

| <b>B.Sc. Part II Statistics (Introduced in the year 2025-26 as per NEP 2020)</b> |                                                                                                                         |
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| <b>Semester III</b>                                                              |                                                                                                                         |
| <b>DSC V : Probability Distributions-I (2DSC03STA31)</b>                         |                                                                                                                         |
| <b>CO No.</b>                                                                    | <b>At the end of the course students will be able to:</b>                                                               |
| CO1                                                                              | Understand some discrete probability distributions and their applications in different fields.                          |
| CO2                                                                              | Compute various statistical measures for continuous univariate and bivariate random variables.                          |
| CO3                                                                              | Understand transformation of continuous univariate and bivariate random variable.                                       |
| CO4                                                                              | Compute various generating functions for continuous univariate and bivariate random variables                           |
| <b>DSC-VI: Statistical Methods (2DSC03STA32)</b>                                 |                                                                                                                         |
| <b>CO No.</b>                                                                    | <b>At the end of the course students will be able to:</b>                                                               |
| CO1                                                                              | Understand the concept of multiple linear regression and residual.                                                      |
| CO2                                                                              | Understand the concept of multiple correlation and partial correlation.                                                 |
| CO3                                                                              | Understand the components and models of time series.                                                                    |
| CO4                                                                              | Apply various methods to remove trend.                                                                                  |
| <b>MIN-V: Data Science(2MIN03STA31)</b>                                          |                                                                                                                         |
| <b>CO No.</b>                                                                    | <b>At the end of the course students will be able to:</b>                                                               |
| CO1                                                                              | Understand the fundamentals of Data Science and its applications in various industries                                  |
| CO2                                                                              | Apply data preprocessing, transformation, and visualization techniques for exploratory data analysis (EDA)              |
| CO3                                                                              | Evaluate models using train-test split and cross-validation methods                                                     |
| CO4                                                                              | Explain and apply different classification techniques.                                                                  |
| <b>MIN-VI: Foundations of Inference &amp; Testing (2MIN03STA32)</b>              |                                                                                                                         |
| <b>CO No.</b>                                                                    | <b>At the end of the course students will be able to:</b>                                                               |
| CO1                                                                              | Understand Normal Distribution and its applications                                                                     |
| CO2                                                                              | Know the basics of testing of hypothesis.                                                                               |
| CO3                                                                              | Develop test procedures for testing of hypothesis.                                                                      |
| CO4                                                                              | Apply large sample and t tests in real life examples.                                                                   |
| <b>DSC-PR-III: DSC Statistics Practical III(2DSC03STA39)</b>                     |                                                                                                                         |
| <b>CO No.</b>                                                                    | <b>At the end of the course students will be able to:</b>                                                               |
| CO1                                                                              | Compute probabilities of standard probability distributions, expected frequencies and test the goodness                 |
| CO2                                                                              | Understand generation of random samples from standard probability distributions.                                        |
| CO3                                                                              | Understand the applications and sketch of various discrete and continuous distributions                                 |
| CO4                                                                              | Solve the real life problems based on Multiple Regression, Multiple & Partial Correlation, Index Number and Time Series |
| <b>MIN-PR-III: MIN Statistics Practical III(2MIN03STA39)</b>                     |                                                                                                                         |

