



# BEJOY NARAYAN MAHAVIDYALAYA

(GOVT. SPONSORED)

NAAC ACCREDITED

P.O. ITACHUNA, DIST. HOOGHLY, PIN - 712147

website : www.bnmv.ac.in ✪ e.mail ID : bnmv2012@yahoo.in

Ref. No. ....

Date. 01-08-20 22

## DEPARTMENT OF STATISTICS

### Programme Outcomes (PO)

(CBCS) B.Sc General (Statistics)

This undergraduate course in Statistics of Burdwan University (started from the session 2017-2018) would provide the opportunity to the students of our Mahavidyalaya:

- **PO-1:** To understand the basic theories and explore the fundamental concepts of statistics and its scope.
- **PO-2:** To understand the concepts and significance of the various statistical data and encourage them to develop the basic ideas in data analysis using statistical software.
- **PO-3:** To apply the theories learnt and the skills acquired to solve real life problems.
- **PO-4:** To acquire a wide range of problem-solving skills based on real life datasets in various fields.
- **PO-5:** To enhance the student's academic abilities, personal qualities and transferable skills this will give them an opportunity to develop as responsible citizens.
- **PO-6:** To motivate the students to pursue PG courses and further higher education in reputed institutions.
- **PO-7:** The course as a whole opens up several career doors for the students interested in various areas of science and technology in private, public and government sectors.
- **PO-8:** Students may get job opportunities in higher education, research organizations, industries as – statistical investigator, data analyst, statistical programmer, data scientist and many others.

*Gyauval Bhattacharya*

Dept. of Statistics  
Bejoy Narayan Mahavidyalaya  
P.O.- Itachuna, Dist.- Hooghly

*[Signature]*

Principal  
Bejoy Narayan  
P.O.- Itachuna, Dist.- Hooghly



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## Course Outcomes (CO)

The outcome of the different courses in this programme are as follows:

### Statistical Methods (TH + PRAC) CC-1/GE-1

**CO-1:** This course contains (definition and scope of Statistics, Concepts of statistical population and sample, Data sets, measures of central tendency, measures of dispersion, bivariate data, theory of attributes and related topics) both theory and practical problems, so students can build an introductory concept about statistics.

**CO-2:** This particular course concerns about the collection, organization, analysis, interpretation, and presentation (tabular and graphic) of data. From the portion -measures of dispersion, students can develop the basic ideas about range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

**CO-3:** This course also contains some important topics, which are very much essential for the students for their future development and motivating them to perform some research work based on real life datasets in near future such as - scatter diagram, simple, partial and multiple correlation, Spearman rank correlation, simple linear regression, principle of least squares and fitting of polynomials and exponential curves, theory of attributes and related topics. It is known that in regression analysis, the problem of interest is the nature of the relationship itself between the dependent variable (response) and the (explanatory) independent variable.

### Introductory Probability (TH + PRAC) CC-2/GE-2

**CO-1:** This is a theory and practical based course, students can have the opportunity to learn some important subtopics, and as an introductory part of probability theory students can develop some basic terminology, such as, random experiments, sample space, events and algebra of events.

**CO-2:** Students can learn Classical, statistical, and axiomatic definitions of probability, conditional probability and many related concepts along with Bayes' theorem, Convergence in probability and its related areas including Central Limit Theorem.

**CO-3:** Several standard probability distributions have been introduced in this particular course.

**CO-4:** Learning Probability Examples in Real Life -Forecasting the weather, Sports outcomes, Card games and other games of chance, Insurance, Traffic signals, medical

*Gejoral Bhattacharya*

Dept. of Statistics  
Bejoy Narayan Mahavidyalaya  
P.O.- Itachuna, Dist.- Hooghly

diagnosis, Election results, Lottery probability, Shopping recommendations, Stock market predictions, etc. So, this course is very much essential & helpful for the students.

