BIDHANNAGAR COLLEGE, GOVERNMENT OF WEST BENGAL, SALT LAKE, KOLKATA

Teaching Plan for Odd Semester, UG course

Department of Statistics

Session 2021-22

Class:B.A/ B.Sc
Semester 1,3,5 **Name of the Teacher: Prof. Debesh Roy**
Subject: Statistics
Paper : CC1, CC11 **(Theory and Practical)**

S. No	Practical syllabus to be covered (Paper code to be mentioned)	Theory syllabus to be covered (Paper code to be mentioned)
Week 1 to week 4	STSACOR01T : Definition, scatter diagram, simple correlation, linear regression and principle of least squares, , , STSACOR11T : Stochastic Process: Introduction and Stationary Process.	STSACOR01P: Solution of numerical problems on topics covered in STSACOR01T 1. Fitting of polynomials, exponential curves. 2. Karl Pearson correlation coefficient. 3. Correlation coefficient for a bivariate frequency distribution
Week 5 to week 8	STSACOR01T: Fitting of polynomials and exponential curves STSACOR11T: Markov Chains: Definition of Markov Chain, transition probability matrix.	STSACOR01P: Solution of numerical problems on topics covered in STSACOR01T 4. Lines of regression, angle between lines and estimated values of variables. 5. Spearman rank correlation with and without ties.
Week 9 to Week 12	STSACOR01T: Spearman rank correlation, correlation ratio STSACOR11T : Order of Markov chain, Markov chain as graphs	STSACOR01P: Solution of numerical problems on topics covered in STSACOR01T 6. Computation of correlation ratio. 7. Computation of intra class correlation coefficient
Week 13	STSACOR01T: intra-class correlation STSACOR11T: Higher transition probabilities.	STSACOR01P: Solution of model numerical problems on topics covered in STSACOR01T
Week13 to week 14		**Internal Exam**
Week 15 to 17	STSACOR01T: Solution of model questions.	

Class:B.A/ B.Sc

Semester 1,3,5
Name of the Teacher: Mr. Arup Kumar Hait
Subject: Statistics
Paper : STSACOR01, STSACOR11,STSACOR12(Theory and Practical)

S. No	Practical syllabus to be covered (Paper code to be mentioned)	Theory syllabus to be covered (Paper code to be mentioned)
Week 1 to week 4	**STSACOR01P** • Graphical representation of data. • Stem and Leaf Display **STSACOR11P** • Determination of trend by curve fitting • Determination of trend by moving averages **STSACOR12P** • Price and quantity index numbers using simple and weighted average of price relatives. • To calculate the Chain Base index numbers.	**STSACOR01T** Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement: nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, column diagram and step diagrams. Stem and Leaf display. **STSACOR11T** Time Series as a Stochastic Process. Time Series data. Application of time series from various fields, Components of a times series, Decomposition of time series. Estimation of trend by free hand curve method, method of semi averages, fitting mathematical curves, and growth curves. Method of moving averages. **STSACOR12T** Index Numbers, price, quantity and value indices, choice of weights, Various formulae and their comparisons. Tests of index numbers. Fisher's ideal index number. Chain Index Number.
Week 5 to week 8	**STSACOR01P** • Problems based on measures of central tendency. **STSACOR11P** • Determination of seasonal indices by method of averages , Ratio to Trend, Ratio to Moving Averages and Link Relative method • Harmonic Analysis **STSACOR12P** • Problems on cost of living index numbers.	**STSACOR01T** Measures of Central Tendency: mathematical and positional. **STSACOR11T** Estimation of seasonal component by Method of simple averages, Ratio to Trend, Ratio to Moving Averages and Link Relative method. Harmonic Analysis. Variate component method. **STSACOR12T** Consumer Price Index, Wholesale Price index & Index of industrial Production- methods of construction and uses. Definition of national income. A brief account of product, expenditure and income approaches for estimation of National Income.
Week 9 to Week 12	**STSACOR01P** • Problems based on measures of dispersion. • Problems based on combined mean and variance and coefficient of variation. **STSACOR11P**	**STSACOR01T** Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation. **STSACOR11T**

	• Correlogram Analysis **STSACOR12P** • Lorenz curve. • Pareto and lognormal fitting.	Stationary Time series Weak stationarity, autocorrelation function and correlogram .Some Special Processes: Moving-average (MA) process and Autoregressive (AR) process of orders one and two, **STSACOR12T** Measurement of poverty and inequality, Desirable properties and different descriptive measures including Gini's coefficient, Lorenz curve. Use of Pareto and Log Normal distributions. Measures of unemployment. Comparative Social Statistics, Indices related to human development and gender disparity.
Week 13 to week 14		**Internal Exam**
Week 15 to 17	**STSACOR01P** • Problems based on moments, skewness and kurtosis. **STSACOR11P** • Fitting of AR 1 and AR 2 models • Simple Exponential Smoothing **STSACOR12P** • Official Statistics	**STSACOR01T** Moments, absolute moments, factorial moments, Measures of skewness and kurtosis. Box Plot. Sheppard's corrections (without proof). **STSACOR11T**Estimation of the parameters of AR (1) and AR (2) – Yule-Walker equations. Simple Exponential smoothing. **STSACOR12T** Present official statistical system in India, Methods of collection of official statistics, their reliability and limitations. Role of Ministry of Statistics and Program Implementation (MoSPI). Central Statistical Office (CSO), National Sample Survey Office (NSSO), and National Statistical Commission. Government of India's Principal publications containing data on the topics such as population, industry and finance.