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| <b>CO No.</b>                                                                  | <b>At the end of the course students will be able to:</b>                                                                      |
| CO1                                                                            | Apply basic data science techniques to collect, clean, and preprocess real-world datasets using R                              |
| CO2                                                                            | Apply different classification techniques using R                                                                              |
| CO3                                                                            | Compute probability of Type I and Type II Error.                                                                               |
| CO4                                                                            | Apply large sample tests in real life examples.                                                                                |
| <b>OEC-PR-III: Probability &amp; Probability Distributions ( 2OEC03MTS32 )</b> |                                                                                                                                |
| <b>CO No.</b>                                                                  | <b>At the end of the course students will be able to:</b>                                                                      |
| CO1                                                                            | Understand sample space, events, and event operations.                                                                         |
| CO2                                                                            | Apply conditional probability, addition, multiplication laws, and Bayes' Theorem                                               |
| CO3                                                                            | Analyse random variables, probability distributions, and key parameters like mean and variance.                                |
| CO4                                                                            | Solve problems using Binomial, Poisson, and Normal distributions effectively                                                   |
| <b>VSC PR-II:Statistical Computing Using MS-Excel (2VSC03STA39)</b>            |                                                                                                                                |
| <b>CO No.</b>                                                                  | <b>At the end of the course students will be able to:</b>                                                                      |
| CO1                                                                            | Understand basic knowledge of MS-Excel.                                                                                        |
| CO2                                                                            | Edit data using conditional formatting                                                                                         |
| CO3                                                                            | Understand the use of functions & formulae on Excel spreadsheet & analyse the data using pivot table & pivot charts.           |
| CO4                                                                            | Understand the use of functions of Excel for fitting of discrete distributions.                                                |
| <b>Semester IV</b>                                                             |                                                                                                                                |
| <b>DSC-VII: Probability Distributions-II(2DSC03STA41)</b>                      |                                                                                                                                |
| <b>CO No.</b>                                                                  | <b>At the end of the course students will be able to:</b>                                                                      |
| CO1                                                                            | Understand various continuous probability distributions.                                                                       |
| CO2                                                                            | Understand applications of various continuous probability distributions in different fields.                                   |
| CO3                                                                            | Compute descriptive statistics, moments, skewness, kurtosis, m. g. f. for continuous distributions                             |
| CO4                                                                            | Understand the relation between various probability distributions.                                                             |
| <b>DSC-VIII: Testing of Hypothesis (2DSC03STA42)</b>                           |                                                                                                                                |
| <b>CO No.</b>                                                                  | <b>At the end of the course students will be able to:</b>                                                                      |
| CO1                                                                            | Understand the basic concepts of testing of hypothesis.                                                                        |
| CO2                                                                            | Distinguish between large and small sample tests.                                                                              |
| CO3                                                                            | Apply small and large sample tests in real life examples.                                                                      |
| CO4                                                                            | Construct confidence intervals for means, variances, and difference of means.                                                  |
| <b>MIN-VII: Vital Statistics (2MIN03STA41)</b>                                 |                                                                                                                                |
| <b>CO No.</b>                                                                  | <b>At the end of the course students will be able to:</b>                                                                      |
| CO1                                                                            | Understand and differentiate various concepts and measures of national income, including GDP, GNP, NNP, and per capita income. |
| CO2                                                                            | Explain and apply different methods of national income estimation.                                                             |
| CO3                                                                            | Compute simple and weighted Index numbers.                                                                                     |

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| CO4                                                                                     | Understand the use of index number and concept of cost of living.                      |
| <b>MIN-VIII: Sampling Techniques(2MIN03STA42)</b>                                       |                                                                                        |
| <b>CO No.</b>                                                                           | <b>At the end of the course students will be able to:</b>                              |
| CO1                                                                                     | Understand basic concepts of sample survey.                                            |
| CO2                                                                                     | Understand and use probability sampling methods                                        |
| CO3                                                                                     | Find appropriate sample size in various methods.                                       |
| CO4                                                                                     | Apply various sampling methods to real life problems.                                  |
| <b>DSC-PR-IV: DSC Statistics Practical IV (2DSC03STA49)</b>                             |                                                                                        |
| <b>CO No.</b>                                                                           | <b>At the end of the course students will be able to:</b>                              |
| CO1                                                                                     | Understand fitting of various continuous distributions.                                |
| CO2                                                                                     | Understand model sampling from various continuous distributions.                       |
| CO3                                                                                     | Apply large and small sample tests to real life problems.                              |
| CO4                                                                                     | Construct confidence intervals for means, variances, and difference of means.          |
| <b>MIN-PR-IV: MIN Statistics Practical IV (MIN03STA49)</b>                              |                                                                                        |
| <b>CO No.</b>                                                                           | <b>At the end of the course students will be able to:</b>                              |
| CO1                                                                                     | Compute different simple and weighted index number.                                    |
| CO2                                                                                     | Construct various control charts for variables and attributes.                         |
| CO3                                                                                     | Understand basic concepts of sample survey.                                            |
| CO4                                                                                     | Apply different methods of sampling in real life.                                      |
| <b>OEC-PR-IV : Inferential Statistics: Large &amp; Small Sample Test ( 2OEC03MTS42)</b> |                                                                                        |
| <b>CO No.</b>                                                                           | <b>At the end of the course students will be able to:</b>                              |
| CO1                                                                                     | Understand concept of testing of hypothesis.                                           |
| CO2                                                                                     | Develop test procedures for testing of hypothesis.                                     |
| CO3                                                                                     | Apply large sample tests in real life examples.                                        |
| CO4                                                                                     | Implement appropriate small sample tests for real life testing of hypothesis problems. |
| <b>VSC PR-III: Introduction to R(2VSC03STA49)</b>                                       |                                                                                        |
| <b>CO No.</b>                                                                           | <b>At the end of the course students will be able to:</b>                              |
| CO1                                                                                     | Understand basics of R programming.                                                    |
| CO2                                                                                     | Know various built-in functions in R.                                                  |
| CO3                                                                                     | Evaluate various descriptive statistics measures using R.                              |
| CO4                                                                                     | Apply different parametric tests using R.                                              |

