## Department of Statistics

## Bethune College , Kolkata

## Programme Specific Outcome (PSO) and Course Outcome (CO)

**Name of the programme :** B.Sc. STATISTICS Honours (under CBCS)

**Year of Introduction :** Session 2018-19

## Programme Specific Outcome (PSO)

**PSO 1 :** This programme will provide a very strong foundation in Statistical theorem and their applicability. Students would have a firm foundation for handling data arising from various fields of study.

**PSO 2** : The students of this programme would have a strong understanding of using statistical tools to Identify, formulate, review and analyze statistical problems reaching substantiated.

**PSO 3** : The students of this programme would have a strong understanding of using statistical tools in actuarial science (insurance), engineering, physics, biology, computer science and even social sciences such as psychiatry, economics and even medical trials.

**PSO 4** : This programme helps the students for fitting, prediction and modelling using Modern software as well as computer languages used in Statistical analysis.

**PSO 5** : The Students will develop effective communication skills, teamwork, leadership and managerial ability which play a strong role in future careers in academic, industry and other fields.

## Course Outcome (CO)

### A. CORE COURSE ( 6 CREDITS PER WEEK )

### Sem -1

**CC 1** : **Descriptive Statistics**

**CO** : At the end of this course a student should be able to understand

**CO 1 :** different types of data and the art of data handling.

**CO 2 :** the techniques of summarization, representation and identification of the salient features of the data through graphical displays and other descriptive measures.

**CO 3 :** correlation and regression of bivariate data, including rank correlation.

**CO4** : analysis of categorical data and finding association, dissociation and independence of attributes.

**CC 2** : **Probability and Probability Distributions I**

**CO** : At the end of this course a student should be able to

**CO 1 :** understand different definitions and meaning of Probability.

**CO 2 :** know different laws of probability and the theorems connecting them.

**CO 3** : apply the laws of probability.

**CO 4 :** know the notion of conditional probability.

**CO 5 :** understand what is a random variable and its probability distribution.

## Sem -2

**CC 3 : Mathematical Analysis**

**CO** : At the end of the course, a student is expected to

**CO 1:** understand sequences of real numbers and their properties.

**CO 2:** learn series of real numbers and apply tests to study their convergence; learn sequences and series of real functions (with special focus on power series), apply tests to identify their various modes of convergence.

**CO 3 :** understand the properties of real valued functions through the concepts of limit, continuity and differentiation.

**CO 4 :** understand and apply Mean Value theorems in various problems, solve indefinite forms of limits; able to optimize and find saddle points of univariate and bivariate functions; find partial differentiation and solve constrained optimization problems.

**CO 5 :** understand and apply Riemann and Darboux integration, apply various Fundamental Theorems of integration, find Jacobian of transformations and solve various types of double integral problems .

**CC 4** : **Probability and Probability Distributions II**

**CO** : At the end of this course a student should be able to

**CO 1:** understand different aspects of univariate discrete and continuous probability distribution.

**CO 2 :** understand bivariate random variable and bivariate probability distribution.

## Sem-3

**CC 5 : Linear Algebra**

**CO** : This course is expected to lay the foundations to learn the courses like Multivariate Analysis and Linear Model. At the end of the course, a student is expected to know.

**CO 1:** matrix algebra and determinants.

**CO 2** : vector spaces, subspaces, their dimensions and basis.

**CO 3 :** theory of equations, quadratic form, characteristics equation.

**CC 6 : Demography and Vital Statistics**

**CO** : At the end of the course a student should

**CO 1 :** have an idea about a population and population study.

**CO 2 :** know some of the basic as well as derived measures for the study of the human population.

**CO 3 :** understand the measures of mortality and fertility.

**CO 4 :** understand the concept of a life table and its significance in real life.

**CO 5 :** have a concept of logistic curve.

**CO 6 :** be familiar with the notion of growth of a population along with methods of estimating and forecasting.

**CC 7 : Statistical Computing and Numerical Analysis using C Programming**

**CO :** At the end of the course a student should

**CO 1 :** have an idea about numerical approximations to functions which are analytically intractable.

**CO 2 :** have an idea about numerical differentiation, integration & solution of equations.

**CO 3 :** acquire knowledge on C Programming and its applications with Numerical Methods.

**CO 4:** learn how to write C-programs using conditional statements, loops, arrays and rebuild programs using multiple functions.

**CO 5:** use C-programing codes to perform various statistical analysis, fitting, modelling, prediction, solving and finding statistical measures using raw data.

## Sem-4

**CC 8 : Survey Sampling and Indian Official Statistics**

**CO** : At the end of the course a student should be able to understand

**CO 1 :** the need for probability sampling when we cannot assume any population distribution.

**CO 2 :** different sampling schemes and situations where these are applicable.

**CO 3 :** the importance of introducing auxiliary variables in the improvement of estimation procedures under certain situations.

**CO 4 :** the sources and mechanisms of collecting official statistics in India.

**CC 9 : Statistical Inference -I and Sampling distributions**

**CO** : At the end of the course a student should be able to understand

**CO 1 :** the notion of sampling distribution of a statistic.

**CO 2 :** the importance of sampling distributions in Statistical Inference.

**CO 3 :** the basics of Testing of Hypotheses.

**CO 4 :** the basic principle underlying tests of significance with application to different distributions.

**CC 10: Index Numbers and Time Series Analysis**

**CO** : At the end of the course a student should have clear idea

**CO 1 :** about Index Number, construction as well as interpretation of different indices and their use in real life data.

