variance for one-way and two way with  $m(\geq 1)$  with one observation per cell for fixed effect models. Analysis of covariance – one way and two-way classified data with one concomitant variable.

**UNIT IV (Lectures: 14)**

Model checking: Prediction from a fitted model, Violation of usual assumptions concerning normality, Homoscedasticity and collinearity.

**PRACTICAL/ LAB. WORK: (Credit:1)**

**List of Practicals**

1. Estimability when X is a full rank matrix and not a full rank matrix.
2. Fitting of Simple Linear Regression.
3. Fitting of Multiple Regression.
4. Tests for Linear Hypothesis.
5. Analysis of Variance of a one way classified data.
6. Analysis of Variance of a two way classified data with  $m(\geq 1)$  observations per cell.
7. Analysis of Covariance of a one way classified data.
8. Analysis of Covariance of a two way classified data.

**SUGGESTED READINGS:**

1. Biswas S (1995): A Linear Model Approach to Regression Analysis and Its Applications, 1<sup>st</sup> Edition, New Central Book Agency (P) Ltd, Kolkata

**U.G. 4<sup>th</sup> SEMESTER SYLLABUS**  
**DEPARTMENT OF STATISTICS**  
**COTTON UNIVERSITY**

---

2. Goon, A.M. and Gupta, M.K. and Dasgupta, B.(1991): An Outline of Statistical Theory, World Press Private Limited
3. Rao, C.R. (1991): Linear Statistical Inference and Its Applications, Wiley Eastern Limited.
4. Renchner, A. C. and Schaalje, G. B. (2008): Linear Models in Statistics (Second edition), John Wiley and Sons.
5. Weisberg, S. (2005): Applied Linear Regression (Third edition). Wiley.
6. Wu, C. F. J. And Hamada, M. (2009): Experiments, Analysis, and Parameter Design Optimization (Second edition), John Wiley.

\*\*\*\*\*

**PAPER: STA403C**

**STATISTICAL QUALITY CONTROL AND INDEX NUMBER**  
**(Credits: 4+0+1=5)**

**UNIT I (Lectures: 12)**

Quality: Definition and its concept, application and importance. Introduction to Process and Product Controls, Seven tools of SPC, Chance and Assignable causes of quality variation. Statistical Control Charts- Construction and Statistical basis of 3- $\sigma$  Control charts, Rational Sub-grouping. Idea of 6- $\sigma$  limits.

**UNIT II (Lectures: 16)**

Control charts for variables: X-bar & R-chart, X-bar & s-chart.  
Control charts for attributes: np-chart, p-chart, c-chart and u-chart.  
Comparison between control charts for variables and control charts for attributes. Analysis of patterns on control chart, Idea of process capability.

**UNIT III (Lectures: 16)**

Acceptance sampling plan: Principle of acceptance sampling plans. Single and Double sampling plan their OC, AQL, LTPD, AOQ, AOQL, ASN, ATI functions with graphical interpretation, use and interpretation of Dodge and Romig's sampling inspection plan tables.

**UNIT IV (Lectures: 20)**

Index Numbers: Definition, problems in their construction. Unweighted and weighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Criterion of good index number. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers: Construction and uses. Base shifting, splicing and deflating of index numbers. Uses and limitations of index numbers.

**PRACTICAL/LAB. WORK: (Credit:1)**

**List of Practicals**

1. Construction and interpretation of statistical control charts: (a) X-bar & R-chart (b) X-bar & s-chart (c) np-chart (d) p-chart (e) c-chart and (f) u-chart
2. Single sample inspection plan: Construction and interpretation of OC, AQL, LTPD, ASN, ATI, AOQ, AOQL curves

**U.G. 4<sup>th</sup> SEMESTER SYLLABUS**  
**DEPARTMENT OF STATISTICS**  
**COTTON UNIVERSITY**

---

3. Calculation of price and quantity index numbers using simple and weighted average of price relatives.
4. Calculation of Chain Base index numbers.
5. Calculation of consumer price index number.
6. Practical based on shifting of base, splicing and deflating of index numbers.

**SUGGESTED READING:**

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Gupta S.C., Kapoor V.K.(2007): Fundamentals of Applied Statistics. 4th Edition, Sultan Chand and Sons., New Delhi.
3. Montogomery, D. C. (2009): Introduction to Statistical Quality Control, 6<sup>th</sup> Edition, Wiley India Pvt. Ltd.
4. Montogomery, D. C. and Runger, G.C. (2008): Applied Statistics and Probability for Engineers, 3rd Edition reprint, Wiley India Pvt. Ltd.
5. Mukhopadhyay, P (2011): Applied Statistics, 2nd edition revised reprint, Books and Allied(P) Ltd.

\*\*\*\*\*

**(Generic Elective)**

**PAPER: STA404G**

**APPLIED STATISTICS**

**(Credits: 3+0+1=4)**

**UNIT I (Lectures: 12)**

Economic Time Series: Components of time series, Decomposition of time series- Additive and multiplicative model with their merits and demerits, Illustrations of time series.

Measurement of trend by method of free-hand curve, method of moving averages and method of least squares. Measurement of seasonal variations by method of ratio to trend.

**UNIT II (Lectures: 12)**

Index numbers: Definition, Uses and limitations of index numbers, Construction of index numbers of prices and quantities, different types of index Numbers, Criteria for a good index number, consumer price index number-definition , construction and uses. Chain base index numbers.

**UNIT III (Lectures: 12)**

Statistical Quality Control: Importance of statistical methods in industrial research and practice. tolerance limits and specification limits. Causes of variations in quality: chance and assignable. General theory of control charts, process & product control, Control charts for variables: X- bar and R-charts. Control charts for attributes: p and c-charts.

**UNIT IV (Lectures: 12)**

Demographic Methods: Introduction, sources of vital statistics, rates and ratios of vital events. Measurement of mortality: CDR, SDR (w.r.t. Age and sex), IMR, Standardized death rates.

**U.G. 4<sup>th</sup> SEMESTER SYLLABUS**  
**DEPARTMENT OF STATISTICS**  
**COTTON UNIVERSITY**

---

Life (mortality) tables: definition , uses, assumptions, different columns of a complete life table. Measurement of fertility and reproduction: CBR, GFR, and TFR. Measurement of population growth: GRR, NRR.

**PRACTICAL/LAB WORK (Credit:1)**

**List of Practicals**

1. Measurement of trend: Fitting of linear, quadratic trend, exponential curve and
2. plotting of trend values and comparing with given data graphically.
3. Measurement of seasonal indices by Ratio-to-trend method and plotting of trend
4. values and comparing with given data graphically.
5. Construction of price and quantity index numbers by Laspeyre's formula, Paasche's
6. formula, Marshall-Edgeworth's formula, Fisher's Formula. Comparison and
7. interpretation.
8. Construction of fixed base index number and consumer price index number with interpretation
9. Construction and interpretation of X bar & R-chart
10. Construction and interpretation p-chart (fixed sample size) and c-chart
11. Computation of measures of mortality
12. Completion of life table
13. Computation of measures of fertility and population growth

**SUGGESTED READING:**

1. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition World Press, Kolkata.
2. Gupta, S. C. and Kapoor, V.K. (2008): Fundamentals Of Applied Statistics, 4th Edition(Reprint), Sultan Chand & Sons
3. Montogomery, D. C. (2009): Introduction to Statistical Quality Control, 6th Edition, Wiley India Pvt. Ltd.
4. 4.Mukhopadhyay, P. (1999): Applied Statistics, New Central Book Agency, Calcutta

\*\*\*\*\*