Criterion 1 - Curricular Aspects

1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs which is reflected in Programme outcomes (POs), Programme specific outcomes (PSOs) and Course Outcomes (COs), of the Programmes offered by the Institution.

Name of the Programme: B.Sc. STATISTICS

Programme Outcomes:

PO 1	Apply acquired scientific knowledge to solve complex issues.
PO 2	Attain Analytical skills to solve complex cultural, societal and environmental issues.
PO 3	Employ latest and updated tools and technologies to analyse complex issues.
PO 4	Demonstrate Professional Ethics that foster Community, Nation and Environment Building Initiatives.

Programme Specific Outcomes:

PSO1	Gain broad knowledge and understanding in pure Mathematics and applications of Mathematics.
PSO 2	Demonstrate a computational ability and apply logical thinking skills to solve problems that can be modelled Mathematically
PSO 3	Read, understand, analyse and formulate Mathematical theorems
PSO 4	Acquire proficiency in the use of technology to assist in learning and investigating, Mathematical ideas and in problem solving.
PSO 5	Communicate Mathematical concepts accurately, precisely and effectively with clarity and coherence both verbal and in written form

Course Outcomes:

Course Code	**Course Title**	**Nature of the Course (Local/National/Regional/Global)**	**Course Description**	**Course Outcomes**
19ST1CC1	Basic Statistics	National	This course introduces the historical development of statistics, presentation of data, descriptive measures and fitting mathematical curves to the data	CO1: Recognizes investigation, investigator, enumerator and enumeration and explain different methods of data collection. CO2: Identifies the need of Classification and Tabulation CO3: Construct and analyze graphical display to summarize data. CO4: Explain and evaluates various measure of central tendency CO5: Compute and interpret measure of centre and spread of data.
19ST1CC2	Probability Theory	Global	This course introduces the concepts of functions and its properties, theorems related to random variables.	CO1: Identify from a probability scenario events that are simple, complementary, mutually exclusive, and independent. CO2: Recognize multiplication rule for two independent events, the addition rule for union of two events, and the complement rule.

				CO3: Describe the main properties of probability distribution and random variables. CO4: Apply general properties of the expectation and variance operators. CO5: Identify and examine generating functions and law of large numbers.
22G1ACST1	Calculus	Global	This course covers differentiation and integration of functions of one variable.	CO1: Able to differentiate the given functions. CO2: Explain higher derivatives and apply Leibnitz theorem to find the nth derivative of functions. CO3: Able to evaluate the definite integrals. CO4: Construct reduction formula for trigonometric functions. CO5: Define Jacobian, double & triple integrals and apply the knowledge of change of variables to solve the problems in double and triple integrals.
19ST2CC3	Descriptive Statistics	National	This course imparts the knowledge of correlation, regression and association of	CO1: Evaluates and interprets the nature of skewness and kurtosis. CO2: Identify the direction and strength of a correlation between two factors. CO3: Compute and interpret the spearman

			attributes to students.	correlation coefficient. CO4: Recognize regression analysis applications for purpose of description and prediction. CO5: Explain the methods of association of attributes.
19ST2CC4	Discrete Probability Distribution	National	This course exposes students the various important discrete probability models and real life situations where these distributions provide appropriate models.	CO1: Recognize cases where the Binomial distribution could be an appropriate model. CO2: Able to apply the Poisson distribution to a variety of problems. CO3: Explore the key properties such as the moment generating function, cumulant of a negative binomial distribution. CO4: Understand and derive the formula for the geometric and hypergeometric probability mass function. CO5: Explain and evaluate multinomial and power series distribution.
19ST2AC2	Algebra	National	This course introduces the concept of classical algebra	CO1: Identify binomial series and solve problems in binomial expansion. CO2: Identify logarithmic and exponential series and solve problems.