Class: B.Sc. (Honours)
Semesters: 1, 3,5 (CBCS)
Name of the Teacher: Kiranmoy Chatterjee
Subject: Statistics
Paper : STSACOR02T, STSACOR05T, STSACOR05P, STSACOR12T, STSACOR12P (CBCS)

S. No	Practical syllabus to be covered (Paper code to be mentioned)	Theory syllabus to be covered (Paper code to be mentioned)
Week 1 to week 4	Paper STSACOR12P(CBCS) : 1. Price and quantity index numbers using simple and weighted average of price relatives.	Paper STSACOR02T(CBCS) : Vector spaces, subspaces, sum of subspaces, Span. Linear dependence and independence, basis and dimension, dimension theorem.

	2. To calculate the Chain Base index numbers. 3. Problems on cost of living index numbers. Paper STSSSEC01M(CBCS) : Statistical Data Analysis Using C-programming and Software Packages Minitab: Unit 1	Paper STSACOR05T(CBCS) : ***Unit 1: Two dimensional random variables: Discrete*** Paper STSACOR12T(CBCS) : Index Numbers, price, quantity and value indices, choice of weights, Various formulae and their comparisons. Tests of index numbers. Fisher's ideal index number. Chain Index Number. Consumer Price Index
Week 5 to week 8	Paper STSSSEC01M(CBCS) : Statistical Data Analysis Using C-programming and Software Packages Minitab: Unit 2	Paper STSACOR02T(CBCS) : Orthogonal vectors, Gram-Schmidt orthogonalization, ortho-complement space. Null space and nullity. A review, theorems related to triangular, symmetric and skew symmetric matrices, idempotent matrices, orthogonal matrices, singular and non-singular matrices and their properties. Trace of a matrix. Paper STSACOR05T(CBCS) : ***Unit 2: Two dimensional random variables: Continuous*** Paper STSACOR12T(CBCS) : Wholesale Price index & Index of industrial Production- methods of construction and uses. Definition of national income. A brief account of product, expenditure and income approaches for estimation of National Income
Week 9 to Week 12	Paper STSACOR05P(CBCS) : 1. Problems based on the property of normal distribution. 2. To find the ordinate for a given area for normal distribution. 3. Application-based problems using normal distribution. 4. Fitting of normal distribution when parameters are given. 5. Fitting of normal distribution when parameters are not given. 6. Fitting of some other continuous distributions. Paper STSACOR12P(CBCS) : 4. Lorenz curve. 5. Pareto and lognormal fitting. Paper STSSSEC01M(CBCS) : Statistical Data Analysis Using C-programming and Software Packages Minitab: Unit 3	Paper STSACOR02T (CBCS) : Row space and column space of a matrix. Definition, properties and applications of determinants for 3rd and higher orders, evaluation of determinants of order 3 and more using transformations. Symmetric and Skew symmetric determinants, Circulant determinants and Vandermonde determinants for nth order. Paper STSACOR05T(CBCS) : ***Unit 3: Generating Functions*** ***Unit 4: Standard continuous probability distributions:*** Uniform, normal, exponential, Cauchy, beta, gamma, lognormal distributions Paper STSACOR12T(CBCS) : ***Unit 2: Measurement of poverty and inequality and Social Statistics:*** Measurement of poverty and inequality, Desirable properties and different descriptive measures including Gini's coefficient, Lorenz curve. Use of Pareto and Log Normal distributions. Measures of unemployment. Comparative Social Statistics, Indices related to human development and gender disparity.

Week 13-14: Internal Exam (for CBCS) and Class Tests (for Part II & III in 1+1+1 system)		
Week 15 to 17	Paper STSSSEC01M(CBCS) : Statistical Data Analysis Using C-programming and Software Packages Minitab: Unit 4	Paper STSACOR02T : Jacobi's Theorem. Product of determinants. Adjoint and inverse of a matrix and related properties. Use of determinants in solution to the system of linear equations. Paper STSACOR05T(CBCS) : ***Unit 4: Standard continuous probability distributions:*** Logistic, double exponential and Pareto along with their properties and limiting/approximation cases. Bivariate Normal Distribution and its properties (Statement only). Paper STSACOR12T(CBCS) : ***Unit 3: Official Statistics*** ***Unit 3: Different Government Organizations***