| <b>B.Sc. Part III Statistics (Introduced in the year 2025-26 as per NEP 2020)</b> |                                                                                                                                             |
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| <b>Semester V</b>                                                                 |                                                                                                                                             |
| <b>Paper IX: Probability Distributions (DSC03STA51)</b>                           |                                                                                                                                             |
| <b>CO No.</b>                                                                     | <b>At the end of the course students will be able to:</b>                                                                                   |
| CO1                                                                               | Understand the knowledge of important univariate distributions such as Laplace, Cauchy, Lognormal, Weibull, Logistic, Pareto distributions. |
| CO2                                                                               | Understand the knowledge of bivariate normal distribution                                                                                   |
| CO3                                                                               | Understand the knowledge of truncated distributions.                                                                                        |
| CO4                                                                               | Apply standard continuous probability distributions to different real-life situations.                                                      |
| <b>Paper X: Statistical Inference - I (DSC03STA52)</b>                            |                                                                                                                                             |
| <b>CO No.</b>                                                                     | <b>At the end of the course students will be able to:</b>                                                                                   |
| CO1                                                                               | Understand the notion of parameter and estimator.                                                                                           |
| CO2                                                                               | Understand the concept of point estimation                                                                                                  |
| CO3                                                                               | Learn various properties of good estimators.                                                                                                |
| CO4                                                                               | Apply various methods of estimation.                                                                                                        |
| <b>Paper XI: Sampling Theory (DSC03STA53)</b>                                     |                                                                                                                                             |
| <b>CO No.</b>                                                                     | <b>At the end of the course students will be able to:</b>                                                                                   |
| 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                                                                                                          |
| <b>DSE-I: Operations Research (DSE03STA51)</b>                                    |                                                                                                                                             |
| <b>CO No.</b>                                                                     | <b>At the end of the course students will be able to:</b>                                                                                   |
| CO1                                                                               | Understand different optimization techniques & transform real life situations/problems to its mathematical form.                            |
| CO2                                                                               | Formulate and solve linear programming, transportation, and assignment problems using suitable optimization methods.                        |
| CO3                                                                               | Apply sequencing techniques to optimize job scheduling and minimize total elapsed and idle times in real-life situations.                   |
| CO4                                                                               | Learn the concept of CPM & PERT.                                                                                                            |
| <b>DSE-II: Machine Learning (DSE03STA52)</b>                                      |                                                                                                                                             |
| <b>CO No.</b>                                                                     | <b>At the end of the course students will be able to:</b>                                                                                   |
| CO1                                                                               | Understand data preprocessing techniques, data cleaning, and types of machine learning.                                                     |
| CO2                                                                               | Explain and apply different classification techniques.                                                                                      |
| CO3                                                                               | Evaluate machine learning models using various performance measures.                                                                        |
| CO4                                                                               | Improve classification accuracy using ensemble methods.                                                                                     |

