B.SC. (Honours (General)) with Statistics

Program Specific Outcomes (PSO):

(a) Increasing statistical understanding via theory and practical.
(b) Understanding different representation, analyses and interpretation of statistical data.
(c) Learning the theory of probability and distribution to draw inferences from the statistical data.
(d) Solving practical problems to get idea of real life.
(e) Attract student from different backgrounds.

Class/Paper/ Semester	Title	Course Outcome(CO)
		UG (CBCS) Semester-I
STATHGGE-1-Statistical Methods (Theory) – Sem 1	Unit 1	Upon completion of the course, students will able to learn: • **Introduction:** Definition and scope of statistics, concepts of statistical population and sample. • **Data:** quantitative and qualitative, attributes, variables, scales of measurement – nominal, ordinal, interval and ratio, frequency distribution. • **Presentation:** tabular and graphic, including histogram and ogives.
	Unit 2	Upon completion of the course, students will able to learn: • **Measures of central tendency:** mathematical and positional. • **Measures of dispersion:** range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.
	Unit 3	Upon completion of the course, students will able to learn: • **Bivariate data:** Definition, scatter diagram, simple, partial and multiple correlation(3 variables only), rank correlation (spearman), Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.
	Unit 4	Upon completion of the course, students will able to learn: • Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.

Class/Paper/ Semester	Title	Course Outcome (CO)
STATHGGE-1- Statistical Methods (Practical) – Sem 1		Upon completion of the course, students will able to learn: **1.** Graphical representation of data. **2.** Problems based on measures of central tendency. **3.** Problems based on measures of dispersion. **4.** Problems based on combined mean and variance and coefficient of variation. **5.** Problems based on moments, skewness and kurtosis. **6.** Fitting of polynomials, exponential curves. **7.** Karl Pearson correlation coefficient. **8.** Partial and multiple correlation coefficient. **9.** Spearman rank correlation with and without ties. **10.** Correlation coefficient for a bivariate frequency distribution. **11.** Lines of regression, angle between lines and estimated values of variables. **12.** Checking consistency of data and fitting association among attributes.
		<u>UG (CBCS) Semester-II</u>
STATHGGE-2- Introductory Probability (Theory) – Sem 2	Unit 1	Upon completion of the course, students will able to learn: • **Probability:** Introduction, random experiments, sample space, events and algebra of events. • **Definition of probability:** Classical, statistical and axiomatic. • Conditional probability, laws of addition and multiplication, independent events, theorem of total probability, Baye's theorem and its application.
	Unit 2	Upon completion of the course, students will able to learn: • **Random Variables:** Discrete and continuous random variables, p.m.f., p.d.f., c.d.f., Illustrations of random variables and its properties, Expectation, Variance, moments and moment generating function.

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	Unit 3	Upon completion of the course, students will able to learn: • Convergence in probability, almost sure convergence, Chebyshev's inequality, weak law of large numbers. • De-Moivre Laplace and Lindeberg-Levy Central limit Theorem (C.L.T).
	Unit 4	Upon completion of the course, students will able to learn: • **Standard probability distributions:** Binomial, Poisson, Geometric, negative binomial, hypergeometric, uniform, normal, exponential, beta, gamma.
STATHGGE-2- Introductory Probability (Practical) – Sem 2		Upon completion of the course, students will able to learn: **1.** Fitting of binomial distributions for n and p=q=$\frac{1}{2}$ given. **2.** Fitting of binomial distributions for n and p given. **3.** Fitting of binomial distributions computing mean and variance. **4.** Fitting of Poisson distributions for given value of lambda. **5.** Fitting of Poisson distributions after computing mean. **6.** Application problems based on binomial distribution **7.** Application problems based on Poisson distribution. **8.** Problems based on area property of normal distribution. **9.** To find the ordinate for a given area for normal distribution. **10.** Application based problems using normal distribution. **11.** Fitting of normal distribution when parameters are given. **12.** Fitting of normal distribution when parameters are not given