			to the students of Statistics	CO3: Relate the roots and co-efficients of the equations and Recognize the important methods in finding roots of the given polynomial. CO4: Explain the transformations of equations. CO5: Examine the nature of the roots and solve algebraic equations using Newton's method and Horner's method.
19ST1NME, 19ST2NME	Fundamentals of Statistics	National	This course is designed to make the students learn the basics of statistics	CO1: Summarize the origin of statistics and its relation with other disciplines. CO2: Explain and evaluate various measure of central tendency. CO3: Examine the various measures of dispersion. CO4: Identify the direction and strength of a correlation between two factors. CO5: Form regression equation of lines and solve.
19ST3CC5	Continuous Probability distribution	National	This course is designed to expose the	CO1: Recognize cases where the normal distribution could be an appropriate. CO2: Understand and derive the moments ,moment generating functions, characteristic functions of rectangular, beta and gamma

			students various important continuous probability models	distribution. CO3: Explore the key properties such as the moment generating function and cumulants of exponential and Cauchy distribution. CO4: Derive chi square distribution and apply in real life problem. CO5: State and apply the definitions of the t and F distributions.
19ST3CC6	Sampling Theory	National	This course is introduced to the students to impart the basic knowledge of statistical sampling concepts.	CO1: Illustrate census and sampling and their advantages and disadvantages. CO2: Differentiates the SRS WOR, SRSWR, methods of SRS – lottery method and random number table method. CO3: Understand and identify stratified random sampling. CO4: Understand and identify systematic sampling. CO5: Analyse ratio estimator.
19ST3AC3	Linear Programming	National	This course enable the students convert real life problems into a Mathematical	CO1: Formulate linear programming problems and solve by graphical method. CO2: Classify simplex method to solve linear programming problems. CO3: Identify and solve two phase and Big–M method.

			problem and to solve the musing different techniques like graphical method, simplex method, Big–M method, Two-phase method and dual simplex method.	CO4: Recognize and formulate transportation and find the optimal solution. CO5: Recognize and formulate assignment problems and find the optimal solution.
19ST3SB1	Practical Statistics I	National	The course provides problems related to measure of central tendency, measure of dispersion, and measures of association of attributes.	CO1: Calculate measure of central tendency. CO2: Classify measures of dispersion, skewness and kurtosis. CO3: Compute correlation, regression and measures of association of attributes.

19ST4CC7	Estimation Theory	National	This course introduces the concepts of statistical estimation theory.	CO1: Explain and compute point estimation. CO2: Estimate maximum likelihood estimator. CO3: Analyse minimum variance unbiased estimator. CO4: Compute interval estimation in large samples using normal distribution. CO5: Distinguish Interval estimation in small samples based on F, chi square and t distribution.
22ST4CC8	Applied Statistics	Global	This course provides some of the applications of statistics which includes topics such as time series, index numbers and national income.	CO1: Fitting of Linear trend and Calculation of Moving Average. CO2: Understand the calculation of seasonal variations using different methods and able to find cyclic fluctuations. CO3: Apply the concept of Index numbers uses and its applications. CO4: Prepare cost of living index and other index numbers for real life situations. CO5: To estimate the national income and to analysis its difficulties.
19ST4AC4	Linear Algebra	National	This course	CO1: Define Vector Space and explain its

			will focus on matrix as linear transformations relative to a basis of a vector space.	various concepts. CO2: Explain basis and dimension. CO3: Illustrate Inner Product Spaces. CO4: Define basic concepts of matrices and solve linear equations, Appraise Eigen Value and Eigen Vectors of matrices. CO5: Describe bilinear forms and quadratic forms.
22ST4SB2	Sampling Distribution	Global	The course provides an application related to the concepts of sampling distribution for large & small samples.	CO1: Recall the definition of a t statistic in terms of statistics of a sample from a normal distribution. CO2: State and apply the definitions of the t, F and Chisquare distributions in terms of the standard normal. CO3: Explain the relation between t, f and χ^2
19ST5CC9	Testing of Hypothesis	National	The course provides the basics of hypothesis testing with emphasis on some commonly encountered	CO1: Describe the process of hypothesis testing and given a statement of a research question, construct an appropriate null and alternative hypothesis to use for hypothesis testing. CO2: Explain best critical region and carryout UMP test for the parameters of univariate normal and exponential

			hypothesis tests in statistical data analysis.	distribution. CO3: Explain LRT and its properties and test mean and variance of normal population. CO4: Analyse the basic properties of non parametric statistical techniques Illustrate the significance level as the probability of rejecting a true null hypothesis. CO5: Illustrate Sequential probability ratio test.
19ST5CC10	Design of Experiments	National	This course is introduced to the students to understand the fundamental principles of experimental designs.	CO1: Define and recognize the terminology of experimental design. CO2: Apply and interpret the methods of analysis of variance. CO3: Analyse CRD, RBD and LSD. CO4: Analyse missing plot technique IRBD and LSD. CO5: Design and conduct two level functional factorial designs, split plot design.
19ST5CC11	Demography	National	This course begins	CO1: Explain sources of demographic data. CO2: Apply fertility measurements such as