#### **Basics of Statistical Inference (TH + PRAC) CC-3/GE-3**

CO-1: This is a theory and practical based course, containing the subtopics, which are - population and sample, parameter and statistic, population distribution and sampling distribution, statistical inference, Some useful distributions for statistical inference, categorical data and related tests, non-parametric tests, ANOVA. Basically, Statistical inference makes propositions about a population, using data drawn from the population with some form of sampling.

CO-2: From this course students can understand that the key difference between parametric and nonparametric test is that the parametric test relies on statistical distributions in data whereas nonparametric do not depend on any distribution. Students can also learn Analysis of variance (ANOVA), which is a collection of statistical models and their associated estimation procedures (such as the "variation" among and between groups) used to analyse the differences among means.

#### **Applied Statistics (TH + PRAC) CC-4/GE-4**

CO-1: This is a theory and practical based course, containing the subtopics, which are - economic time series, index numbers, measures of inequality and development, statistical quality control (SQC), demographic methods, life (mortality) tables, measurement of population growth. Time series are used in statistics, signal processing, pattern recognition, econometrics, mathematical finance, weather forecasting, earthquake prediction, electroencephalography, control engineering, astronomy, communications engineering, and largely in any domain of applied science and engineering

CO-2: Students can learn index number, which is an economic data figure reflecting price or quantity compared with a standard or base value. The base usually equals 100 and the index number is usually expressed as 100 times the ratio to the base value. SQC is the application of statistical methods to monitor and control the quality of a production process. This helps to ensure that the process operates efficiently, producing more specification-conforming products with less waste scrap.

CO-3: In this course students can also develop their ideas about vital statistics and related topics. Vital statistics is accumulated data gathered on live births, deaths, migration, foetal deaths, marriages and divorces. Efforts to improve the quality of vital statistics will therefore be closely related to the development of civil registration systems in countries. So, this course is very fruitful for the students.

#### **Probability and Probability Distributions –II (TH+PRAC) DSE-1**

CO-1: This is a theory and practical based course, containing the subtopics, which are - Continuous random variables and related topics, univariate transformations with applications,

*Gejwal Bhattacharya*

Dept. of Statistics  
Bejoy Narayan Mahavidyalaya  
P.O.- Itachuna, Dist.- Hooghly

two dimensional random variables, Mathematical Expectation, Probability generating function, Moments, Moment generating function, Correlation coefficient, Conditional expectation and variance, Probability Inequalities, Standard continuous probability distributions, Bivariate Normal Distribution and related topics.

**CO-2:** This course is based on little advanced level probability theory and probability distributions. The concept of the probability distribution and the random variables which they describe underlies the mathematical discipline of probability theory, and the science of statistics. There is spread or variability in almost any value that can be measured in a population (e.g., height of people, durability of a metal, sales growth, traffic flow, etc.); almost all measurements are made with some intrinsic error; in physics, many processes are described probabilistically, from the kinetic properties of gases to the quantum mechanical description of fundamental particles. For these and many other reasons, simple numbers are often inadequate for describing a quantity, while probability distributions are often more appropriate. This course is so much necessary for the students to understand the Probability theory in advance mode.

#### **Time Series Analysis (TH+PRAC) DSE-1**

**CO-1:** This is a theory and practical based course on time series analysis in advanced mode, containing the subtopics - Introduction to time series data with real life applications, Modelling time series, Components of a time series, Estimation of trend, Effect of elimination of trend on other components of the time series, Estimation of seasonal component by Method of simple averages, Notions of multiplicative models: ratio to Trend, Introduction to stochastic modelling, Box-Jenkins modelling, Forecasting.

**CO-2:** Time series analysis comprises methods for analyzing time series data in order to extract meaningful statistics and other characteristics of the data. Time series forecasting is the use of a model to predict future values based on previously observed values. While regression analysis is often employed in such a way as to test relationships between one or more different time series, this type of analysis is not usually called "time series analysis", which refers in particular to relationships between different points in time within a single series. Time series have applications in many fields. Time Series Analysis is used for many applications, such as economic forecasting, sales forecasting, budgetary analysis, stock market analysis, yield projections, process and quality control, etc. This course is so much essential for the students in advance mode which may help them in higher education.

