

BSc (Statistics)

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1	Demonstrate the ability in collection, presentation, analysis and interpretation of data.
PSO 2	Understand and solve problems in probability, statistical distributions, correlation and regression.
PSO 3	Understand and apply the theories of classical inference involving estimation of parameters and testing of hypotheses.
PSO 4	Understand and apply the techniques used in design of experiments, statistical quality control, time series and population studies

COURSE OUTCOMES (COs)

STA1B01: OFFICIAL STATISTICS AND PROBABILITY

CO1	Recognize important Statistical organizations in India and apply the measures of central tendency, measures of location, measures of dispersion and measures of shape.
CO2	Distinguish between correlation and regression in terms of explaining the relationship between two or more variables.
CO3	Apply the principle of least squares in fitting linear and non-linear curves.
CO4	Understand the concepts of random experiments and definitions of probability.
CO5	Understand and apply the theorems and results to compute the probabilities of events.
CO6	Explain discrete and continuous random variables, their probability functions and properties.

SEMESTER II

STA2B02: BIVARIATE RANDOM VARIABLE AND PROBABILITY DISTRIBUTIONS

CO1	Understand the idea of expectations and there by obtaining the moments
CO2	Understand and apply the concepts of bivariate random variables and their probability distributions
CO3	Describe the shape of frequency curve and compute the conditional mean and variance using mathematical expectation.
CO4	Determine the nature of relationship and the independence of bivariate random variables using mathematical expectation.
CO5	Explain standard discrete probability distributions.
CO6	Understand and apply the law of large numbers.

SEMESTER III

STA3B03: STATISTICAL ESTIMATION

CO Statement

CO1	Explain standard continuous distributions and their applications in real-life situations.
CO2	Establish and apply Lindberg- Levy central limit theorem for i.i.d case.
CO3	Distinguish between population and sample, and understand the concept of the sampling distribution.
CO4	Establish and explain t, chi square and F distributions and their properties.
CO5	Explain the properties of point estimation and apply the methods of point estimation.

CO6	Discuss the methods of interval estimation and construct confidence interval for mean and variance.
-----	---

SEMESTER IV
STA4B04: TESTING OF HYPOTHESES

CO Statement

CO1	Understand the concepts of testing of hypotheses and compute the probabilities of two types of errors.
CO2	Illustrate the concepts of most powerful tests and SPRT.
CO3	Understand and apply the statistical tests for means and proportions.
CO4	Explain and apply tests based on F and Chi Square distribution
CO5	Discuss the concepts of Non parametric tests.
CO6	Identify and apply non parametric tests for suitable situations.

SEMESTER V
STA5B05: MATHEMATICAL METHODS IN STATISTICS

CO Statement

	CO Statement
CO1	Explain real number system and its properties.
CO2	Explain the concept of sequences and related theorems.
CO3	Describe infinite series and its convergence.
CO4	Discuss continuity and uniform continuity of real valued functions and associated theorems.
CO5	Explain differentiation and supporting results.
CO6	Explain Riemann integrability and fundamental theorems on integral calculus.

STA5B06: SAMPLE SURVEYS

CO Statements

CO1	Compare census and sampling and discuss the organization and execution of sample surveys and associated errors.
CO2	Design a questionnaire.
CO3	Explain the methods for simple random sampling and estimate the population mean, population total and their variances using simple random sampling methods.
CO4	Explain stratified and systematic sampling methods and estimate the population mean, population total and their variances using these methods.
CO5	Describe cluster sampling and estimate the population mean, population total and their variances using cluster sampling methods.
CO6	Compare stratified, systematic and cluster sampling with simple random sampling.

STA5B07: LINEAR REGRESSION ANALYSIS

CO Statement

CO1	Discuss the fundamentals of regression and model building.
CO2	Construct simple linear regression model, estimate its parameters and test their significance.
CO3	Describe and apply interval estimation of simple linear regression parameters and explain the method of maximum likelihood for estimating the parameters.

CO4	Construct multiple linear regression model, estimate its parameters and test their significance.
CO5	Explain and apply residuals and residual plots for model adequacy checking.
CO6	Discuss polynomial and logistic regression methods and estimate their parameters.

