Department of Statistics

Programme Outcome:

After successful completion of the 3 year B.Sc. programme (under CBCS) in Statistics students will be able to:

1. *Analytical Thinking and Knowledge*: Develop knowledge and importance of collection and analyzing data using different types of data visualizations and analytical tools which plays a vital role in this modern data driven world.

2. *Problem Solving*: Identify and formulate statistical and mathematical models based on real-life data arising from different sections like physical science, society, economy, industry, marketing etc. These models are used for prediction and making decisions which helps to build sophisticated and harmonious human society.

3. *Design/Development of Solutions*: Design and simulation of random experiments to get optimized rules and solutions which meet the specified needs with appropriate considerations in social and environmental sectors.

4. *Modern Tool Usage*: Create, select, and apply appropriate techniques, resources, modern statistical and mathematical tools, statistical packages like R, MINITAB for prediction and modeling in complex scientific and economic activities with an understanding of the limitations.

5. *Communication*: Develop good communication skills through projects, presentation and also by participating in various cultural and social activities like quiz contests, seminars at national, state and college level.

6. *Ethics*: Apply ethical principles for data protection, conducting experiments like clinical trials, marketing research etc.

7. *Life-long Learning*: Recognize the need for lifelong learning and development of sophisticated data specific tools to analyze the uncertainties in different social, environmental and physical phenomena.

Course Outcome:

Course Code	Course Name	Course Outcome
CC1	Descriptive Statistics	At the end of this course a student should be able to understand 1. Different types of data, data structure and the art of data handling. , the techniques of summarization and identification of the salient features of the data through graphical displays and other descriptive measures, computation and interpretation of various descriptive measures. 2. Concept of bivariate data, notion of correlation of two variables. Prediction using linear and polynomial regression. Concept of rank correlation as a measure of agreement between two judges. 3. Different measures of categorical variables - computations and interpretations, concept of retrospective and perspective study, cross-sectional studies, relative risks, odds ratios.
CC2	Probability and Probability Distributions-I	At the end of this course a student should be able to understand 1. Concept of empirical and objective probability as a measure of uncertainty. 2. Problems related to real world. 3. Axiomatic definition of probability 4. Notion of conditional probability and use of Bayes' theorem. 5. Notion of random variable and probability distributions. 6. Different measures for different features of probability distribution.
GE1	Descriptive Statistics	At the end of this course a student should be able to understand 1. The basic data structures. 2. Different features of data like central tendency, dispersion, skewness and their measures. 3. Notion of bivariate data.

CC3	Mathematical Analysis	At the end of this course a student should be able to understand 1. Basics Mathematical techniques used in the deduction of various theoretical results of Statistics. 2. Identify sequence and series of real numbers and their convergence/divergence. 3. Understand the properties of real valued functions, such as limit, continuity, differentiability. 4. Learn to use Taylor's Theorem to approximate functions by polynomial functions. 5. Learn to find maximum and minimum values of a function of several variables and various techniques to evaluate multiple integrations. 6. Develop a solid logical foundation for a newly proposed statistical tool, comparing its efficacy with the existing tools
CC4	Probability and Probability Distributions-II	At the end of this course a student should be able to understand 1. Different aspects of univariate discrete probability distributions like binomial, Poisson, negative binomial, geometric distribution with applications to real life situations 2. Different aspects of univariate continuous probability distributions like normal, exponential, gamma, beta distribution with applications to real life situations. 3. Different aspects of bivariate discrete and continuous probability distribution with applications to real life situations. 4. Definition and use of trinomial and bivariate normal distributions.
GE2	Elementary Probability Theory	At the end of this course a student should be able to understand 1. Definition and some real life application of probability measure. 2. Some discrete and continuous probability distributions with real life applications

CC5	Linear Algebra	By taking this course a student should be able to understand 1. Fundamental concepts in linear algebra, including vectors, vector spaces, matrices, systems of linear equations. 2. Solvability of system of equations. Concept of rank, inverse and determinants of matrices. 3. Solve systems of linear equations: Students will be able to solve systems of linear equations using various methods such as Gaussian elimination, matrix inversion, and matrix equations. 4. Notion of eigen values and eigen vectors of matrices and quadratic forms with real life applications.
CC6	Demography and Vital Statistics	At the end of this course a student should be able to understand 1. Basic concepts of Demographic and Vital Statistics data and the associated errors. 2. Sources and processes of data collection on Vital Statistics 3. Basic measures of mortality and fertility and how to interpret the results. 4. Concept of Life Tables, their constructions and uses. 5. Different measures of population growth and their interpretations. 6. The concepts of stable and stationary populations. 7. Estimation, projection and forecasting of the size of a given population.
CC7	Statistical Computing and Numerical Analysis Using C Programming	By taking this course students should be able to understand 1. The usefulness of statistical computing in modern statistical learning. 2. Writing code for different statistical measures and numerical methods using C language.

SEC-A1	Research Methodology	By taking this course students should be able to understand 1. Fundamental concepts and principles of research process, research design and data collection methods. 2. Developing questionnaire for types of survey, data validation and drawing inferences. 3. Writing research papers and presentations.
SEC A2	Statistical Data Analysis Using R	By taking this course students should be able to understand 1. Basic functions, syntax and data structures in statistical software R 2. Drawing random samples from probability distributions using R with real life examples
GE3	Introduction to Statistical Inference	By taking this course students should be able to understand 1. Basic concepts of statistical inference 2. Fundamental techniques used in statistical inference with real life examples.
CC8	Survey Sampling and Indian Official Statistics	By taking this course students should be able to understand 1. The notion of sampling frame, sampling design and unbiased estimators in drawing sample from finite population. 2. The use different sampling design like simple random sampling, stratified random sampling, systematic sampling, cluster sampling, two stage sampling to draw samples. 3. Estimation of population parameters like population mean, population total using unbiased estimators, regression estimators, ratio estimators, double sampling method. 4. Structure of Indian statistical system and its different functions.