Class:B.Sc
Semester 1, 3 and 5 **Name of the Teacher: Suryasish Chatterjee**
Subject: Statistics
Paper : STSACOR02T, STSACOR06T, STSACOR06P, STSADSE02T, STSADSE02P

S. No	**Practical syllabus to be covered (Paper code to be mentioned)**	**Theory syllabus to be covered (Paper code to be mentioned)**
Week 1 to week 4	**Paper STSACOR06P:** 1. Testing of significance for single proportion and difference of two proportions. 2. Testing of significance for single Poisson mean and difference of means of two independent Poisson distributions. **Paper STSADSE02P:** 1. Testing of significance and confidence intervals for single proportion and difference of two proportions using CLT. 2. Testing of significance and confidence intervals for single Poisson mean and difference of two Poisson means using CLT table.	**Paper STSACOR02T**: Sequence of real numbers and their convergence, limits of sequences, Cauchy's general principle of convergence, Cauchy's first theorem on limits, monotonic sequences, limit superior and limit inferior of a bounded sequence **Paper STSACOR06T:** Definitions of random sample, parameter and statistic, sampling distribution of a statistic. Distributions of functions of random variables. Illustration through simple transformation and generating function technique. **Paper STSADSE02T:** Convergence in Probability, Weak Laws of Large Numbers and their applications, Convergence in Distribution, relation between two kind of convergence, Slutsky's Theorem, De-Moivre-Laplace Limit Theorem. Normal approximation to Poisson distribution, Statement of Central Limit Theorem (iid case) and its use in test and confidence interval for binomial proportions and Poisson means.

Week 5 to week 8	**Paper STSACOR06P:** 3. Testing of significance and confidence intervals for single mean and difference of two means and paired tests. 4. Testing if the population variance has a specific value and its confidence intervals **Paper STSADSE02P:** 3. Testing of significance and confidence intervals concerning sample standard deviation, coefficient of variation and correlation coefficient (both single sample, two sample cases). 4. Testing of significance and confidence intervals using variance stabilizing transformations.	**Paper STSACOR02T**: Infinite series, positive-termed series and their convergence. Comparison tests, D'Alembert's ratio test and Cauchy's n_{th} root test, (Statements and examples only). Absolute convergence of series, Leibnitz's test for the convergence of alternating series, Conditional convergence. **Paper STSACOR06T:** Definition and derivation of p.d.f. of $\chi 2$ with n degrees of freedom (d.f.) using m.g.f., nature of p.d.f. curve for different degrees of freedom, mean, variance, m.g.f., mode, additive property and limiting form of $\chi 2$ distribution. Student's and Fishers t-distribution, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t distribution **Paper STSADSE02T:** Derivation and uses of large sample standard error of sample moments, Standard deviation, Coefficient of Variation, b_1 & b_2 measures, Correlation coefficient. Asymptotic distribution of sample quantiles. Transformation of Statistics, Derivation and use of $\sin^{-1}$, square root, logarithmic & Fisher's Z- transformations.
Week 9 to Week 12	**Paper STSACOR06P:** 5. Testing of significance and confidence intervals of correlation coefficient. 6. Testing of equality of population variances for two independent normal populations and related confidence intervals. table.	**Paper STSACOR02T**: Statement of the fundamental theorem of algebra and its consequences. Relation between roots and coefficients of any polynomial equations. Solutions of cubic and biquadratic equations when some conditions on roots of equations are given **Paper STSACOR06T:** Snedecore's F-distribution, Derivation of p.d.f., nature of p.d.f. curve with different degrees of freedom, mean, variance and mode. Distribution of $1/F(n_1,n_2)$. Relationship between t, F and $\chi 2$ distributions. Sampling distributions of sample mean and sample variance when parent population is normal. Null distribution of sample correlation coefficient (statement only). Exact tests relating to Binomial proportion (s) and Poisson mean (s) **Paper STSADSE02T:**

		Consistency Asymptotic efficiency, ARE, CAN and BAN estimators. Properties of MLE (statement only) and their uses in testing and confidence interval
Week 13	**Paper STSACOR06P:** 7. Testing of ratio of variances for bivariate normal population and related confidence interval **Paper STSADSE02P:** 5. Determination of the minimum sample size required to achieve normality by sample proportion, mean and standard deviation. 6. Tests for goodness of fit, independence and homogeneity using Pearsonian chi-square statistic	**Paper STSACOR06T:** Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region. Tests of significance and confidence intervals based on χ_2, t and F distribution when samples are generated from Univariate and Bivariate normal population (s) **Paper STSADSE02T:** Large Sample distribution of Pearsonian χ_2 statistic, its uses goodness of fit.
Week13 to week 14		**Internal Exam**
Week 15 to 17		**Paper STSACOR06T:** Introduction, distribution of the rth order statistic, smallest and largest order statistics. Joint distribution of rth and sth order statistics, distribution of sample median and sample range **Paper STSADSE02T:** Chi square tests for independence, homogeneity. Yates' correction in a 2x2 contingency table.