OPEN COURSES

STA5D 01: ECONOMIC STATISTICS

CO Statement

CO1	Understand components and models of time series data.
CO2	Determination of trends and construction of seasonal indices.
CO3	Explain the definition and construction of index numbers.
CO4	Test the consistency for index numbers.

STA5D 02: QUALITY CONTROL

CO Statement

CO1	Explain the fundamental concept of control charts and causes of variations.
CO2	Understand and apply control charts for variables and attributes.
CO3	Discuss the fundamentals of acceptance sampling and OC curve.
CO4	Explain simple and double sampling plans and discuss the measures for the evaluation of performance of sampling plans.

STA5D03 : BASIC STATISTICS

CO Statement

CO1	Compare census and sampling and discuss the principal steps in sample surveys and associated errors.
CO2	Understand and apply the measures of central tendency and measures of dispersion.
CO3	Discuss univariate and bivariate data and examine the linear correlation between two random variables.
CO4	Apply the principle of least squares in fitting curves.
CO5	Understand the concepts of random experiments and definitions of probability.
CO6	Understand and apply the theorems and results to compute the probabilities of events.

SEMESTER VI

STA6B09: TIME SERIES AND INDEX NUMBERS

CO Statement

CO1	Understand the components and models of time series
CO2	Determination of trends and construction of seasonal indices.
CO3	Discuss the income and allied distributions.
CO4	Explain the definition and construction of index numbers.
CO5	Test the consistency for index numbers.
CO6	Discuss the attitude measurement scale and issues associated with it.

STA6B10: DESIGN OF EXPERIMENTS

CO Statement

CO1	Understand the idea of estimation and there by obtaining the best estimates.
-----	--

CO2	Understand and apply analysis of variance and related post hoc tests.
CO3	Understand the concept of analysis of covariance with a single observation per cell.
CO4	Understand the basic principles of experimentation
CO5	Compare and contrast complete block designs.
CO6	Understand and apply factorial designs and complete block designs.

STA6B11: POPULATION STUDIES, ACTUARIAL SCIENCE AND VITAL STATISTICS

CO Statement

CO1	Recognize sources of vital statistics in India and its major functions
CO2	Understand and compute mortality rates, fertility and reproduction rates.
CO3	Understand and construct life tables.
CO4	Understand the fundamentals of insurance.
CO5	Construct mortality tables to enhance the calculation of premiums of the life insurances.

STA6B12: OPERATIONS RESEARCH AND STATISTICAL QUALITY CONTROL

CO Statement

CO1	Understand and apply linear programming problem to solve real life problems.
CO2	Understand and apply the transportation and assignment problems to solve real life problems.
CO3	Explain the fundamental concept of control charts and causes of variations.
CO4	Understand and apply control charts for variables and attributes.
CO5	Discuss the fundamentals of acceptance sampling and OC curve.
CO6	Explain simple and double sampling plans and discuss the measures for the evaluation of performance of sampling plans.

ELECTIVE COURSE

STA6B16(E): RELIABILITY THEORY

CO Statement

CO1	Understand the idea of notions of structural properties of binary system.
CO2	Explore the concepts of system reliability
CO3	Understand the type of ageing properties of lifetime distribution
CO4	Determine the bounds of reliability.
CO5	Understand the applications of exponential and Poisson distributions in system reliability.

STA6B14 (E): PROBABILITY MODELS AND RISK THEORY

CO Statement

CO1	Discuss the model for individual claim random variables and sums of independent random variables of Individual risk model for a short time.
CO2	Explain the approximation for the distribution of sum of individual risk model for a short time and its application to insurance.
CO3	Describe the collective risk models for a single period and approximation to the distributions of aggregate claims.
CO4	Discuss the collective risk models over an extended period and understand the maximal aggregate loss.

CO5	Establish the applications of risk theory and claim amount distributions approximating the individual model.
CO6	Describe the stop-loss reinsurance and the effect of reinsurance on the probability of ruin.