#### **Survey Sampling and Indian Official Statistics (Th+Prac) DSE-2**

**CO-1:** This is a theory and practical based course, having the subtopics - Concept of population and sample, complete enumeration versus sampling, sampling and non-sampling errors, Types of sampling, basic principle 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 these estimates, estimates of their variances and sample size determination, Stratified random sampling, Systematic Sampling, Introduction to Ratio and regression methods of estimation and related topics, An outline of present official statistical system in India and related topics, Consumer price Index,

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Bejoy Narayan Mahavidyalaya  
P.O.- Itachuna, Dist.- Hooghly

Wholesale price index number and index of industrial production, National Income. These are very much necessary for the students.

**CO-2:** Students can develop their concepts in wide range from the particular course. They can also learn some basic concepts, such as - What is the need for sample surveys? Sample selection, Advantages of sample surveys, Disadvantages of sample surveys (Sampling errors, Complexity involved, Survey pattern, Need for statistical expertise), etc. This course is important for the students.

### Demography and Vital Statistics (Th + Prac) DSE -2

**CO-1:** This is a theory and practical based course, from where students can learn the important portions, such as - Population Theories: Coverage and content errors in demographic data, use of balancing equations and Chandrasekaran-Deming formula to check completeness of registration data, adjustment of age data, use of Myer and UN indices, population composition, dependency ratio, introduction and sources of collecting data on vital statistics, errors in census and registration data, measurement of population, rate and ratio of vital events, measurements of Mortality, stationary and stable population, life (Mortality) Tables, measurements of Fertility, measurement of Population Growth, population estimation, projection and forecasting, fitting of Logistic curve for population forecasting.

**CO-2:** Vital statistics, also known as vital events or vital records, are an important source of demographic data. They explain statistically such events as births, deaths, marriages, divorces, etc. Vital statistics are of much importance for the people and nation, viz -Vital statistics, also known as vital events or vital records, are an important source of demographic data. Vital Statistics system is the entire procedure of compiling by civil registration, enumeration, or implied estimation, information over the occurrence frequency of vital events, preferred characteristics of the events and the persons associated, and the collecting, investigating, evaluating, and distribution of such data in abstracted statistical form. This course is essential for the students.

### Numerical Analysis (TH) SEC-1

**CO-1:** This is a theoretical course based on real life applications, students can learn - approximation of numbers and functions, absolute and relative errors, interpolation and related topics, numerical differentiation and its applications, numerical integration, numerical solution of equations.

**CO-2:** Numerical analysis finds application in all fields of engineering and the physical sciences, and in the 21st century also the life and social sciences, medicine, business and even the arts. So, this course is very useful for the students.

### Research Methodology (TH) SEC -2

**CO-1:** This is a theoretical course based on real life situations, from this course students can acquire the respective concepts, such as -basic concepts about research, role of Research in

*Gajendra Bhattacharya*

Dept. of Statistics  
Bejoy Narayan Mahavidyalaya  
P.O.- Itachuna, Dist:- Hooahiv

important areas, characteristics of scientific method, process of research, types of research, survey methodology and data collection, review of various techniques for data analysis, develop a questionnaire, collect survey data pertaining to a research problem, formats and presentations of reports. Research methodology is the specific procedures or techniques used to identify, select, process, and analyse information about a topic. The methodology section answers two main questions: How was the data collected or generated? How was it analysed? This course is very much efficient for the students who want to continue their research work in near future.

### Monte Carlo Method (Th) SEC-3

**CO-1:** This is a theoretical course based on practical situations, students have the opportunity to learn some important portions, which are - using the computer for random number generation, a brief look at some popular approaches, simulating a coin toss, a die roll and a card shuffle, CDF inversion method, simulation from standard distributions, finding probabilities and moments using simulation, Monte Carlo integration, generating from Binomial and Poisson distributions, and comparing the histograms to the PMFs, 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.

