

B.Sc. Part I Statistics (Introduced in the year 2023-24 as per NEP 2020)	
Semester I	
Descriptive Statistics I (DSC03STA11)	
CO No.	On completion of the course, student will be able to:
CO1	Know scope of Statistics and sampling methods
CO2	Compute descriptive statistics.
CO3	Compute moments, skewness, kurtosis and its interpretation
CO4	Use an appropriate measure in given situations/data.
Elementary Probability Theory (DSC03STA12)	
CO No.	On completion of the course, student will be able to:
CO1	Distinguish between Deterministic and Non-deterministic experiments.
CO2	Understand the basic concepts of probability, conditional probability and independence of events.
CO3	Learn theorems on probabilities and compute probabilities.
CO4	Understand the concept of discrete random variable, probability distributions and mathematical expectation.
Descriptive Statistics I (MIN03STA11)	
CO No.	On completion of the course, student will be able to:
CO1	Know scope of Statistics and sampling methods
CO2	Compute descriptive statistics.
CO3	Compute moments, skewness, kurtosis and its interpretation
CO4	Use an appropriate measure in given situations/data.
Elementary Probability Theory (MIN03STA12)	
CO1	Distinguish between Deterministic and Non-deterministic experiments.
CO2	Understand the basic concepts of probability, conditional probability and independence of events.
CO3	Learn theorems on probabilities and compute probabilities.
CO4	Understand the concept of discrete random variable, probability distributions and mathematical expectation.
Data Visualization & Sample Survey (OEC03STA11)	
CO No.	On completion of the course, student will be able to:
CO1	Prepare instruments for the data collection.

CO2	Learn basic concepts of sample survey & different methods of sampling.
CO3	Visualize data diagrammatically.
CO4	Visualize data graphically.
Exploratory Data Analysis (OEC03STA12)	
CO No.	On completion of the course, student will be able to:
CO1	Learn basic concepts in statistics.
CO2	Compute descriptive statistics.
CO3	Understand the concept of bivariate data.
CO4	Analyze data by using correlation and regression.
Semester II	
Descriptive Statistics II (DSC03STA21)	
CO No.	On completion of the course, student will be able to:
CO1	To compute correlation coefficient and its interpretation.
CO2	To compute regression coefficients and regression lines.
CO3	Analyze data pertaining to attributes and interpret the results.
CO4	Understand the need of vital statistics and concepts of mortality and fertility.
Discrete Probability Distributions (DSC03STA22)	
CO No.	On completion of the course, student will be able to:
CO1	Apply some univariate standard discrete probability distributions to different situations.
CO2	Obtain mathematical expectation of different distributions.
CO3	To learn relation between different discrete distributions.
CO4	Concept of bivariate random variable, probability distributions
Descriptive Statistics II (MIN03STA21)	
CO No.	On completion of the course, student will be able to:
CO1	To compute correlation coefficient and its interpretation.
CO2	To compute regression coefficients and regression lines.
CO3	Analyze data pertaining to attributes and interpret the results.
CO4	Understand the need of vital statistics and concepts of mortality and fertility.
Discrete Probability Distributions (MIN03STA22)	
CO No.	On completion of the course, student will be able to:
CO1	Apply some univariate standard discrete probability distributions to different

	situations.
CO2	Obtain mathematical expectation of different distributions.
CO3	To learn relation between different discrete distributions.
CO4	Concept of bivariate random variable, probability distributions
Business Statistics (OEC03STA21)	
CO No.	On completion of the course, student will be able to:
CO1	Measure trend and seasonal indices in Time series.
CO2	Compute simple and weighted Index numbers.
CO3	Understand the concept of probability and probability distributions and apply probability distributions in real life.
CO4	Distinguish between process and product control, plotting control charts for variable and Attributes.
Testing of Hypothesis (OEC03STA22)	
CO No.	On completion of the course, student will be able to:
CO1	Understand concept of testing of hypothesis.
CO2	Develop test procedures for testing hypothesis.
CO3	Apply small and large sample tests in real life examples
CO4	Implement appropriate nonparametric tests for real life testing of hypothesis problems.
Sample Survey & Official Statistics (SEC03STA21)	
CO No.	On completion of the course, student will be able to:
CO1	Understand the basic concepts of sample survey.
CO2	Learn different methods of sampling.
CO3	Understand Indian Statistical system.
CO4	Know the functioning of MoSPI.
DSC Practical-1 (DSC03STA29)	
CO No.	On completion of the course, student will be able to:
CO1	Use various graphical and diagrammatic techniques and Interpret.
CO2	Compute descriptive statistics.
CO3	Computation of Moments, Skewness, Kurtosis & its interpretation.
CO4	Computation of various probabilities.
CO5	Compute correlation coefficient, regression coefficients.
CO6	Analyze data pertaining to attributes and interpret the results.