			by focusing on understanding the core social demographic variables such as fertility, mortality and migration and how these variables influence population growth,composition and structure.	CBR, TFR, GRR and NRR. CO3: Compute mortality measures CDR, SDR and infant mortality rate. CO4: Construct the demographic table. CO5: Explain the factors affecting migration and the basic ideas of Stationary and Stable population.
19ST5CC12	Real Analysis	Global	This course introduces the basic concepts in analysis and to enable the students understand fundamental ideas and theorems in analysis.	CO1: Describe fundamental ideas and theorems on sequences. CO2: Distinguish convergent and divergent sequences. CO3: Distinguish convergent and divergent series. CO4: Explain the concept of limits and metric space and their roles in the real line.

				CO5: Organize theorems in a correct mathematical way.
19ST5ME1	Computer Programming in C	National	This course provides skills in designing and writing simple programs in C.	CO1: Explain various data types and operators in C. CO2: Summarize DecisionMaking Branching, looping statements and arrays. CO3: Categorize function, pointers and structures. CO4: Describe Strings and String Handling Functions. CO5: Create C program for real life problems.
19ST5MEP1	C Practicals	National	This course provides skills in designing and writing simple programs in C.	
22ST5ME3	Object Oriented programming with C++	Global	This course introduces the student to object-oriented programming	CO1: Define the features of C++ supporting object oriented programming. CO2: Describe classes and objects. CO3: Distinguish Constructors and Destructors and Explain overloading

			through a study of the concepts of program specification and design, algorithm development.	concepts. CO4: Classify Inheritance in C++. CO5: Design C++ programs for real life situations.
19ST5SB3	Practical Statistics III	National	The course provides an application based on MLEs, analysis of time series, index numbers and vital statistics & curve fitting.	CO1: Analyze the problems based on confidence interval for proportions, mean, variances and correlation coefficient. CO2: Apply and interpret the methods of curve fitting, timeseries. CO3: Analyze the problem based on vital statistics.
19ST5SB4	Statistical Software-SPSS	National	The course is introduced to learn a programming language which helps to handle all aspects of	CO1: Understand how to start SPSS and record variables and prepare data for analysis. CO2: Conduct descriptive and basic inferential statistics. CO3: Carry out statistical analysis that can test hypothesis and analyze factorial experiments.

			data analysis using statistical software SPSS.	
19ST6CC13	Statistical Quality Control	National	This course is designed to introduce students to statistical quality control emphasizing those aspects which are relevant for SQC spractical implementation	CO1: Describe the use of control charts. CO2: Demonstrate the ability to design, use and interpret control charts for variables. CO3: Identify the difference between $\bar{X}$,R, p,np and C charts. CO4: Explain the process of acceptance sampling and describe the use of OCcurve. CO5: Make use of the concept of Reliability and examine its uses in problems of quality and cost.
19ST6CC14	Stochastic Processes	Global	This course covers Markov chains in discrete time, the Poisson process and the Markov processes in continuous time	CO1: Explain the concept of stochastic processes and stationary and appreciate their significance. CO2: Compute probabilities of transition between states and identify classes of states in Markov chains and characterize the classes. CO3: Generalization of independent Bernoulli trails. CO4: Explain Poisson process and its related

				distributions. CO5: Demonstrate the knowledge in Pure and Death process.
19ST6CC15	Actuarial Statistics	National	The course covers the applications of insurance and finance.	CO1: Calculate quantities such as SI &CI, nominal and effective rates of interest and simple discount. CO2: Recognize simple assurance and annuities contracts and develop formulae for the present value of payments. CO3: Explain the concepts of redemption of loans. CO4: Construct the demographic statistics and premiums. CO5: Describe the policy values and its types.
19ST6ME5	Numerical Methods	National	This course enables the students to solve equations using various NumericalMethods	CO1: Solve algebraic and transcendental equations using various methods. CO2: Identify the various methods of solving simultaneous linear algebraic equations. CO3: Recognize difference operators and apply the concept of interpolation. CO4: Compute the values of the derivatives at some point using numerical differentiation and integration.