Class:B.Sc
Semester 3 and 5 **Name of the Teacher: Soumyadeep Das**
Subject: Statistics
Paper : STSACOR07T, STSACOR07P, STSHGEC03T, STSHGEC03P, STSADSE01T, STSADSE01P

S. No	Practical syllabus to be covered (Paper code to be mentioned)	Theory syllabus to be covered (Paper code to be mentioned)
Week 1 to week 4	**Paper STSACOR07P:** 1. To select a SRS with and without replacement. 2. For a population of size 5, estimate population mean, population mean square and population variance. Enumerate all possible samples of size 2 by WR	**Paper STSACOR07T**: Concept of population and sample, complete enumeration versus sampling, sampling and non-sampling errors. Types of sampling: non-probability and probability sampling, basic principles of sample survey, simple random sampling with and without replacement, definition and procedure of selecting a sample, estimates of population mean, total and proportion, variances of

	and WOR and establish all properties relative to SRS. 3. For SRSWOR, estimate mean, standard error, the sample size **Paper STSHGEC03P:** 1. Estimators of population mean. 2. Confidence interval for the parameters of a normal distribution (one sample and two sample problems). **Paper STSADSE01P:** 1. Regression diagnostics **2.** Measures of association for 2x2 contingency table.	these estimates, estimates of their variances and sample size determination. **Paper STSHGEC03T:** Estimation of population mean, confidence intervals for the parameters of a normal distribution (one sample and two sample problems). **Paper STSADSE01T:** Introduction to Categorical Data, 2 X 2 contingency table, notion of independence & association, ideas of complete and absolute association. Yules measures of association and colligation, Cramer's measure of association, Extension to kxl contingency table: Pearson's chi-square, Kendall's tau's, Goodman-Kruskal's γ.
Week 5 to week 8	**Paper STSACOR07P:** 4. Stratified Sampling: allocation of sample to strata by proportional and Neyman's methods. Compare the efficiencies of above two methods relative to SRS. 5. Estimation of gain in precision in stratified sampling. **Paper STSADSE01P:** 3. Relative risk, odds ratio 4. Measures of association for kxl contingency table.	**Paper STSACOR07T:** Stratified random sampling, Technique, estimates of population mean and total, variances of these estimates, proportional and optimum allocations and their comparison with SRS. Practical difficulties in allocation, estimation of gain in precision. **Paper STSHGEC03T:** The basic idea of significance test. Null and alternative hypothesis. Type I & Type II errors. **Paper STSADSE01T:** Difference of proportions, relative risk, odds ratio, log odds ratio; types of observational studies.
Week 9 to Week 12	**Paper STSACOR07P:** 6. Comparison of systematic with stratified sampling and SRS in the presence of a linear trend. **Paper STSADSE01P:** 5. Fitting a logit model 6. Fitting a probit model 7. Fitting of multiple logistic regression. table.	**Paper STSACOR07T:** Systematic Sampling, Technique, estimates of population mean and total, variances of these estimates (N=n x k case). Comparison of systematic sampling with SRS and stratified sampling in the presence of linear trend and corrections. **Paper STSHGEC03T:** level of significance, concept of p-value. **Paper STSADSE01T:** Generalized linear Model, Components of a generalized linear model, Random component, systematic component, Link function. Generalized linear model for binary data, Logistic and probit regression model, Multiple logistic regression. Model fitting by using score function.
Week 13	**Paper STSACOR07P:** 7. Ratio and Regression estimation: Calculate the population mean or total of the population. Calculate mean squares. Compare the efficiencies of ratio and regression estimators relative to SRS. **Paper STSHGEC03P:** 3. Tests of hypotheses for the parameters of a normal distribution (one sample and two sample problems).	**Paper STSACOR07T:** Ratio and Regression methods of estimation in simple random sampling **Paper STSHGEC03T:** Tests of hypotheses for the parameters of a normal distribution (one sample and two sample problems). **Paper STSADSE01T:** Log linear model of independence for twoway table, Interpretation of the parameters in independence model, saturated model for two way table. The log-linear-logistic connection.

Week13 to week 14		**Internal Exam**
Week 15 to 17	**Paper STSACOR07P:** 8. Cluster sampling: estimation of mean or total, variance of the estimate, estimate of intra-class correlation coefficient, efficiency as compared to SRS. 9. Two stage sampling. **Paper STSHGEC03P:** 4. Chi-square test of proportions. 5. Chi-square tests of association. 6. Chi-square test of goodness-of-fit.	**Paper STSACOR07T:** Hartley-Ross estimator. Cluster sampling (equal-size clusters only) estimation of population mean and its variance, Concept of sub sampling. Two-stage sampling, Estimation of Population mean and variance of the estimate, comparison between two-stage, cluster and uni-stage sampling. **Paper STSHGEC03T:** Categorical data: Tests of proportions, tests of association and goodness-of-fit using Chi square test, Yates' correction.