**CO-2:** Monte Carlo methods, or Monte Carlo experiments, are a broad class of computational algorithms that rely on repeated random sampling to obtain numerical results. Monte Carlo methods are especially useful for simulating phenomena with significant uncertainty in inputs and systems with many coupled degrees of freedom. Areas of application include: Physical sciences, Engineering, Climate change and radiative forcing, Computational biology, Computer graphics, Applied statistics, Artificial intelligence for games, Design and visuals, Finance and business, Library science, etc.

### Statistical Data Analysis Using R (Th) SEC-3

**CO-1:** This course is completely based on R software, which is freely available. R is a programming language for statistical computing and graphics supported by the R Core Team and the R Foundation for Statistical Computing. Students can learn the respective portions, viz, Introduction to R, Using R as a calculator, Insert some Standard functions, e.g., sin, cos, exp, log in R, The different types of numbers in R: Division by zero leading to Inf or -Inf, NaN, NA., Variables, creating a vector, Functions to summarise a vector: sum, mean, sd, median etc, Using R as a graphing calculator, simple linear regression using  $lm(y \sim x)$ , Matrix operations in R, Loading data from a file, Problems on discrete and continuous probability distributions.

**CO-2:** Statistical data analysis is a procedure of performing various statistical operations. Statistical data analysis generally involves some form of statistical tools, which a layman cannot perform without having any statistical knowledge. There are various software packages to perform statistical data analysis. This software includes Statistical Analysis

System (SAS), Statistical Package for the Social Sciences (SPSS), Stat soft, etc. But, in this particular course students have to use R software. This course is so much favourable for the students who want to learn advance programming languages.

#### Design of Experiment (Th) SEC-4

**CO-1:** This is a theoretical course based on practical situations, students have a chance to learn the portions from this particular course, such as - Experimental designs, Concepts about Treatments, Experimental units & Blocks, Experimental error, Basic principles of Design of Experiments, Uniformity trials, fertility contour maps, choice of size and shape of plots and blocks in Agricultural experiments, Uses in Industrial Experiments, Basic designs: CRD, RBD, LSD - layout, model and statistical analysis, relative efficiency, Analysis with one missing observation in RBD and LSD. Design of experiments (DOE) is defined as a branch of applied statistics that deals with planning, conducting, analysing, and interpreting controlled tests to evaluate the factors that control the value of a parameter or group of parameters. DOE is a powerful data collection and analysis tool that can be used in a variety of experimental situations.

**CO-2:** One can use DOE when more than one input factor is suspected of influencing an output. For example, it may be desirable to understand the effect of temperature and pressure on the strength of a glue bond. DOE can also be used to confirm suspected input/output relationships and to develop a predictive equation suitable for performing what-if analysis. Experimental design can be used at the point of greatest leverage to reduce design costs by speeding up the design process, reducing late engineering design changes, and reducing product material and labor complexity. Designed Experiments are also powerful tools to achieve manufacturing cost savings by minimizing process variation and reducing rework, scrap, and the need for inspection. This course is so vital for the students.

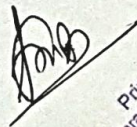
#### Data Base Management Systems (Th) SEC-4

**CO-1:** This is a theoretical course based on real life situations, students can learn various important areas from this specific course, such as, Overview of Database Management System, Introduction to Database Languages, advantages of DBMS over file processing systems, Relational Database Management System and related topics, Modifying relations, Database Structure: Introduction, Levels of abstraction in DBMS, Types of Data Models Hierarchical databases, Network databases, Relational databases, Object oriented databases.

**CO-2:** Following are a few applications which utilize the information base administration framework -Railway Reservation System, Library Management System, Banking, Education Sector, Credit card exchanges, Social Media Sites, Broadcast communication, Account, Online Shopping, Human Resource Management, Manufacturing, Airline Reservation System, Healthcare, Data retrieval, Data manipulation, Security, Data backup and recovery, Multi-user access, Reporting and analysis.

*Gayatri Bhattacharya*

**Dept. of Statistics**  
**Bejoy Narayan Mahavidyalaya**  
**R.O.- Machuna, Dist.- Hooghly**



**Principal**  
**Bejoy Narayan Mahavidyalaya**  
**P.O.- Machuna, Dist.- Hooghly.**