				CO5: Compute numerical solution of differential equation
19ST5ME6	Multivariate Analysis	National	The course covers multivariate normal distribution, hotelling T^2 statistics, multivariate classification and discrimination analysis, principal components and cluster analysis.	CO1: Derive the important properties of multivariate normal distribution. CO2: Compute hotelling T^2 statistics test on mean vector and multivariate normal population. CO3: Understand how to assess the efficacy of a classification and discrimination analysis. CO4: Introduce principal components analysis and clustering methods. CO5: Explain and Analyse contingency tables.
19ST6ME7	Regression Analysis	National	This course focuses on building a greater understanding on statistical tools for applying the linear	CO1: Classify and compute simple,multiple and partial correlation. CO2: Evaluate the regression model and estimate the standard error. CO3: Apply multiple linear regression analysis and classify simple linear regression analysis and multiple linear

			regression model and its generations.	regression analysis. CO4: Test equality of regression coefficients
19ST6ME8	Operations Research	National	This helps in solving indifferent environments that needs decisions.	CO1: Define sequencing problem and apply it to solve real life problems. CO2: Solve problems in decision making. CO3: Apply inventory control to solve practical problems. CO4: Classify queuing models. CO5: Explain CPM and PERT to plan schedule and control project activities.
19ST6ME9	Industrial Statistics	National	This course is concerned with maintaining and improving the quality of goods and services	CO1: Summarize the concept of deterministic models when the demands occur uniformly with and without shortage costs. CO2: Explain the policy for production planning when inventory levels are reviewed periodically. CO3: Demonstrate the concept of forecasting and its applications in manufacturing and nonmanufacturing industrial situations. CO4: Classify survival functions and

				hazard functions
19ST6ME10	Econometrics	National	This course provides the basic principles of econometric models	CO1: Ability to perform analyses of economic data based on broad knowledge of the linear regression model. CO2: Estimate and test regression model. CO3: Assess the appropriateness of a linear regression model by defining residuals and examining the residual plot graphs. CO4: Check the existence of multicollinearity in a data set can lead to less reliable results due to larger standard errors. CO5: Articulate the null and alternative hypotheses for the Durbin-Watson (DW) test.
19ST6SB5	Practical Statistics IV	Global	The course provides an application related to statistical quality control, non parametric tests & design of experiments	CO1: Analyze the problems based on statistical quality control. CO2: Examine various non parametric tests. CO3: Examine various non parametric tests.

19ST6SB6	Statistical Software - R	National	The course is introduced to learn a programming language which helps to handle all aspects of statistical software.	CO1: To impart efficient Data Handling Techniques. CO2: To equip students to Statistical Programming Skills based on examples and data sets. CO3: Able to explore results using ANOVA and ANOCOVA.
22ST2SL1	Quantitative Aptitude and Data Interpretations	National	To enable the students understand the mathematical concepts required to learn statistics	CO1:Can interpret the data in picture format CO2: Understand Venn diagram and Casselet data. CO3:Able to compute Permutations and Combination. CO4:Understand the share value and brokerage. CO5:Able to find the present worth , bankers' discount and gain.

19UGSLST1	Official Statistics	National	This paper gives an idea about various methods in which Statistics are being collected in different sectors Goal	CO1:Understand the function of various Indian statistical organisations. CO2:Knows the procedure of collecting informations. CO3:Able to understand the method of National Income and its estimates. CO4:Find different methods of collecting population census. CO5:Understand various sources and limitations of Industrial statistics.
19UGSLST2	Bio Statistics	National	This course covers the basic tools for the collection, analysis and presentation of	CO1:Understand the study design and its risk value. CO2:Measures the accuracy of diagnosis through chi-square method. CO3:Estimate the different phases of cinical trials. CO4:Understand the survival distributions

			data in all areas of public health.	and its parameters. CO5:Able to estimate the survival function and its variance using various methods.
22UGSLST1	Differential Equations	National	To enable the students understand the mathematical concepts required to learn statistics	CO1:Able to solve homogenuous and non-homogenuous differential equations. CO2:Compute solutions for I order differential equations. CO3:Able to solve linear equations with constant and variable coefficients. CO4:Form partial differential equations of some standard forms. CO5:Understand the application of linear differential equations.
22ST2SL1	Quantitative Aptitude and Data	National	To enable the students understand the mathematical	CO1:Can interpret the data in picture format CO2: Understand Venn diagram and Casselet data.

	Interpretations		concepts required to learn statistics	CO3:Able to compute Permutations and Combination. CO4:Understand the share value and brokerage. CO5:Able to find the present worth , bankers' discount and gain.