BIDHANNAGAR COLLEGE, GOVERNMENT OF WEST BENGAL, SALT LAKE, KOLKATA

Teaching Plan for Even Semester, UG course

Department of Statistics

Session 2021-22

Class:B.A/ B.Sc
Semester 2,4,6 **Name of the Teacher: Prof. Debesh Roy**
Subject: Statistics
Paper : cc14, …….. ……. (Theory and Practical)

S. No	Practical works to be covered (Paper code to be mentioned)	Theory topics to be covered (Paper code to be mentioned)
Week 1 to week 4	STSACOR14T: Bivariate Normal Distribution (BVN) 12 Lectures P.d.f. of BVN, properties of BVN, marginal and conditional p.d.f. of BVN. Random Vector: Probability mass/density functions, Distribution function, Mean vector & Dispersion matrix, Marginal and Conditional distributions.	STSACOR14P:
Week 5 to week 8	STSACOR14T: Multinomial Distribution, Multivariate Normal distribution and its properties. Sampling distribution for mean vector and variance- covariance matrix (Statement only).	STSACOR14P: 1. Multiple Correlation 2. Partial Correlation 3. Bivariate Normal Distribution.
Week 9 to Week 12	STSACOR14T: Applications of Multivariate Analysis, Discriminant Analysis,	STSACOR14P: 4. Multivariate Normal Distribution 5. Discriminant Analysis
Week 13	STSACOR14T: Principal Components Analysis	STSACOR14P 6. Principal Components Analysis
Week 13 to week 14		**Internal Exam**
Week 15 to 17	STSACOR14T: Solution of Model Problems.	

Class:B.A/ B.Sc
Semester 2,4,6
Name of the Teacher: Arup Kumar Hait
Subject: STATISTICS
Paper : STSACOR04,STSACOR13 &STSHGEC04 (Theory and Practical)

S. No	Practical works to be covered (Paper code to be mentioned)	Theory topics to be covered (Paper code to be mentioned)
Week 1 to week 4	**STSACOR13** • Layout of Design **STSHGEC04** • Measurement of trend: Fitting of linear & quadratic trend and plotting of trend values and comparing with given data graphically.	**STSACOR04T** Row reduction and echelon forms. Partitioning of matrices and simple properties. Rank of a matrix,row-rank, column-rank, standard theorems on ranks, rank of the sum and the product of two matrices. **STSACOR13** Experimental designs, Role, historical perspective. Terminologies: Experimental error, Basic principles, Uniformity trials, Fertility contour maps, Choice of size and shape of plots and blocks. **STSHGEC04** 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 semi-averages. Method of least squares (linear & quadratic).
Week 5 to week 8	**STSACOR13** • Analysis of CRD • Analysis of an RBD • Analysis of an LSD • Analysis of an RBD with one missing observation • Analysis of an LSD with one missing observation **STSHGEC04** • Measurement of trend: Fitting of exponential, modified exponential curve and plotting of trend values and comparing with given data graphically. • Measurement of seasonal indices by Ratio-to-trend method and plotting of trend values and comparing with given data graphically.	**STSACOR04T** Matrix equations Ax=b, solution sets of linear equations. Applications of linear equations, inverse of a matrix. **STSACOR13** Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) – Layout, Model and Analysis, Relative Efficiencies, Analysis with one missing observation. **STSHGEC04** Measurement of exponential trend and modified exponential trend. Measurement of seasonal variations by method of ratio to trend.

Week 9 to Week 12	**STSACOR13** • Intra Block analysis of a BIBD • Analysis of 2_2 and 2_3 factorial in CRD and RBD • Analysis of 2^2 and 2^3 factorial in LSD **STSHGEC04** • Construction of price and quantity index numbers by Laspeyre's formula, Paasche's formula, Marshall-Edgeworth's formula, Fisher's Formula. Comparison and interpretation.	**STSACOR04T** Characteristic roots and Characteristic vector, Properties of characteristic roots, Cayley Hamilton theorem, Quadratic forms: Classification and canonical reduction. Linear transformations. **STSACOR13** Balanced Incomplete Block Design (BIBD) – parameters, relationships among its parameters, incidence matrix and its properties. Advantages, Notations and Concepts of 2^n factorial experiments. 2^n factorial experiments -their design and analysis. **STSHGEC04** Index numbers: Definition, Criteria for a good index number, different types of index numbers.
Week 13 to week 14		**Internal Exam**
Week 15 to 17	**STSACOR13** • Analysis of a completely confounded two level factorial design in 2 block • Analysis of a completely confounded two level factorial design in 4 blocks • Analysis of a partially confounded two level factorial design • Analysis of a single replicate of a 2_n design • Analysis of a fraction of 2_n factorial design **STSHGEC04** • Construction of wholesale price index number, fixed base index number and consumer price index number with interpretation	**STSACOR04T** Applications of Linear Algebra in Statistics. **STSACOR13** Total and Partial confounding for 2^n factorial experiments.($N<6$) **STSHGEC04** Construction of index numbers of prices and quantities, consumer price index number. Uses and limitations of index numbers.