STA6B15 (E): STOCHASTIC PROCESSES

CO Statement:

CO1	Discuss Conditional probability and Baye's theorem.
CO2	Understand stochastic process and its classifications.
CO3	Understand the fundamentals of Markov process
CO4	Explain Transition probability matrices
CO5	Discuss first passage probability and stationary distribution.
CO6	Understand Ergodic theorems and periodicity.

COMPLIMENTARY COURSES

SEMSTER I

STA1C01: INTRODUCTORY STATISTICS

CO Statement

CO1	Recognize important Statistical organizations in India.
CO2	Describe data and apply the measures of central tendency, measures of location, measures of dispersion and measures of shape.
CO3	Distinguish between correlation and regression in terms of explaining the relationship between two or more variables.
CO4	Apply the principle of least squares in fitting linear and non-linear curves.
CO5	Understand the concept and components of time series and compare the methods for estimating trends and seasonal variations.
CO6	Explain the concept of index numbers and compare the methods for constructing index numbers

SEMSTER II

STA2C02: PROBABILITY THEORY

CO Statement

CO1	Understand the concepts of random experiments and definitions of probability.
CO2	Understand and apply the theorems and results to compute the probabilities of events.
CO3	Explain and apply discrete and continuous random variables, their probability functions and properties.
CO4	Understand and apply the idea of expectations and there by obtaining the moments.
CO5	Understand and apply the concepts of bivariate random variables and their probability distributions.
CO6	Determine the nature of relationship and the independence of bivariate random variables using mathematical expectation.

SEMSTER III

STA3C03: PROBABILITY DISTRIBUTIONS AND SAMPLING THEORY.

CO Statement

CO1	Understand and derive discrete probability distributions and their properties.
-----	--

CO2	Understand and derive continuous probability distributions and their properties.
CO3	Explain and apply Central Limit Theorems and laws of large numbers.
CO4	Understand the methods of sampling and identify the suitable situations.
CO5	Understand the fundamentals of sampling distribution.
CO6	Explain and derive Chi square, t, F distributions and their properties.

SEMESTER IV

STA4C04: STATISTICAL INFERENCE AND QUALITY CONTROL.

CO Statement

CO1	Understand and apply the theory of point estimation.
CO2	Understand and apply the theory of interval estimation.
CO3	Explore the concepts of testing of hypotheses.
CO4	Identify and apply suitable parametric tests for varying situations.
CO5	Identify and apply suitable non parametric tests for varying situations.
CO6	Explain and apply control charts for variables and attributes.

M. Sc. Statistics

Programme Specific Outcomes (PSO) of M.Sc Statistics

PSO1	Understand and apply mathematical fundamentals of statistical techniques for data analysis.
PSO2	Understand and implement the techniques involved in probability and statistical distributions in real life situations.
PSO3	Understand and implement statistical sampling and inference techniques in real situations.
PSO4	Carry out stochastic modelling of real life problems.
PSO5	Explain and apply the techniques of design of experiments, statistical quality control and life time data analysis in real life situations.
PSO5	Implement the statistical techniques using R and Python softwares

SEMESTER- I

MST1C01: ANALYTICAL TOOLS FOR STATISTICS – I

CO Statement

CO1	Understand and apply the functional properties of Multivariable functions and its applications in statistics
CO2	Understand and examine the analyticity of a complex function.
CO3	Understand and apply theorems on complex integral.
CO4	Examine types of Singularities and residues
CO5	Understand Laplace and Fourier transform and associated results.
CO6	Apply Laplace transform to solve differential equations

MST1C02: ANALYTICAL TOOLS FOR STATISTICS – II

CO Statement

CO1	Understand the basics of linear algebra and examine the linear independence of vectors.
CO3	Understand and apply operations on matrices and its properties.
CO4	Discuss matrices with special structures and their properties.