**CO 2 :** about time series data, application of time series in various fields.

**CO 3 :** how to decompose time series data into classical components and how to estimate these components.

**CO 4 :** about stochasting modeling .

## Sem-5

**CC 11: Statistical Inference-II**

**CO** : At the end of the course a student should

**CO 1 :** understand the basic idea of Statistical Inference.

**CO 2 :** the criteria of a good estimator.

**CO 3 :** understand the Neyman Pearson approach and Likelihood approach to tests of significance.

**CO 4 :** have an idea about interval estimation.

**CO 5 :** able to apply the estimation and testing procedure in different distributions.

**CO 6 :** have an idea about large sample theory.

**CC 12 : Linear Models and Regression**

**CO** : At the end of the course, a student is expected to

**CO 1 :** have an idea about the theory of linear estimation and Gauss –Markov model.

**CO 2 :** have an idea about ANOVA models to test for the differential effects of factors and interaction effects between two factors.

**CO 3 :** deal with testing problems related to regression models.

**CO 4 :** understand the use of concomitant variables in ANCOVA models and test different effects of factors.

## Sem-6

**CC 13: Design of Experiments**

**CO** : At the end of the course, a student should be able to

**CO 1 :** understand Randomization and Replication as essential principles and Local Control as a desirable principle in statistical designing of experiments.

**CO 2 :** construct standard designs – CRD, RBD and LSD and apply ANOVA techniques to analyse these designs.

**CO 3 :** compare relative efficiency of one design with respect to the other.

**CO 4 :** analyse the standard designs if one observation is missing in the layout.

**CO 5 :** construct and analyse un-confounded and confounded Factorial Designs.

**CO 6 :** construct split plot, strip plot design and groups of experiments.

**CC 14: Multivariate Analysis and Non Parametric Methods**

**CO** : At the end of the course students should know

**CO 1 :** about multiple regression, multiple and partial correlations.

**CO 2 :** about Multivariate Probability Distribution.

**CO 3 :** Multinomial and Multivariate Normal distributions along with their properties.

**CO 4 :** application of multivariate techniques in Principal Component Analysis and Factor analysis.

**CO 5 :** different nonparametric tests for location, scale and randomness.

### B. SKILL ENHANCEMENT COURSE ( 2 CREDITS PER WEEK)

## Sem-3

**SEC A : Statistical Data Analysis using R**

**CO :** At the end of the course students should

**CO 1 :** understanding of solving programming related problems using the R language.

**CO 2 :** get an exposure to basic concepts in R apart from use of different libraries in R, basic statistics concepts using R Commander.

**CO 3 :** use their knowledge in real-life projects, R Cloud Labs and case studies.

## Sem-4

**SEC B : Monte Carlo Methods**

**CO :** At the end of the course students should have developed a clear understanding of

**CO 1 :** generation of random numbers.

**CO 2 :** simulation.

**CO 3 :** approximation of functions and moments of a distribution.

### C. DISCIPLINE SPECIFIC ELECTIVE COURSE ( 6 CREDITS PER WEEK )

## Sem -5

**DSE A1: Statistical Quality Control**

**CO** : At the end of the course, a student is expected to

**CO 1 :** have an exposure to the application of statistical theory in the industry.

**CO 2 :** distinguish the various phases of SQC and capture the variation in quality of the manufactured items.

**CO 3 :** learn about Statistical Techniques used in various phases, namely Control Charts in Process Control and Sampling Inspection Techniques in Product Control. Learn to measure process capability.

**CO 4 :** learn about recent developments in SQC – Six Sigma Plans, Total Quality Management, Lean Management.

**DSE B1 : Stochastic Processes & Queueing Theory**

**CO :** At the end of the course students should have developed a clear understanding of

**CO 1 :** the fundamental concepts of stochastic processes.

**CO 2 :** tools needed to analyze stochastic processes.

**CO 3 :** Markov chains and stability of Markov chains

**CO 4 :** Queuing system.

**DSE A2 : Survival Analysis**

**CO** : At the end of the course, a student is expected to

**CO 1 :** understand the elements of reliability, hazard function and its applications.

**CO 2 :** understand the concept of censoring, life distributions and ageing classes.

**CO 3 :** understand competing theory.

**DSE B2 : Project Work**

**CO** 1 : It gives opportunities to develop and practice research related skills.

**CO 2 :** The project work will provide hands-on training to the students to deal with real life data.

**D. GENERAL ELECTIVE ( 6 CREDITS PER WEEK )**

## Sem -1

**GE 1: Descriptive Statistics**

**CO :** At the end of this course a student should be able to understand

**CO 1 :** different types of data and the art of data handling.

**CO 2 :** the techniques of summarization and identification of the salient features of the data through graphical displays and other descriptive measures.

**CO 3 :** the salient features of the data related to a single variable, two variables.

## Sem -2

**GE 2 :** Elementary Probability Theory

**CO** : At the end of this course a student should be able to

**CO 1 :** understand different definitions and meaning of Probability.

**CO 2 :** know different laws of probability and the theorems connecting them.

**CO 3 :** apply the laws of probability.

**CO 4 :** know the notion of conditional probability.

**CO 5 :** understanding the random variable and its probability distribution.

**CO 6 :** understand different aspects of univariate probability distribution and bivariate probability distribution.

## Sem -3

**GE 3 : Introduction to Statistical Inference**

**CO :** At the end of the course a student should be able to understand

**CO 1 :** the notion of sampling distribution of a statistic.

**CO 2 :** the importance of sampling distributions in Statistical Inference.

**CO 3 :** the basics of estimation and testing of hypotheses and their application on different distributions.

**CO 4 :** the basics of ANOVA and design.

## Sem -4

**GE 4 : Application of Statistics**

**CO :** At the end of this course a student should be able to

**CO 1 :** understand different concepts of population statistics.

**CO 2 :** understand different concepts of time series.

**CO 3 :** understand different concepts of sample survey.

**CO 4 :** understand different concepts of time series.