CO7	Apply various discrete distributions
CO8	Compute mortality and fertility rates.
MIN Practical-1 (MIN03STA29)	
CO No.	On completion of the course, student will be able to:
CO1	Use various graphical and diagrammatic techniques and Interpret.
CO2	Compute descriptive statistics.
CO3	Computation of Moments, Skewness, Kurtosis & its interpretation.
CO4	Computation of various probabilities.
CO5	Compute correlation coefficient, regression coefficients.
CO6	Analyze data pertaining to attributes and interpret the results.
CO7	Apply various discrete distributions
CO8	Compute mortality and fertility rates.
OEC Practical-1 (OEC03STA29)	
CO No.	On completion of the course, student will be able to:
CO1	Use various graphical and diagrammatic techniques and interpret.
CO2	Compute descriptive statistics.
CO3	Analyze bivariate data through correlation and regression.
CO4	Calculate the simple linear regression equation for a set of data.
CO5	Learn various methods of time series and
CO6	compute simple and weighted Index numbers.
CO7	Learn applications of various distributions and control charts
CO8	Learn applications of testing of hypothesis

B.Com. Part I Statistics	
(Introduced in the year 2023-24 as per NEP 2020)	
Semester I	
Business Statistics - I (SEC02STA11)	
CO No.	On completion of the course, student will be able to:
CO1	Apply Statistics in various fields and learn its applications.
CO2	Classify data and representing it graphically and diagrammatically.
CO3	Understand basic terms in sampling and different sampling methods.
CO4	Learn to compute various descriptive statistics.
Semester II	
Business Statistics - II (SEC02STA21)	
CO1	Understand the concept of probability and probability distributions.
CO2	Learn the concept and type of random variable.
CO3	Know applications of probability distributions in real life.
CO4	Distinguish between process and product control, plot various control charts.

B.Sc. Part III Statistics (Introduced in the year 2023-24 as per NEP 2020)	
Semester V	
Paper IX: Probability Distributions (DSE 1004E1)	
CO No.	On completion of the course, student will be able to:
CO1	Understand the knowledge of important univariate distributions such as Laplace, Cauchy, Lognormal, Weibull, Logistic, Pareto, Power series distributions.
CO2	Understand the knowledge of multinomial distribution and bivariate normal distribution
CO3	Understand the knowledge of truncated distributions.
CO4	Apply standard continuous probability distributions to different real-life situations.
Paper X: Statistical Inference - I (DSE 1004E2)	
CO No.	On completion of the course, student will be able to:
CO1	Understand the notion of parameter and estimator.
CO2	Understand the concept of point estimation
CO3	Recall various properties of good estimators.
CO4	Apply various methods of estimation
Paper XI: Sampling Theory (DSE 1004E3)	
CO No.	On completion of the course, student will be able to:
CO1	Understand basic concepts in sampling theory.
CO2	Learn different sampling methods.
CO3	Estimate population parameters using sampling distributions of estimator.
CO4	Compare different sampling methods
Paper XII: Operations Research (DSE 1004E4)	
CO No.	On completion of the course, student will be able to:
CO1	Understand different optimization techniques.
CO2	Transform real life situations/problems to its mathematical form.
CO3	Apply appropriate optimization technique to solve real life problems.
CO4	Generate real life scenario.
Semester VI	
Paper XIII: Probability Theory (DSE 1004F1)	
CO No.	On completion of the course, student will be able to:

CO1	Understand necessity of order statistics and its distributions.
CO2	Implement various laws of probability to get solution for different problems in Statistics.
CO3	Understand basic concepts of stochastic processes and their applications.
CO4	Apply Queuing theory and its real-life situations.
Paper XIV: Statistical Inference -II (DSE 1004F2)	
CO No.	On completion of the course, student will be able to:
CO1	Construct confidence intervals for population parameters.
CO2	Understand concept of testing of hypothesis.
CO3	Develop test procedures for testing hypothesis.
CO4	Implement appropriate nonparametric tests for real life testing of hypothesis problems
Paper XV: Design of Experiments (DSE 1004F3)	
CO No.	On completion of the course, student will be able to:
CO1	Understand the basic terminology in design of experiments.
CO2	Analyse different real life situations using appropriate designs.
CO3	Compare efficiency of different designs.
CO4	Understand concepts of ANOCOVA, factorial experiment and Confounding.
Paper XVI: Quality Management (DSE 1004F4)	
CO No.	On completion of the course, student will be able to:
CO1	Understand concept of quality and dimensions of quality.
CO2	Construct various types of control charts for quality control problems.
CO3	Apply acceptance sampling plan for monitoring quality of products.
CO4	Learn different sampling schemes used in SQC.