CO5	Determine the rank and generalized inverse of a matrix.
CO5	Understand and execute the decomposition of a matrix.
CO6	To understand the solution of homogeneous equations and their application in real situations, use of g inverse and classification of quadratic forms

MST1C03: DISTRIBUTION THEORY

CO Statement

CO1	Understand the behavior of various discrete probability distributions and discuss the characterisation properties of it.
CO2	Understand the behavior of various continuous probability distributions and discuss the characterisation properties of it.
CO3	Illustrate the origin of the distributions based on the family concepts.
CO4	Understand and apply the terminologies of joint, marginal and conditional distributions.
CO5	Understand the fundamentals of sampling distribution.
CO6	Explain and derive Chi square, t, F distributions and their properties.

MST1C04: PROBABILITY THEORY

CO Statement

CO1	Understanding the idea of sets, random variables and its properties
CO2	Understand fundamentals of distribution function and properties of expectation.
CO3	Explain the properties of characteristic function, independence of random variables and derive the associated results.
CO4	Explain the convergence of random variables and the related results.
CO5	State and prove the inequalities and properties related to law of large numbers
CO6	Explain the proof and applications of central limit theorems.

MST1C05: STATISTICAL COMPUTING-I

Teaching scheme: 5 hours practical per week.

SEMESTER II

MST2C06: DESIGN AND ANALYSIS OF EXPERIMENTS

CO Statement

CO1	Understand the basic principles of experimentation and apply complete block designs.
CO2	Discuss analysis of covariance and analysis of experiments with missing observations
CO3	Explain the concepts and applications of incomplete block designs
CO4	Understand and apply factorial and fractional factorial designs to take decisions in real scenario.
CO5	Understand the concepts of split plot design and strip plot design.
CO6	Understand the fundamentals of Response surface designs, orthogonality and rotatability.

MST2C07: ESTIMATION THEORY

CO Statement

CO1	Understand sufficiency of estimators and related results.
CO2	Describe Exponential and Pitman family of distributions.
CO3	Understand unbiasedness of estimators and related results.
CO4	Understand consistency of estimators and related results.
CO5	Explain and apply methods of estimation.
CO6	Understand the concepts of interval estimation and classify confidence intervals.

MST2C08: SAMPLING THEORY

CO Statement

CO1	Recollecting and expanding the knowledge about the census and sampling procedures
CO2	Understand and apply Simple random sampling, Stratified sampling, Systematic sampling and cluster sampling methods.
CO3	Carry out the estimation of population mean, population total and their variances using Simple random sampling, Stratified sampling, Systematic sampling and cluster sampling methods
CO4	Apply and compare Ratio method and Regression method for estimating population total and mean.
CO5	Estimate the population total, population mean and their variances using probability proportions to size sampling with and without replacement.
CO6	Understand and apply multi stage and multiphase sampling methods.

MST2C09: TESTING OF STATISTICAL HYPOTHESES

CO Statement

CO1	Recall the fundamentals of testing of hypotheses and understand most powerful tests.
CO2	Understand UMP unbiased test for multi parameter case and explain the construction of α similar tests with Neyman structure.
CO3	Understand the concept of locally most powerful tests, Likelihood ratio tests and Bayesian tests.
CO4	Understand and apply single sample non parametric tests.
CO5	Understand and apply two sample non parametric tests.
CO6	Understand the fundamentals of sequential probability ratio test, Operating characteristics and Average sample number.

MST2C10: STATISTICAL COMPUTING-II

Teaching scheme: 5 hours practical per week.

MST3C12: STOCHASTIC PROCESSES

CO Statement

CO1	Recollecting the basic concepts of random variables and conditional probabilities.
CO2	Understand the fundamentals of Markov process and classification of states.

CO3	Explore inter arrival time and waiting time distributions and their properties.
CO4	Understand generalized Poisson process and their properties.
CO5	Understand the concept and applications of renewal process.
CO6	Understand the basic characteristics of queues and the properties of Brownian motion.

MST3C13: STATISTICAL COMPUTING-III
Teaching scheme: 5 hours practical per week.

SEMESTER IV
MST4C14: MULTIVARIATE ANALYSIS

CO Statement

CO1	Understand the probability functions and their properties of multivariate random variable.
CO2	Understand the independence and probability distributions of quadratic and linear forms.
CO3	Compute the MLE estimates of the parameters of multivariate normal distribution and determine their sampling distributions.
CO4	Discuss Wishart's distribution and its properties
CO5	Describe the testing problems in connection with multivariate normal distribution.
CO6	illustrate and apply the techniques of Classification, principal component analysis and factor analysis.