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| <b>DSE-III: Reliability Theory (DSE03STA53)</b>                        |                                                                                                                                                                                                                                                         |
| <b>CO No.</b>                                                          | <b>At the end of the course students will be able to:</b>                                                                                                                                                                                               |
| CO1                                                                    | Improve classification accuracy using ensemble methods.                                                                                                                                                                                                 |
| CO2                                                                    | Understand the different properties of ageing.                                                                                                                                                                                                          |
| CO3                                                                    | Interpret and apply survival functions, hazard functions, and mean residual life functions in reliability analysis.                                                                                                                                     |
| CO4                                                                    | Derive and utilize reliability measures for Exponential, Gamma, Weibull, and Pareto distributions                                                                                                                                                       |
| <b>DSC Statistics Practical V ( DSC03STA59)</b>                        |                                                                                                                                                                                                                                                         |
| <b>CO No.</b>                                                          | <b>At the end of the course students will be able to:</b>                                                                                                                                                                                               |
| CO1                                                                    | Compute probabilities of standard probability distributions, expected frequencies and test the goodness of fit and understand the generation of random samples.                                                                                         |
| CO2                                                                    | Understand the methods of point estimation.                                                                                                                                                                                                             |
| CO3                                                                    | Estimate population parameters using sampling distributions of estimator and compare different sampling methods.                                                                                                                                        |
| CO4                                                                    | Apply appropriate optimization technique to solve real life problems/ apply survival functions, Hazard functions in reliability analysis/ apply transition probability matrices, state classifications, and stationary distributions to solve problems. |
| <b>VSC PR IV : Statistical Computing using Python I ( VSC03STA59 )</b> |                                                                                                                                                                                                                                                         |
| <b>CO No.</b>                                                          | <b>At the end of the course students will be able to:</b>                                                                                                                                                                                               |
| CO1                                                                    | Understand Python's features, installation process, and different IDEs for programming.                                                                                                                                                                 |
| CO2                                                                    | Apply fundamental programming concepts such as variables, data types, operators, and expressions.                                                                                                                                                       |
| CO3                                                                    | Implement control flow mechanisms using conditional statements and loops                                                                                                                                                                                |
| CO4                                                                    | Develop programs using lists, tuples, and strings, utilizing their methods and built-in functions.                                                                                                                                                      |
| <b>MIN-IX: Reliability Theory (MIN03STA51)</b>                         |                                                                                                                                                                                                                                                         |
| <b>CO No.</b>                                                          | <b>At the end of the course students will be able to:</b>                                                                                                                                                                                               |
| CO1                                                                    | Improve classification accuracy using ensemble methods.                                                                                                                                                                                                 |
| CO2                                                                    | Understand the different properties of ageing.                                                                                                                                                                                                          |
| CO3                                                                    | Interpret and apply survival functions, hazard functions, and mean residual life functions in reliability analysis.                                                                                                                                     |
| CO4                                                                    | Derive and utilize reliability measures for Exponential, Gamma, Weibull, and Pareto distributions                                                                                                                                                       |
| <b>Semester VI</b>                                                     |                                                                                                                                                                                                                                                         |
| <b>Paper XIII: Probability Theory (DSE03STA61)</b>                     |                                                                                                                                                                                                                                                         |
| <b>CO No.</b>                                                          | <b>At the end of the course students will be able to:</b>                                                                                                                                                                                               |
| 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 concept of simulation.                                                                                                                                                                                                                       |
| CO4                                                                    | Generate real life scenario.                                                                                                                                                                                                                            |
| <b>Paper XIV: Statistical Inference -II (DSE03STA62)</b>               |                                                                                                                                                                                                                                                         |