M.Sc. Part I Statistics (Introduced in the year 2023-24 as per NEP 2020)	
Semester I	
Distribution Theory (DSC17STA11)	
CO No.	On completion of the course, student will be able to:
CO1	Recognize and learn concept of mixture of distribution and their decomposition.
CO2	Execute transformation of univariate random variables and different moment inequalities.
CO3	Describe the concept of central and non-central distributions.
CO4	Learn the concept of order statistics.
Estimation Theory (DSC17STA12)	
CO No.	On completion of the course, student will be able to:
CO1	Describe the notion of a parametric models, point estimation of the parameters of those models.
CO2	Construct the sufficient statistic, minimal sufficient statistic, m.l.e., moment estimator of the parameter.
CO3	Discuss the concept of MVUE, MVBUE, UMVUE.
CO4	Describe the concept of Bayesian inference and their real life applications.
Statistical Computing (DSC17STA13)	
CO No.	On completion of the course, student will be able to:
CO1	Construct formulas, including the use of built-in functions and analysis tool pack.
CO2	Learn Lookup functions, pivot table and pivot chart
CO3	Develop the fundamentals of statistical analysis in R environment.
CO4	Learn different control statements and test procedures.
Research Methodology (RMD17STA11)	
CO No.	On completion of the course, student will be able to:
CO1	Understand the concept of research, research process, and research ethics.
CO2	Understand and apply various sampling methods for data collection and estimate the parameters.
CO3	Understand the concept of simulation and able to simulate real life processes
CO4	Apply numerical methods to solve systems of linear equations and definite integrals.
Mathematical Statistics (DSE17STA11)	

CO No.	On completion of the course, student will be able to:
CO1	Define and recognize the basic properties of the field of real numbers.
CO2	Define and recognize the series of real numbers and convergence.
CO3	Demonstrate understanding of the concepts of vector space and subspace, linear independence, span, and basis.
CO4	Apply principles of matrix algebra to linear transformations and solve systems of linear equations using multiple methods.
Real Analysis (DSE17STA12)	
CO No.	On completion of the course, student will be able to:
CO1	Define and recognize the basic properties of the field of real numbers.
CO2	Define and recognize the series of real numbers and convergence.
CO3	Apply the theorem in a correct mathematical way.
CO4	Define and recognize the real functions and its limits and differentiability of real functions and its related theorems.
Linear Algebra (DSE17STA13)	
CO No.	On completion of the course, student will be able to:
CO1	Solve matrix operations, including inverses and determinants.
CO2	Demonstrate understanding of the concepts of vector space and subspace, linear independence, span, and basis.
CO3	Describe eigenvalues and eigenvectors and solve eigenvalue problems.
CO4	Apply principles of matrix algebra to linear transformations and solve systems of linear equations using multiple methods.
Semester II	
Linear model and Regression Analysis (DSC17STA21)	
CO No.	On completion of the course, student will be able to:
CO1	Understand General linear model, Gauss Markov theorem, variances and covariance's of BLUEs.
CO2	Understand and apply multiple regression models in real life situations.
CO3	Understand concept of multicollinearity and non-linear regression.
CO4	Understand concept of Robust regression, Logistic regression and Poisson regression.
Theory of Testing of Hypothesis (DSC17STA22)	
CO No.	On completion of the course, student will be able to:
CO1	Formulate null and alternative hypotheses, compute probabilities of types of error, MP tests and MLR property.