MST4C15: PROJECT/DISSERTATION AND COMPREHENSIVE VIVA-VOCE

MST4C16: STATISTICAL COMPUTING-IV
Teaching scheme: 5 hours practical per week.

E01: Operations Research-I

CO Statement:

CO1	Discuss the concept of Operations Research.
CO2	Understand and apply linear programming problem to solve real life problems.
CO3	Understand and apply the transportation and assignment problems to solve real life problems.
CO4	Discuss sensitivity analysis and parametric programming.
CO5	Understand integer programming problems.
CO6	Explain game theory and apply it in real life problems.

E02: Time Series Analysis

CO Statement

CO1	Discuss the fundamentals and components of time series.
CO2	Describe applications and methods of smoothing.
CO3	Discuss time series models and determine suitable models.
CO4	Estimate the parameters of ARMA models and apply these models for forecasting.
CO5	Apply time series models using statistical packages.

CO6	Explain spectral analysis of weakly stationary process describe non-linear time Series models.
-----	--

E03: Operations Research-II

CO Statement:

CO1	Discuss the Non linear programming problems and methods to solve the problems.
CO2	Understand and solve quadratic programming problem.
CO3	Explain Dynamic and Geometric programming.
CO4	Discuss inventory management, deterministic and probability models.
CO5	Understand Replacement models.
CO6	Understand simulation modeling and random number generation

E04: Queueing Theory

CO Statement

CO1	Understanding basic concepts of queueing theory
CO2	Analyze behaviours of queueing models
CO3	Study on queueing networks
CO4	Apply queueing models
CO5	Evaluate performance measures
CO6	Create significance and applications of queueing theory

E05: Lifetime Data Analysis

Course objectives

CO1	Discuss life time distributions and important parametric models.
CO2	Explain censoring and estimation of parameters using censored data.
CO3	Understand and estimate the survival probabilities using product – limit and Nelson-Aalen methods.
CO4	Describe inference under exponential model and discuss the comparison of distributions.
CO5	Explain important hazard models and apply Rank test, Log-rank test and Generalized Wilcoxon test
CO6	Discuss multivariate lifetime models and data

E06: Advanced Distribution Theory

CO Statement

CO1	Discuss stopped sum distributions.
CO2	Describe the bivariate discrete distributions and its properties.
CO3	Explain bivariate continuous models and distributions with specified conditionals.
CO4	Discuss bivariate Pareto family and multivariate Liouville distributions.
CO5	Understand record values and its properties.
CO6	Illustrate the moments relationships and characterizations of record values from exponential, Weibull and logistic models.

E07: Statistical Decision Theory (4 Credits)

CO Statement

CO1	Understand the statistical decision problems and Interpret the decision rules and loss randomized decision rules.
CO2	Interpret the utility and classify the loss functions, standard loss functions and vector valued loss functions
CO3	Discuss the effort of prior information in the decision rules and Compare the informative and non-informative priors
CO4	Describe posterior distribution, Bayesian inference
CO5	CO5. Understand the Bayesian robustness Admissibility of Bayes Rule

E08: Reliability Modelling

CO Statement

CO1	Understand basic concepts of structural reliability
CO2	Analyze system reliability
CO3	Study on ageing properties of a system
CO4	Apply reliability theory to shock models and stress-strength models
CO5	Study on maintenance and replacement models
CO6	Create significance and applications of reliability theory

E09: Actuarial Statistics

CO1	Understand and apply the elements of interest.
CO2	Discuss regular pattern of cash flows and related topics.
CO3	Illustrate and apply individual and collective risk models for a short period.
CO4	Discuss survival distributions and derive survival functions.
CO5	Explain and apply life insurance models.
CO6	Discuss and apply annuity models.