Class: B.Sc. (Honours)
Semesters: 2, 4, 6 (CBCS)
Name of the Teacher: Kiranmoy Chatterjee
Subject: Statistics
Paper : STSACOR04T, STSACOR09T, STSACOR09P, STSADSE04T, STSADSE04P, STSHGEC04T, STSHGEC04P(CBCS)

S. No	Practical works to be covered (Paper code to be mentioned)	Theory topics to be covered (Paper code to be mentioned)
Week 1 to week 4	Paper STSACOR09P(CBCS): 1. Estimability in Gauss Markov Model. 2. Simple linear regression. 3. Multiple regression. Paper STSADSE04P(CBCS): 6. Computation of Mortality rate. 7. Preparation of Life Table.	Paper STSACOR04T(CBCS) : Row reduction and echelon forms. Partitioning of matrices and simple properties. Rank of a matrix, row-rank, column-rank, standard theorems on ranks, rank of the sum and the product of two matrices. Paper STSACOR09T(CBCS) : ***Unit 1: Multivariate Data*** ***Unit 2: Gauss-Markov set-up*** Theory of linear estimation, Estimability of linear parametric functions, Method of least squares, Gauss-Markov theorem, Estimation space and Error Space Paper STSADSE04T(CBCS) : ***Unit 1: Introduction*** ***Unit 2: Measurements of Mortality*** Paper STSHGEC04T(CBCS): ***Unit 4: Demography*** Demographic Methods: Introduction, measurement of population, rates and ratios of vital events
Week 5 to week 8	Paper STSACOR09P(CBCS): 4.Tests for linear hypothesis. 5. Analysis of variance of one way classified data. 6. Analysis of variance of a two way classified data with one observation per cell. Paper STSADSE04P(CBCS): 1. Computation of Crude Birth Rate. 2. Computation of different Fertility Rate. 3. Computation of Reproduction Rate. 4. Computation of Vital index.	Paper STSACOR04T(CBCS) : Matrix equations Ax=b, solution sets of linear equations. Applications of linear equations, inverse of a matrix. Characteristic roots and Characteristic vector. Paper STSACOR09T(CBCS) : ***Unit 2: Gauss-Markov set-up*** Estimation of error variance. Tests of General Linear Hypotheses (statements only). Classification of Linear Models. ***Unit 3: Regression analysis*** Hypothesis testing in case of simple and multiple regression models. Paper STSADSE04T(CBCS): ***Unit 3: Measurements of Fertility***

	Paper STSHGEC04P(CBCS): 7. Computation of measures of mortality 8. Completion of life table. 9. Computation of measures of fertility and population growth	Paper STSHGEC04T(CBCS): ***Unit 4: Demography*** Life (mortality) tables: definition of its main functions and uses. Measurement of fertility and reproduction: CBR, GFR, and TFR. Measurement of population growth: GRR, NRR.
Week 9 to Week 12	Paper STSACOR09P(CBCS): 7. Analysis of variance of two way classified data with equal number of observations per cell. 8. Analysis of covariance of a one way classified data with one concomitant variable. Paper STSADSE04P(CBCS): 5. Fitting of population curve for population forecasting. Paper STSHGEC04P(CBCS): 5. Construction and interpretation of X bar & R-chart. 6. Construction and interpretation p-chart (fixed sample size) and c-chart	Paper STSACOR04T(CBCS): Properties of characteristic roots, Cayley Hamilton theorem, Quadratic forms: Classification and canonical reduction. Paper STSACOR09T(CBCS): ***Unit 4: Analysis of variance and covariance*** Analysis of Variance in one-way and two-way classified data (with equal number of observations per cell) for fixed effect as well as random effect models. Paper STSADSE04T(CBCS): ***Unit 4: Estimation*** Paper STSHGEC04T(CBCS): ***Unit 3: Statistical Quality Control*** Statistical Quality Control: Importance of statistical methods in industrial research and practice. Determination of tolerance 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.
Week 13-14: Internal Exam (for CBCS)		
Week 15 to 17	Paper STSACOR09P(CBCS): 9. Analysis of covariance of a two way classified data with one concomitant variable.	Paper STSACOR04T(CBCS) : Linear transformations. Applications of Linear Algebra in Statistics. Revision of all the topics. Paper STSACOR09T(CBCS) : ***Unit 4: Analysis of variance and covariance*** Analysis of covariance for one-way and two-way classified data with one concomitant variable

Class:B.Sc
Semester 2, 4 and 6 **Name of the Teacher: Suryasish Chatterjee**
Subject: Statistics
Paper : STSACOR04T, STSACOR08T,STSACOR08P, STSACOR14T, STSACOR14P, STSSSEC02M