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| <b>CO No.</b>                                          | <b>At the end of the course students will be able to:</b>                                                       |
| 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 problems                                                |
| <b>Paper XV: Design of Experiments (DSE03STA62)</b>    |                                                                                                                 |
| <b>CO No.</b>                                          | <b>At the end of the course students will be able to:</b>                                                       |
| 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 factorial experiment and Confounding.                                                    |
| <b>DSE-I: Statistical Quality Control (DSE03STA61)</b> |                                                                                                                 |
| <b>CO No.</b>                                          | <b>At the end of the course students will be able to:</b>                                                       |
| 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.                                                                   |
| <b>DSE-II: Biostatistics (DSE03STA62)</b>              |                                                                                                                 |
| <b>CO No.</b>                                          | <b>At the end of the course students will be able to:</b>                                                       |
| CO1                                                    | Understand need and ethics of any clinical trial.                                                               |
| CO2                                                    | Apply various designs of clinical trials to the data.                                                           |
| CO3                                                    | Compare different clinical trial designs.                                                                       |
| CO4                                                    | Perform statistical analysis of categorical and survival data from clinical trials.                             |
| <b>DSE-III: Stochastic Process (DSE03STA63)</b>        |                                                                                                                 |
| <b>CO No.</b>                                          | <b>At the end of the course students will be able to:</b>                                                       |
| CO1                                                    | Understand basic concepts of stochastic processes and their applications.                                       |
| CO2                                                    | Apply transition probability matrices, state classifications, and stationary distributions to solve problems.   |
| CO3                                                    | Apply Queuing theory and its real-life situations.                                                              |
| CO4                                                    | Solve problems using probability distributions in queuing systems and analyze M/M/1 models                      |
| <b>DSC Statistics Practical VI (2DSC03STA69 )</b>      |                                                                                                                 |
| <b>CO No.</b>                                          | <b>At the end of the course students will be able to:</b>                                                       |
| CO1                                                    | Understand how to use test of goodness of fit and understand the generation of random samples using simulation. |
| CO2                                                    | Understand the methods of interval estimation and non-parametric tests.                                         |
| CO3                                                    | Analyze the data by using different techniques of designs of experiment.                                        |

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| CO4                                                              | Construction of appropriate control charts/apply different classification techniques / apply various designs of clinical trials to the data. |
| <b>VSC PR V: Statistical Computing using Python (VSC03STA69)</b> |                                                                                                                                              |
| <b>CO No.</b>                                                    | <b>At the end of the course students will be able to:</b>                                                                                    |
| CO1                                                              | Understand Python basics, including features, installation, IDEs, variables, data types, and operators.                                      |
| CO2                                                              | Develop Python programs using control structures and data structures such as lists, tuples, and strings.                                     |
| CO3                                                              | Understand Python dictionaries and apply their basic operations and methods.                                                                 |
| CO4                                                              | Define and implement functions, including arguments, return values, lambda functions, and recursion.                                         |
| <b>MIN Paper -X: Stochastic Process ( MIN03STA61)</b>            |                                                                                                                                              |
| <b>CO No.</b>                                                    | <b>At the end of the course students will be able to:</b>                                                                                    |
| CO1                                                              | Understand basic concepts of stochastic processes and their applications.                                                                    |
| CO2                                                              | Apply transition probability matrices, state classifications, and stationary distributions to solve problems.                                |
| CO3                                                              | Apply Queuing theory and its real-life situations.                                                                                           |
| CO4                                                              | Solve problems using probability distributions in queuing systems and analyze M/M/1 models                                                   |

| <b>M.Sc. I Statistics (Introduced in the year 2025-26 as per NEP 2020)</b> |                                                                                                                                                              |
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| <b>Semester I</b>                                                          |                                                                                                                                                              |
| <b>Distribution Theory ( DSC17STA11)</b>                                   |                                                                                                                                                              |
| <b>CO No.</b>                                                              | <b>At the end of the course students will be able to:</b>                                                                                                    |
| 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.                                                                                                                       |
| <b>Estimation Theory ( DSC17STA12)</b>                                     |                                                                                                                                                              |
| <b>CO No.</b>                                                              | <b>At the end of the course students will be able to:</b>                                                                                                    |
| 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                                                                        | Understand and analyze the consistency and asymptotic properties of estimators, including weak, strong, joint, and marginal consistency, and CAN estimators. |
| <b>Statistical Computing ( DSC17STA13)</b>                                 |                                                                                                                                                              |
| <b>CO No.</b>                                                              | <b>At the end of the course students will be able to:</b>                                                                                                    |
| 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                                                                                                       |
| <b>Introduction to Real Analysis and Linear Algebra (DSE17STA11)</b>       |                                                                                                                                                              |
| <b>CO No.</b>                                                              | <b>At the end of the course students will be able to:</b>                                                                                                    |
| 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.                                   |
| <b>REAL ANALYSIS ( DSE17STA12)</b>                                         |                                                                                                                                                              |
| <b>CO No.</b>                                                              | <b>At the end of the course students will be able to:</b>                                                                                                    |
| 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.                                                                                                             |

