

# Department of Statistics

## Govt. Autonomous College, Rourkela

### **PROGRAMME OUTCOME**

The mission of the undergraduate statistics programmes is to provide high - quality and broad-based education in Statistics that emphasizes thinking and communication skills while preparing graduates for professional careers and lifelong learning. The faculty has adopted the educational objectives listed below for the statistics undergraduate programmes.

**PO1:** Expand their knowledge of current and emerging issues in the field of statistics and continuing career long professional development through engagement in lifelong learning.

**PO2:** Grow professionally and advance throughout their technical careers utilizing skills in effective communication; responsible, multidisciplinary team work; and adherence to principles of professional accountability and ethics.

### **PROGRAMME SPECIFIC OUTCOME**

**PSO1:** Understand the concept of quality control, chance and assignable causes of variation control charts for variable and attributes, producers and consumers risk Acceptance Sampling plans.

**PSO2:** Understand the setting of mean chart limits, range chart limits using mean and range charts.

**PSO3:** Know the various techniques of operation research.

**PSO4:** Analyze the results and propose recommendations to the decision making processes.

**PSO5:** Analyze statistical data using MS-Excel.

## **COURSE OUTCOME:**

### **B.Sc.STATISTICS**

#### **SEMESTER I:**

**Core – I :DESCRIPTIVE STATISTICS:** Statistical Methods, Measures of Central Tendency, Bivariate, Index Numbers.

**Core – II : ALGEBRA:** Theory of equations, Algebra of matrices, Determinants of Matrices, Rank of the matrix.

#### **SEMESTER II:**

**Core – III : PROBABILITY AND PROBABILITY DISTRIBUTION:** Probability, Random variables, mathematical Expectation, Standard discrete probability distribution.

**Core – IV :CALCULUS:** Differential calculus, Integral Calculus, Differential Equation, Formation and solution of a partial differential equations.

#### **SEMESTER III:**

**Core – V :SAMPLING DISTRIBUTION:** Limit Laws, convergence in probability, Inequality, Definition of random sample, Exact sampling distribution, Chi – square distribution, Student's and fisherst – distribution, F – Distribution.

**Core – VI :SURVEY SAMPLING AND INDIAN OFFICIAL STATISTICS:** Concept of population and sample, Stratified random sampling, Introduction to ratio and regression method, Present Official statistical system in India, CSO, NSSO.

**Core – VII :MATHEMATICAL ANALYSIS:** Real Analysis, Review of limit points, Continuity and Differentiability, Numerical Analysis, Numerical Integration.

#### **SEMESTER IV:**

**Core – VIII :STATISTICAL INFERENCE:** Estimation, MVUE, MVB estimator, Method of estimation, Principle of test of significance, Sequential Analysis.

**Core – IX : LINEAR MODEL:** Gauss – Markov set – up , Regression Analysis, Analysis of variance, Model Checking.

**Core – X :STATISTICAL QUALITY CONTROL:** Statistical quality control, control charts for Variable, Acceptance sampling plan, Introduction to Six – Sigma. TQM, VOC.

## **SEMESTER V:**

**Core – XI :STOCHASTIC PROCESS & QUEUING THEORY:** Probability Distribution, Markov Chains, Poisson Process, Queuing System, M/M/1 with finite and infinite system capacity .

**Core – XII : STATISTICAL COMPUTING USING C & R PROGRAMMING:** History and importance of C. Components, Decision making and branching, User – defined functions, Introduction R.

**DSE – I: OPERATIONS RESEARCH:** Introduction to Operation research, Transportation Problem, game Theory, Inventory Management.

**DSE – II: TIME SERIES ANALYSIS:** Introduction to time series data, Trend Component, Seasonal Component, Stationary Time Series.

## **SEMESTER VI:**

**Core – XIII : DESIGN OF EXPERIMENT:** Design of Experiment, Analysis of Variance, Completely Randomised Design, Randomised Block Design, Latin square Design and Factorial experiments, Total and Partial confounding.

**Core – XIV : MULTIVARIATE ANALYSIS AND NON PARAMETRIC METHODS:** Bivariate Normal Distribution (BND), Multivariate Normal Distribution and its properties, Nonparametric Tests, Komogrov Smirnov two samples test.

**DSE – III: DEMOGRAPHY AND VITAL STATISTICS:** Population Theories, Introduction and sources of collection data on vital statistics, Stationary and Stable population, Abridged life Tables.

**DSE – IV: ECONOMETRICS:** Introduction: Objective behind building econometric models, Multi co – linearity, Generalized least squares estimation, Hetero scedastic disturbances.

# **MSc STATISTICS**

## **SEMESTER I:**

**STS101: MATHEMATICAL ANALYSIS AND LINEAR ALGEBRA:** Sequence and series, convergence, Functions of several variables, Metric space - limits and metric space, Lebesgue integral, Vector spaces, linear dependence and independence.

**STS102: STATISTICAL METHODS:** Review of descriptive statistics, Bivariate and multivariate data, Concept of multivariate distribution, multiple regression analysis, partial and multiple correlations, Exact sampling distributions –  $t$ ,  $F$  and chi-square distributions, Association and contingency.