S. No	Practical syllabus to be covered (Paper code to be mentioned)	Theory syllabus to be covered (Paper code to be mentioned)
Week 1 to week 4	**Paper STSACOR08P:** 1. Unbiased estimators (including unbiased but absurd estimators) 2. Cramer-Rao inequality and MVB estimators 3. Sufficient Estimators – Factorization Theorem, Rao-Blackwell theorem, Complete Sufficient estimators 4. Lehman-Scheffe theorem and UMVUE **Paper STSACOR14P:** 1.Test for randomness based on total number of runs, 2.Kolmogrov Smirnov test for one sample. 3. Sign test: one sample, two samples, large samples. 4. Wilcoxon-Mann-Whitney U-test 5. Kruskal-Wallis test **Paper STSSSECO2M:** Learn how to load data, plot a graph viz. histograms (equal class intervals and unequal class intervals), box plot, stem-leaf, frequency polygon, pie chart, ogives with graphical summaries of data.	**Paper STSACOR04T**: Sequence of real numbers and their convergence, limits of sequences, Cauchy's general principle of convergence, Cauchy's first theorem on limits, monotonic sequences, limit superior and limit inferior of a bounded sequence. Infinite series, positive-termed series and their convergence. Comparison tests, D'Alembert's ratio test and Cauchy's n_{th} root test, (Statements and examples only). Absolute convergence of series, Leibnitz's test for the convergence of alternating series, Conditional convergence. **Paper STSACOR08T:** Concepts of estimation, unbiasedness, mean square error, sufficiency, completeness and exponential family of distributions. Factorization theorem. Minimum variance unbiased estimator (MVUE), Rao Blackwell and Lehmann-Scheffe theorems and their applications. Cramer-Rao inequality (statement and applications) and MVB estimators. **Paper STSACOR14T:** Nonparametric Tests, Introduction and Concept
Week 5 to week 8	**Paper STSACOR08P:** 5. Maximum Likelihood Estimation 6. Estimation by the method of moments, minimum Chi-square 7. Most powerful critical region (NP Lemma) 8. Uniformly most powerful critical region **Paper STSACOR14P:**	**Paper STSACOR04T**: Vector spaces, subspaces, sum of subspaces, Span. Linear dependence and independence, basis and dimension, dimension theorem. Orthogonal vectors, Gram-Schmidt orthogonalization, ortho complement space. Null space and nullity **Paper STSACOR08T:**

	3. Sign test: one sample, two samples, large samples. 4. Wilcoxon-Mann-Whitney U-test **Paper STSSSECO2M:** Generate automated reports giving detailed descriptive statistics, correlation and lines of regression.	Method of moments, method of maximum likelihood estimation, method of minimum Chi square, basic idea of Bayes estimators **Paper STSACOR14T:** Test for randomness based on total number of runs, Empirical distribution function,
Week 9 to Week 12	**Paper STSACOR08P:** 9. Unbiased critical region. 10. Power curves. 11. Likelihood ratio tests for simple null hypothesis against simple alternative hypothesis. 12. Likelihood ratio tests for simple null hypothesis against composite alternative hypothesis **Paper STSACOR14P:** 5. Kruskal-Wallis test **Paper STSSSECO2M:** Random number generation and sampling procedures. Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution, Normal probability plot.	**Paper STSACOR04T**: A review, theorems related to triangular, symmetric and skew symmetric matrices, idempotent matrices, orthogonal matrices, singular and non-singular matrices and their properties. Trace of a matrix. Row space and column space of a matrix. Definition, properties and applications of determinants for 3rd and higher orders, evaluation of determinants of order 3 and more using transformations. Symmetric and Skew symmetric determinants, Circulant determinants and Vandermonde determinants for nth order, Jacobi's Theorem. Product of determinants. Adjoint and inverse of a matrix and related properties. Use of determinants in solution to the system of linear equations **Paper STSACOR08T:** 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). **Paper STSACOR14T:** Kolmogrov Smirnov test for one sample, Sign tests- one sample and two samples
Week 13 to week 14		**Internal Exam**
Week 15 to 17	**Paper STSACOR08P:** 13. Asymptotic properties of LR tests 14. SPRT procedure 15. OC function and OC curve 16. ASN function and ASN curve **Paper STSSSECO2M:**	**Paper STSACOR04T**: Statement of the fundamental theorem of algebra and its consequences. Relation between roots and coefficients of any polynomial equations. Solutions of cubic and biquadratic equations when some conditions on roots of equations are given. **Paper STSACOR08T:**

	Simple analysis and create and manage statistical analysis projects import data, code editing. Basics of statistical inference to understand hypothesis testing and compute p-values and confidence intervals.	Sequential probability ratio test (SPRT) for simple vs simple hypotheses. Fundamental relations among α, β, A and B, determination of A and B in practice. Wald's fundamental identity and the derivation of operating characteristics (OC) and average sample number (ASN) functions. Examples based on Normal, Poisson, Binomial and Exponential distributions **Paper STSACOR14T:** Wilcoxon-Mann-Whitney test, Kruskal-Wallis test

Class:B.Sc
Semester 2, 4 and 6 **Name of the Teacher: Soumyadeep Das**
Subject: Statistics
Paper : STSACOR03T,STSACOR03P, STSACOR10T,STSACOR10P, STSADSE05T, STSADSE05P