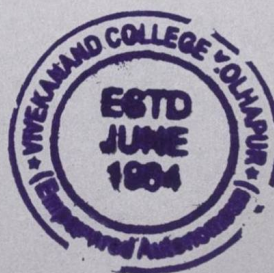
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| CO4                                                  | Define and recognize the real functions and its limits and differentiability of real functions and its related theorems.   |
| <b>Linear Algebra ( DSE17STA13)</b>                  |                                                                                                                            |
| <b>CO No.</b>                                        | <b>At the end of the course students will be able to:</b>                                                                  |
| 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. |
| <b>Research Methodology ( RMD17STA11)</b>            |                                                                                                                            |
| <b>CO No.</b>                                        | <b>At the end of the course students will be able to:</b>                                                                  |
| 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.                                       |
| <b>Semester II</b>                                   |                                                                                                                            |
| <b>Probability Theory ( DSC17STA21)</b>              |                                                                                                                            |
| <b>CO No.</b>                                        | <b>At the end of the course students will be able to:</b>                                                                  |
| CO1                                                  | Memorize the basic concepts of Sets, Sequence, Measurable function and limit.                                              |
| CO2                                                  | Recognize the measure theory, random variable, distribution function, limit of sequencevariables.                          |
| CO3                                                  | Explain the concept of convergence and applications with example.                                                          |
| CO4                                                  | Implement the central limit theorem and large-sample approximations for common statistics                                  |
| <b>Theory of Testing of Hypothesis ( DSC17STA22)</b> |                                                                                                                            |
| <b>CO No.</b>                                        | <b>At the end of the course students will be able to:</b>                                                                  |
| 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 hypothesisproblem.                |
| CO4                                                  | Execute small, large sample size tests and non-parametric tests in real life problems.                                     |
| <b>Multivariate Analysis ( DSC17STA33)</b>           |                                                                                                                            |
| <b>CO No.</b>                                        | <b>At the end of the course students will be able to:</b>                                                                  |
| CO1                                                  | Review of multivariate normal distribution and their real life applications.                                               |
| CO2                                                  | Understand Wishart distribution, Hotelling T2 and Mahalanobis D2 statistic.                                                |

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| 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.  |
| <b>Linear Models and Regression Analysis( DSE17STA21)</b> |                                                                                                                     |
| <b>CO No.</b>                                             | <b>At the end of the course students will be able to:</b>                                                           |
| 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.                                |
| <b>Statistical Analysis System (SAS)( DSE17STA22)</b>     |                                                                                                                     |
| <b>CO No.</b>                                             | <b>At the end of the course students will be able to:</b>                                                           |
| CO1                                                       | Understand the SAS environment, its components, and basic programming.                                              |
| CO2                                                       | Perform data handling, preprocessing, and management using SAS procedures.                                          |
| CO3                                                       | Conduct statistical analysis, hypothesis testing, regression, and ANOVA using SAS.                                  |
| CO4                                                       | Use SAS for visualization, report generation, and automation of statistical workflows.                              |
| <b>RELIABILITY THEORY ( DSE17STA33 )</b>                  |                                                                                                                     |
| <b>CO No.</b>                                             | <b>At the end of the course students will be able to:</b>                                                           |
| CO1                                                       | Understand different types of systems and evaluate the reliability of such systems                                  |
| CO2                                                       | Construct the reliability block diagrams and structure functions of coherent system using minimal path and cut sets |
| CO3                                                       | Understand the concepts of ageing of systems and classify them based on ageing properties                           |
| CO4                                                       | Learn reliability estimation for statistical testing.                                                               |