CO2	Understand UMP and UMPU test with their applications.
CO3	Construct asymptotic confidence interval of a parameter and its relation with testing of hypothesis problem.
CO4	Execute small, large sample size tests and non-parametric tests in real life problems.
Multivariate Analysis (DSC17STA23)	
CO No.	On completion of the course, student will be able to:
CO1	Review of multivariate normal distribution and their real life applications.
CO2	Understand Wishart distribution, Hotelling T ² and Mahalanobis D ² statistic.
CO3	Implement dimension reduction techniques using software on real life problems.
CO4	Demonstrate knowledge of the basic ideas behind discriminant and clustering analysis techniques with applications.
Probability Theory (DSE17STA21)	
CO No.	On completion of the course, student will be able to:
CO1	Memorize the basic concepts of Sets, Sequence, Measurable function and limit.
CO2	Recognize the measure theory, random variable, distribution function, limit of sequence variables.
CO3	Explain the concept of convergence and applications with example.
CO4	Implement the central limit theorem and large-sample approximations for common statistics
Reliability Theory (DSE17STA22)	
CO No.	On completion of the course, student will be able to:
CO1	Understand concept of quality and dimensions of quality.
CO2	Construct various types of control charts for quality control problems.
CO3	Apply acceptance sampling plan for monitoring quality of products.
CO4	Learn different sampling schemes used in SQC.

M.Sc. Part I Applied Statistics (Introduced in the year 2023-24 as per NEP 2020)	
Semester I	
Distribution Theory (DSC18STA11)	
CO No.	On completion of the course, student will be able to:
CO1	Recognize and learn concept of mixture of distribution and their decomposition.
CO2	Execute transformation of univariate random variables and different moment inequalities.
CO3	Describe the concept of central and non-central distributions.
CO4	Learn the concept of order statistics.
Estimation Theory (DSC18STA12)	
CO No.	On completion of the course, student will be able to:
CO1	Describe the notion of a parametric models, point estimation of the parameters of those models.
CO2	Construct the sufficient statistic, minimal sufficient statistic, m.l.e., moment estimator of the parameter.
CO3	Discuss the concept of MVUE, MVBUE, UMVUE.
CO4	Describe the concept of Bayesian inference and their real life applications.
Statistical Computing (DSC18STA13)	
CO No.	On completion of the course, student will be able to:
CO1	Construct formulas, including the use of built-in functions and analysis tool pack.
CO2	Learn Lookup functions, pivot table and pivot chart
CO3	Develop the fundamentals of statistical analysis in R environment.
CO4	Learn different control statements and test procedures.
Research Methodology (RMD18STA11)	
CO No.	On completion of the course, student will be able to:
CO1	Understand the concept of research, research process, and research ethics.
CO2	Understand and apply various sampling methods for data collection and estimate the parameters.
CO3	Understand the concept of simulation and able to simulate real life processes
CO4	Apply numerical methods to solve systems of linear equations and definite integrals.
C Programming (DSE18STA11)	

CO No.	On completion of the course, student will be able to:
CO1	Explain the Basic Terminology Used in Computer Programming
CO2	Implement different Operations on arrays, functions, pointers, structures, unions and files.
CO3	Write Compile and Debug Programs in C Language.
CO4	Analyze and Solve Complex and Real-Life Problems by Developing Application Programs using C Programming Language.
Statistical Analysis Using SPSS (DSE18STA12)	
CO No.	On completion of the course, student will be able to:
CO1	Enter and manipulate data efficiently.
CO2	Learn diagrammatical and graphical representation of data.
CO3	Compute descriptive statistics and probabilities.
CO4	Model and test hypothesis using SPSS.
Semester II	
Linear model and Regression Analysis (DSC18STA21)	
CO No.	On completion of the course, student will be able to:
CO1	Understand General linear model, Gauss Markov theorem, variances and covariance's of BLUEs.
CO2	Understand and apply multiple regression models in real life situations.
CO3	Understand concept of multicollinearity and non-linear regression.
CO4	Understand concept of Robust regression, Logistic regression and Poisson regression.
Theory of Testing of Hypothesis (DSC18STA22)	
CO No.	On completion of the course, student will be able to:
CO1	Formulate null and alternative hypotheses, compute probabilities of types of error, MP tests and MLR property.
CO2	Understand UMP and UMPU test with their applications.
CO3	Construct asymptotic confidence interval of a parameter and its relation with testing of hypothesis problem.
CO4	Execute small, large sample size tests and non-parametric tests in real life problems.
Multivariate Analysis (DSC18STA23)	
CO No.	On completion of the course, student will be able to:
CO1	Review of multivariate normal distribution and their real life applications.
CO2	Understand Wishart distribution, Hotelling T ² and Mahalanobis D ² statistic.