CC9	Statistical Inference-I and Sampling Distributions	At the end of this course a student should be able to understand 1. Determine the probability distributions of functions of random observations. 2. To develop foundation for statistical estimation and hypothesis testing. 3. To conceptualize the errors associated with statistical decision. 4. To conduct hypotheses testing without going into details of theory. 5. About the basic concept of interval estimation. 6. The concept of order statistics and their sampling distributions.
CC10	Index Numbers and Time Series Analysis	By taking this course the students will be able to understand 1. The notion of index numbers to measure the inflation and deflation in price and other economic commodities. 2. The time series data and its different components like trend, seasonality, cyclical variations and other irregularities. 3. The notion of stationary time series to model de-trended and de-sesonalized data and use of those models in forecasting for short time periods.
SEC-B1	Monte Carlo Method	By taking this course the students will be able to understand 1. The notion of pseudo random numbers generated by computers. 2. Simulating different random experiments and drawing random samples from different probability distributions 3. Notion of Monte Carlo integration
SEC-B2	Data Base Management System	By taking this course the students will be able to understand 1. The concept of relational data base and ER diagram 2. Some basic commands of SQL
GE4	Applications of Statistics	By taking this course the students will get a brief introduction about applications of Statistics in different social and economic fields.

CC11	Statistical Inference-II	At the end of this course a student should be able to understand 1. Different modes of convergence of statistics and their inter-relationship 2. The large sample behaviour of different statistics (based on both moments and quantiles) relating to estimation and tests of hypothesis. 3. About various transformations on statistics and their use in inferential problems. 4. About Pearsonian Chi-Square statistic and its uses. 5. About the fundamental concept of point estimation. 6. About the properties of statistic such as sufficiency, completeness. 7. Different types of estimators and their properties such as unbiasedness, consistency and minimum variance. 8. About different methods of estimations and related properties. 9. About the theory of hypothesis testing to find optimum tests and the properties of the developed tests. 10. The theory of interval estimation to determine some optimum confidence interval and its relation with hypothesis testing.
CC12	Linear model and regression	By taking this course the students will be able to understand 1. The response –predictor modeling defined by Gauss Markov model. 2. Analysing different data using ANOVA or ANCOVA and their underlying theory. 3. Methods for testing of hypothesis regarding parameters involved in the linear model and regression. 4. The logistic and Poisson regression for categorical response 5. Some real life examples

DSE-A1.1	Statistical Quality Control	By taking this course students will be able to understand 1. The definition of quality of a produced item, different ISO quality standards. 2. Use of control charts to detect the variations in quality of produced item and estimation of process capability 3. Notion of OC curve, AOQL, ASN for product control. 4. The use six-sigma limits for quality improvement of produced item.
DSE-A1.2	Econometrics	By taking this course students will be able to understand 1. Notion of econometric modelling and use of dummy variable. 2. Notions of multicollinearity, autocorrelation and heteroscedasticity in data 3. Use weighted least squares in estimation model parameters with applications
DSE-B1.1	Operations Research	By taking this students will be able to understand 1. Use of mathematical modelling in different industrial and marketing areas. 2. Idea of optimizing a function under constraints using linear programming. 3. Notion of duality and use to solve the optimization problem of linear functions. 4. Applications of LPP in transportation and assignment problem. 5. Notion of game theory and payoff function
DSE-B1.2	Stochastic Process	By taking this course the students will be able to understand 1. Modeling real life problems like spreading contagious disease, fluctuations in stock price as a random process. 2. Notions Markov chain to incorporate certain types of dependencies in a class of random variables. 3. Concept of stationary distribution of Markov chain and usefulness to describe equilibrium state of different physical processes like heat exchange etc. 4. Notions of Poisson process and Queuing theory for traffic modeling, performance evaluation and traffic management.

CC13	Design of experiments	By taking this course the students will be able to understand 1. The notions of experimental design and terms like experimental units, blocks, experimental error. 2. The use of randomization, replication and local control to minimize the experimental error in different experimental designs like CRD, RBD, LSD. 3. Use of factorial designs to compare two or more treatments in two or more levels. 4. Concept of split plot and strip plot designs.
CC14	Multivariate Analysis and Nonparametric Methods	At the end of this course a student should be able to understand 1. Learn handling of data in a multivariate setup. 2. Measure the marginal and joint influence of different variables on the characteristic of interest and thus take decisions on retaining the variables of real importance in the model of analysis. 3. Learn fitting of multiple linear regression models under square error loss. 4. Learn isolating different components of variation in multivariate data and reduction of data dimension to a considerable extent retaining most of the components of variability in the original data. 5. Learn to classify a data point in one of several groups of data. 6. About the basic concept of nonparametric or distribution free approach. 7. Learn to test hypotheses relaxing the assumption of a specific distribution.
DSE-A2	Survival Analysis	By taking this course the students will be able to understand 1. Notions of survival function, hazard function, cumulative hazard function and mean residual life and their interpretations. 2. Notions of different types of censoring of data. 3. Parametric and Non-parametric methods of estimation of parameters for censored data. 4. Notions of competing risk to estimate survivability when more than one causes are present.
DSE-B2	Project Work	By taking this the students should be able to understand 1. The collection of primary or secondary data from different sources and use and applicability of different statistical measures in real life situations. 2. Some idea about writing research papers.