**STS103: PROBABILITY THEORY AND DISTRIBUTIONS – I:** Sequence of sets, limsup, liminf and limit of sequence of sets, Borel sigma field, Measure and its properties, Bayes' theorem Moments, probability generating and moment generating functions, moment inequalities, Order statistics and their distributions. Conditional expectations, Discrete probability distributions, Continuous probability distributions.

**STS 104: STATISTICAL INFERENCE –I:** Point estimation, properties of estimators, Mean square error, Unbiasedness and minimum variance, Minimum Variance Unbiased Estimators(MVUE), Consistent estimators, Consistent Asymptotic Normal (CAN) estimators, Interval estimation.

**STS 105: STATISTICAL COMPUTING-I:** Computer application and Data Processing Low and High level languages, Network – LAN, WAN, internet, intranet, Flowchart, Data, Information, Database, Data analysis using Excel and SPSS, Frequency distribution, Correlation, regression, Test of hypothesis -  $t$  and  $F$  tests, chi-square test,  $z$  test, Fitting of distributions.

## **SEMESTER II:**

**STS201: PROBABILITY THEORY & DISTRIBUTIONS – II:** Non central chi-square,  $t$  and  $F$ , distributions, Convergence on a probability space, Characteristic function, Helly-Bray theorem, Borel-Cantelli lemma, Laws of large numbers.

**STS202: STATISTICAL INFERENCE-II:** Tests of hypothesis, MP and UMP test, Neyman-Pearson Lemma, Type A and type A1 tests, OC and ASN function, Non Parametric tests.

**STS203: SURVEY SAMPLING METHODS:** Basic concepts of finite population and sampling techniques, Stratified random sampling, Cluster sampling, Use of auxiliary information in sample surveys, Methods of estimation, Double sampling.

**STS204: OFFICIAL STATISTICS:** Introduction to Indian and International statistical systems, Role, function and activities of Central and State statistical organizations, Role of National Sample Survey Office, Population growth in developed and developing countries, Estimation of national income-product approach.

**STS 205: STATISTICAL COMPUTING-II : R PROGRAMMING LANGUAGE: Programming on R**

Data types in R: numeric, character, logical; real, integer, complex, strings, Graphics in R: the plot command, histogram, barplot, boxplot, points, lines, segments, arrows, Vector matrix operations: matrix operations, addition, subtraction, multiplication, linear equations and eigenvalues,

### **SEMESTER III:**

**STS 301: MULTIVARIATE ANALYSIS:**Multivariate normal distribution, Estimation of partial and multiple correlation coefficients, Hotelling's  $T^2$  statistic, Classification and discrimination procedures, Fisher's discriminant function, Cluster Analysis, Factor Analysis, Wishart matrix, Principal components.

**STS302: DESIGN&ANALYSIS OF EXPERIMENTS:**Analysis of variance of one-way and two-way  
Analysis of unbalanced data. Complete block designs, randomized block designs, latin square designs, General factorial experiments, Confounding, Incomplete block designs.

**STS 303: APPLIED STOCHASTIC PROCESSES:** Notations and specification of stochastic process, stationary process, martingales, random walk and ruin problems, Markov chains, ergodic theorem, Markov processes with discrete state space – poisson process, Markov processes with continuous state space – Brownian motion, Wiener process.

**STS304: DEMOGRAPHY& VITAL STATISTICS:**Coverage and errors in demographic data, Component & Growth Models, Leslie Matrix, Measures of fertility (period and cohort), Measures of mortality, comparative mortality index, Lexis Diagram, Stationary and stable population models.

**STS305: SEMINAR PRESENTATION, STUDY TOUR & LITERATURE REVIEW.**

**STS306: COMPUTATIONAL STATISTICS LABORATORY:**Multivariate Analysis, Design of Experiments, Demographic data, Statistical Decision Theory, Vital Statistics.

### **SEMESTER IV:**

**STS401: ECONOMETRICS:**Variables linear models assumptions, OLS estimations  
Multicollinearity, Simultaneous equation models, Heteroscedasticity, Simultaneous equation methods, method of indirect least squares (ILS), method of two-stage least squares (2SLS).

**STS402: ADVANCED SURVEY SAMPLING METHODS:**Unequal probability sampling with replacement, Unequal probability sampling without replacement, Problems of finite population inference under a fixed population set up, Errors in surveys – types of errors, mathematical models for measurement error.

**STS403: TIME SERIES AND STATISTICAL QUALITY CONTROL:**Time series as discrete parameter stochastic process. Auto covariance and autocorrelation function and their properties,

stationary processes, statistical quality control, Acceptance sampling plans – single and double sampling plans for attributes, Sequential probability ratio test- OC and ASN functions.

**STS404: SURVIVAL ANALYSIS AND CLINICAL TRIALS:** Functions of survival time, hazard function, Life tables, Kaplan –Meier methods, Semi-parametric regression, Introduction to clinical trials.

**STS405: PROJECT WORK**

**STS406: STATISTICAL COMPUTING – III (ADVANCED R AND C/C++ PROGRAMMING):** Basic Statistics, Linear models: the lm function; fitting a linear model, R functions, Regression, Multivariate Analysis, Demographic data, Design of Experiments.