CO3	Implement dimension reduction techniques using software on real life problems.
CO4	Demonstrate knowledge of the basic ideas behind discriminant and clustering analysis techniques with applications.
DBMS (DSE18STA21)	
CO No.	On completion of the course, student will be able to:
CO1	Basic knowledge in database systems.
CO2	Enable the students to be well placed in leading business organizations anywhere in the world.
CO3	To acquaint the students with the use of current relational database systems.
CO4	Ability to build a solid foundation for advanced studies in database area.
Statistical Analysis Using Minitab (DSE18STA22)	
CO No.	On completion of the course, student will be able to:
CO1	Enter and manipulate data efficiently.
CO2	Learn diagrammatical and graphical representation of data.
CO3	Compute descriptive statistics and probabilities.
CO4	Model and test hypothesis using SPSS.

M.Sc. Part II Statistics (Introduced in the year 2023-24)	
Semester III	
Asymptotic Inference (CC-2312A)	
CO No.	On completion of the course, student will be able to:
CO1	Distinguish between weak and strong consistency, joint and marginal consistency
CO2	Understand the concept of CAN and BAN estimators, their related results.
CO3	Understand the concept of super-efficient estimator, variance stabilizing transformation and their application in large sample test.
CO4	Obtain the asymptotic confidence interval based on CAN and VST.
Multivariate Analysis (CC-2313A)	
CO No.	On completion of the course, student will be able to:
CO1	Understand multivariate normal distribution and their real life applications.
CO2	Understand Wishart distribution, Hotelling T ² and Mahalanobis D ² statistic.
CO3	Implement dimension reduction techniques using software on real life problems.
CO4	Demonstrate knowledge of the basic ideas behind discriminant and clustering analysis techniques with applications.
Stochastic Processes (CC-2314A)	
CO No.	On completion of the course, student will be able to:
CO1	Understand the stochastic processes, Markov chain and Transition probability matrix, various types of states and limiting distribution.
CO2	Learn random walk model, Gambler Ruin Problem and able to compute long run distribution of Markov chain.
CO3	Apply the Poisson process, Birth and Death process and various Queuing systems in real life
CO4	Learn branching process and able to make simulation of Markov Chain, Poisson process and branching process.
Data Mining (CC-2315A)	
CO No.	On completion of the course, student will be able to:
CO1	Understand and clean the big data sets.
CO2	Apply classification methods to real life problems in various fields.
CO3	Select and evaluate the models based on datasets using different modelling techniques.

CO4	Understand unsupervised learning and supervised learning techniques for univariate and multivariate data.
Time Series Analysis (CC-2316A)	
CO No.	On completion of the course, student will be able to:
CO1	Remove trend and seasonality using different methods to convert the time series into stationary.
CO2	Understand time series, auto-covariance, auto-correlation their properties, various smoothing techniques.
CO3	Obtain Causality and inevitability, π -weights and ψ - weights, ACVF, ACF, PACF.
CO4	Understand estimation of ARIMA model, residual analysis and diagnostic checking, their forecasting.
Semester IV	
Generalized Linear Models (CC-2318B)	
CO No.	On completion of the course, student will be able to:
CO1	Understand and use the principles of statistical modelling.
CO2	Understand the general theory of GLM and apply GLM for the analysis related to data sets in various domains
CO3	Understand concept of Logistic regression and Poisson regression and its implementation in real life situation.
CO4	Understand concept of Generalized linear mixed models.
Survival Analysis (CC-2319B)	
CO No.	On completion of the course, student will be able to:
CO1	Collect the life time data using different methods of censoring.
CO2	Apply the Cox regression model.
CO3	Understand concept of competing risk analysis and how to apply in real life situations.
CO4	Use regression methods for life time data.
Biostatistics (CC-2320B)	
CO No.	On completion of the course, student will be able to:
CO1	Understand need and ethics of any clinical trial and how to conduct clinical trial of any medicine in different phases.
CO2	Apply various designs of clinical trials to the data.
CO3	Understand the designs of clinical trials and Epidemiological studies.
CO4	Analyze and report the clinical trials.
Optimization Techniques (CC-2321B)	

CO No.	On completion of the course, student will be able to:
CO1	Understand basics and formulation of linear programming problems and appreciate their limitations; solve linear programming problems using graphical method.
CO2	Apply simplex method to solve real life problems.
CO3	Solve artificial variable technique, duality theory, revised simplex method, sensitivity analysis.
CO4	Understand the concept of Game theory and dynamic programming to solve their problems and understand their real life applications
Statistical Quality Control (CC-2322B)	
CO No.	On completion of the course, student will be able to:
CO1	Understand concepts of control charts in quality improvement.
CO2	Construct modified control charts to monitor the process.
CO3	Analyze process capability using control charts.
CO4	Evaluate the quality of products using various acceptance sampling plans.




HEAD
DEPARTMENT OF STATISTICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)