| <b>M.Sc. I Applied Statistics (Introduced in the year 2025-26 as per NEP 2020)</b> |                                                                                                                                                              |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Semester I</b>                                                                  |                                                                                                                                                              |
| <b>Distribution Theory ( DSC18STA11)</b>                                           |                                                                                                                                                              |
| <b>CO No.</b>                                                                      | <b>At the end of the course students will be able to:</b>                                                                                                    |
| 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.                                                                                                                       |
| <b>Estimation Theory ( DSC18STA12)</b>                                             |                                                                                                                                                              |
| <b>CO No.</b>                                                                      | <b>At the end of the course students will be able to:</b>                                                                                                    |
| 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                                                                                | Understand and analyze the consistency and asymptotic properties of estimators, including weak, strong, joint, and marginal consistency, and CAN estimators. |
| <b>Statistical Computing ( DSC18STA13)</b>                                         |                                                                                                                                                              |
| <b>CO No.</b>                                                                      | <b>At the end of the course students will be able to:</b>                                                                                                    |
| 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                                                                                                       |
| <b>Data Base management System (DBMS)(DSE18STA11)</b>                              |                                                                                                                                                              |
| <b>CO No.</b>                                                                      | <b>At the end of the course students will be able to:</b>                                                                                                    |
| 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.                                                                                   |
| <b>Statistical Analysis Using Minitab ( DSE18STA12)</b>                            |                                                                                                                                                              |
| <b>CO No.</b>                                                                      | <b>At the end of the course students will be able to:</b>                                                                                                    |
| CO1                                                                                | Enter and manipulate data efficiently.                                                                                                                       |
| CO2                                                                                | Learn diagrammatical and graphical representation of data.                                                                                                   |
| CO3                                                                                | Compute descriptive statistics and probabilities.                                                                                                            |

|                                                           |                                                                                                                    |
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| CO4                                                       | Model and test hypothesis using Minitab.                                                                           |
| <b>Research Methodology ( RMD18STA11)</b>                 |                                                                                                                    |
| <b>CO No.</b>                                             | <b>At the end of the course students will be able to:</b>                                                          |
| 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.                               |
| <b>Semester II</b>                                        |                                                                                                                    |
| <b>Probability Theory ( DSC18STA21)</b>                   |                                                                                                                    |
| <b>CO No.</b>                                             | <b>At the end of the course students will be able to:</b>                                                          |
| 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                          |
| <b>Theory of Testing of Hypothesis ( DSC18STA22)</b>      |                                                                                                                    |
| <b>CO No.</b>                                             | <b>At the end of the course students will be able to:</b>                                                          |
| 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.                             |
| <b>Multivariate Analysis ( DSC18STA33)</b>                |                                                                                                                    |
| <b>CO No.</b>                                             | <b>At the end of the course students will be able to:</b>                                                          |
| CO1                                                       | Review of multivariate normal distribution and their real life applications.                                       |
| CO2                                                       | Understand Wishart distribution, Hotelling T <sup>2</sup> and Mahalanobis D <sup>2</sup> 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. |
| <b>Linear Models and Regression Analysis( DSE18STA21)</b> |                                                                                                                    |
| <b>CO No.</b>                                             | <b>At the end of the course students will be able to:</b>                                                          |
| 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.     |
| <b>Statistical Analysis System (SAS)( DSE18STA22)</b> |                                                                                          |
| <b>CO No.</b>                                         | <b>At the end of the course students will be able to:</b>                                |
| CO1                                                   | Understand the SAS environment, its components, and basic programming.                   |
| CO2                                                   | Perform data handling, preprocessing, and management using SAS procedures.               |
| CO3                                                   | Conduct statistical analysis, hypothesis testing, regression, and ANOVA using SAS.       |
| CO4                                                   | Use SAS for visualization, report generation, and automation of statistical workflows.   |
| <b>Power BI and Tableau ( DSE18STA33 )</b>            |                                                                                          |
| <b>CO No.</b>                                         | <b>At the end of the course students will be able to:</b>                                |
| CO1                                                   | Understand data preparation, transformation, and integration in Power BI and Tableau.    |
| CO2                                                   | Apply statistical functions, predictive analytics, and trend analysis in both tools.     |
| CO3                                                   | Create interactive dashboards and reports for effective data visualization.              |
| CO4                                                   | Utilize advanced analytics, automation, and storytelling techniques for decision-making. |



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