E10: Statistical Quality Control

CO Statement

CO1	Understand the concepts quality, quality assurance and acceptance sampling.
CO2	Explain and compare the methods of acceptance sampling for attributes.
CO3	Explain acceptance sampling by variables and continuous sampling plans.
CO4	Describe and apply the control chart for attributes.
CO5	Explain and implement control chart for variables.
CO6	Understand process capability analysis and Explain CUSUM and EWMA control charts.

E11: Advanced Probability Theory

CO Statement

CO1	Introduce the basic concepts of Probability, Mathematical expectation and Lebesgue - Stieltjes integrals
CO2	Study on Weak and Complete convergence of random variables.
CO3	Illustrate the Infinitely divisible distributions then connect it with Stable distribution then discuss its convergence.
CO4	Describe the basic theorems based on Decomposition of normal distribution

CO5	Discuss the relevance's of Conditional expectations in Martingales and Random-Nikodyn theorem
-----	---

E12: Official Statistics

CO Statement

CO1	Understand Indian and International Statistical systems, its role, functions and activities
CO2	Discuss the scope and contents of population census of India.
CO3	Understand the population growth in developed and developing countries and evaluate the performance of family welfare programmes
CO4	Identify Statistics related to industries, foreign trade, balance of payment, cost of living inflation, educational and social statistics
CO5	Understand economic development and national income estimation using product approach, income approach and expenditure approach
CO6	Discuss the measures of inequality in income and measures of incidence and intensity.

E13: Biostatistics

CO Statement

CO1	Discuss types of Biological data and Principles of Biostatistical design of medical studies.
CO2	Understand the concepts of survival time functions of important parametric models and comparing two survival distributions using L.R test and Cox's F-test.
CO3	Explain censoring and estimation of parameters using censored data.
CO4	Understand and estimate the non-parametric methods for estimating survival function and variance of the estimator using actuarial and Kaplan –Meier methods.
CO5	Describe competing risk theory and estimate the probabilities of death by ML method.
CO6	Discuss the Basic biological concepts in genetics and clinical trials.

E14: Econometric Models

CO Statement

CO1	Understand basic concepts of Economics.
CO2	Discuss the optimization problems with more than one choice variable in Economics.
CO3	Explain the optimization problems with equality constraints and discuss Domar growth model, Solow growth model and Cobweb model.
CO4	Explain the meaning and methodology of econometrics and understand the concept of regression and autocorrelation.
CO5	Discuss the dynamic econometric models
CO6	Discuss the inconsistency of OLS estimators and understand the basic concepts of stochastic process

E15: Demographic Techniques

CO Statement

CO1	Understand the sources of demographic Statistics and explain basic demographic measures.
CO2	Understand life tables and construct a lifetable.
CO3	Explain the measures of fertility.
CO4	Understand the point estimates and population projections based on mortality, fertility and migration basis.

CO5	Discuss the ageing of the population
CO6	Estimate the demographic measures from incomplete data

E16: Stochastic Finance

CO Statement

CO1	Understand the basic concepts of financial markets and market lines.
CO2	Learn the usage of Statistical models in modeling Financial data.
CO3	Interpret and apply the black Scholes theorem and its properties.
CO4	Describe the pricing of European and American options by monte-Carlo and finite difference methods.
CO5	Discuss on the modelling security market and price process models
CO6	CO6. Learn the special features of the financial time series and their models and its estimation

E17: Longitudinal Data Analysis

CO Statement

CO1	Study the basic concepts of Linear Model in longitudinal data analysis
CO2	Analyze numerical methods two solve the problems in Linear Model
CO3	Study on Study on basic concepts of Generalized Linear Model
CO4	Illustrate and study on missing data mechanism in longitudinal data analysis
CO5	Study on Multivariate and Time-dependent covariates in longitudinal data analysis

E18: Data Mining Techniques

CO1	Understand and apply classification techniques and concept of decision trees.
CO2	Discuss clustering techniques in statistical and data mining viewpoints.
CO3	Explain and apply unsupervised and unsupervised learning and data reduction techniques.
CO4	Explain and apply artificial neural networks and extensions of regression models.
CO5	Discuss data warehousing and online analytical data processing.
CO6	Explain and apply the techniques of association rules and prediction.