S. No	Practical syllabus to be covered (Paper code to be mentioned)	Theory syllabus to be covered (Paper code to be mentioned)
Week 1 to week 4	**Paper STSACOR03P**: 1. Numerical sums using classical definition of Probability. **Paper STSADSE05P:** 1.Practical problems on the uses of different interpolation formulae.	**Paper STSACOR03T**: Introduction, random experiments, sample space, events and algebra of events. Sigma algebra of events. Definitions of Probability – classical, statistical and axiomatic. **Paper STSACOR10T:** Definition, dimensions of quality, historical perspective of quality control and improvements starting from World War II, historical perspective of Quality Gurus and Quality Hall of Fame. Quality system and standards: Introduction to ISO quality standards, Quality registration. Statistical Process Control - Seven tools of SPC, chance and assignable Causes of quality variation. Statistical Control Charts- Construction and Statistical basis of 3-σ Control charts, Rational Sub-grouping. **Paper STSADSE05T:** Finite differences and interpolation. Difference and shift Operators. Newton's forward and backward interpolation formulae. Lagrange's interpolation formulae.
Week 5 to week 8	**Paper STSACOR03P:** 2. Numerical sums on conditional probability. **Paper STSACOR10P:** 1. Construction and Interpretation of statistical control charts X-bar & R chart X-bar & s-chart np- chart p-chart c-chart u- chart **Paper STSADSE05P:**	**Paper STSACOR03T**: Theorem of compound probability, theorem of total probability, Conditional probability and independence of event. Bayes theorem and its applications. **Paper STSACOR10T:** 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. Estimation of process capability. **Paper STSADSE05T:**

	2.Computation of numerical integration. 3. Solution of transcendental equations.	Numerical Integration, Gauss quadrature, Trapezoidal rule, Simpson's one-third rule with error terms. Stirling's approximation to factorial n. Solution of equations in a single variable- Bisection, Iteration and Newton Raphson method.
Week 9 to Week 12	**Paper STSACOR03P:** 3. Fitting of binomial distribution for given n and p. 4. Fitting of binomial distribution after computing mean and variance. 5. Fitting of Poisson distribution for given value of lambda. 6. Fitting of Poisson distribution after computing mean. 7. Fitting of negative binomial. 8. Fitting of suitable distribution. 9. Application problem based on binomial distribution 10. Application problem based on Poisson distribution. 11. Application problem based on negative binomial distribution. **Paper STSACOR10P:** 2. Single sample inspection plan: Construction and interpretation of OC, AQL, LTPD, ASN, ATI, AOQ, AOQL curves. **Paper STSADSE05P:** 4. Computation of Simulation problems.	**Paper STSACOR03T**: Discrete random variables, p.m.f. and c.d.f., statement of properties of c.d.f, illustrations. Derivation of moments (discrete situation). Standard discrete probability distributions: binomial, Poisson, geometric, negative binomial, hypergeometric, uniform. **Paper STSACOR10T:** 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. **Paper STSADSE05T:** Using the computer for random number generation (treated as a black box). A brief look at some popular approaches (no mathematical justification needed). Simulating a coin toss, a die roll and a card shuffle. CDF inversion method. Simulation from standard distributions. Finding probabilities and moments using simulation.
Week 13	**Paper STSACOR10P:** **3.** Calculation of process capability and comparison of 3-sigma control limits with specification limits. **Paper STSADSE05P:** 5.Computation of Monte Carlo integration.	**Paper STSACOR03T**: p.d.f. and c.d.f., illustrations and properties, **Paper STSACOR10T:** Overview of Six Sigma, Lean Manufacturing and Total Quality Management (TQM). Organizational Structure and Six Sigma training plans- Selection Criteria for Six-Sigma roles and training plans. Voice of customers (VOC): Importance and VOC data collection. Critical to Quality (CTQ). Introduction to DMAIC using one case study: Define Phase, Measure Phase, Analyse Phase, Improve Phase and Control Phase. **Paper STSADSE05T:** Monte Carlo integration. Basic idea of importance sampling. (MCMC not included). Generating from Binomial and Poisson distributions, and comparing the histograms to the PMFs.
Week13 to week 14		**Internal Exam**
Week 15 to 17	**Paper STSACOR10P:** **4.** Use a case study to apply the concept of six sigma application in DMAIC: practical application.	**Paper STSACOR03T**: univariate transformations with illustrations. Derivation of moments. Probability Inequalities: Markov and Chebyshev. **Paper STSADSE05T:**

	Paper STSADSE05P: 6.Graphical understanding of the laws of large numbers.	Generating from Uniform (0, 1) distribution, and applying inverse CDF transforms. Simulating Gaussian distribution using Box-Muller method. Approximating the expectation of a given function of a random variable using simulation. Graphical demonstration of the Law of Large Numbers. Approximating the value of pi by simulating dart throwing.