Class/Paper/ Semester	Title	Course Outcome (CO)
UG (CBCS) Semester-III		
STATHGGE-1- Statistical Methods (Theory) – Sem 3	Unit 1	Upon completion of the course, students will able to learn: • **Introduction:** Definition and scope of statistics, concepts of statistical population and sample. • **Data:** quantitative and qualitative, attributes, variables, scales of measurement – nominal, ordinal, interval and ratio, frequency distribution. • **Presentation:** tabular and graphic, including histogram and ogives.
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STATHGGE-1- Statistical Methods (Practical) – Sem 3		Upon completion of the course, students will able to learn: **1.** Graphical representation of data. **2.** Problems based on measures of central tendency. **3.** Problems based on measures of dispersion. **4.** Problems based on combined mean and variance and coefficient of variation. **5.** Problems based on moments, skewness and kurtosis. **6.** Fitting of polynomials, exponential curves. **7.** Karl Pearson correlation coefficient. **8.** Partial and multiple correlation coefficient. **9.** Spearman rank correlation with and without ties. **10.** Correlation coefficient for a bivariate frequency distribution. **11.** Lines of regression, angle between lines and estimated values of variables. **12.** Checking consistency of data and fitting association among attributes.
		UG (CBCS) Semester-IV
STATHGGE-2- Introductory Probability (Theory) – Sem 4	Unit 1	Upon completion of the course, students will able to learn: • **Probability:** Introduction, random experiments, sample space, events and algebra of events. • **Definition of probability:** Classical, statistical and axiomatic • Conditional probability, laws of addition and multiplication, independent events, theorem of total probability, Baye's theorem and its application.
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STATHGGE-2-Introductory Probability (Practical) – Sem 4		Upon completion of the course, students will able to learn: **1.** Fitting of binomial distributions for n and p=q=$\frac{1}{2}$ given. **2.** Fitting of binomial distributions for n and p given. **3.** Fitting of binomial distributions computing mean and variance. **4.** Fitting of Poisson distributions for given value of lambda. **5.** Fitting of Poisson distributions after computing mean. **6.** Application problems based on binomial distribution **7.** Application problems based on Poisson distribution. **8.** Problems based on area property of normal distribution. **9.** To find the ordinate for a given area for normal distribution. **10.** Application based problems using normal distribution. **11.** Fitting of normal distribution when parameters are given. **12.** Fitting of normal distribution when parameters are not given

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	Unit 4	Upon completion of the course, students will able to learn: • Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.
STATHGGE-1- Statistical Methods (Practical) – Sem 1		Upon completion of the course, students will able to learn: **1.** Graphical representation of data. **2.** Problems based on measures of central tendency. **3.** Problems based on measures of dispersion. **4.** Problems based on combined mean and variance and coefficient of variation. **5.** Problems based on moments, skewness and kurtosis. **6.** Fitting of polynomials, exponential curves. **7.** Karl Pearson correlation coefficient. **8.** Partial and multiple correlation coefficient. **9.** Spearman rank correlation with and without ties. **10.** Correlation coefficient for a bivariate frequency distribution. **11.** Lines of regression, angle between lines and estimated values of variables. **12.** Checking consistency of data and fitting association among attributes.
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STATHGGE-2- Introductory Probability (Theory) – Sem 2	Unit 1	Upon completion of the course, students will able to learn: • **Probability:** Introduction, random experiments, sample space, events and algebra of events. • **Definition of probability:** Classical, statistical and axiomatic. Conditional probability, laws of addition and multiplication, independent events, theorem of total probability, Baye's theorem and its application.

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		7. Application problems based on Poisson distribution. 8. Problems based on area property of normal distribution. 9. To find the ordinate for a given area for normal distribution. 10. Application based problems using normal distribution. 11. Fitting of normal distribution when parameters are given. 12. Fitting of normal distribution when parameters are not given
		<u>UG (CBCS) Semester-III</u>
STATHGGE-3-BASICS OF STATISTICAL INFERENCE (Theory) – Sem 3	Unit 1	Upon completion of the course, students will able to learn: • Estimation of population mean, confidence intervals for the parameters of a normal distribution (one sample and two sample problems). • The basic idea of significance test, Null and alternative hypothesis. • Type I and Type II errors, level of significance, concept of p-value. • Tests of hypotheses for the parameters of a normal distribution (one sample and two sample problems).
	Unit 2	Upon completion of the course, students will able to learn: • **Categorical data:** Tests of proportions, tests of association and goodness-of-fit using chi square test, Yates' correction.
	Unit 3	Upon completion of the course, students will able to learn: • Tests for the significance of correlation coefficient, sign test for median, sign test for symmetry. • Wilcoxon two-sample test.

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	Unit 4	Upon completion of the course, students will able to learn: • Analysis of variance, one-way and two-way classification, Brief exposure of three basic principles of design of experiments, treatment, plot and block. • Analysis of completely randomized design, randomized complete block design. Bioassay.
STATHGGE-3-BASICS OF STATISTICAL INFERENCE (Practical) – Sem 3		Upon completion of the course, students will able to learn: 1. Estimators of population mean. 2. Confidence interval for the parameters of a normal distribution (one sample and two sample problems). 3. Tests of hypotheses for the parameters of a normal distribution (one sample and two sample problems). 4. Chi-square test of proportions. 5. Chi-square test of association. 6. Chi-square test of goodness-of-fit. 7. Test for correlation coefficient. 8. Sign test for median. 9. Sign test for symmetry. 10. Wilcoxon two-sample test. 11. Analysis of Variance of a one way classified data. 12. Analysis of Variance of a two way classified data. 13. Analysis of a CRD. 14. Analysis of a RBD.
		UG (CBCS) Semester-IV
STATHGGE-4-APPLIED STATISTICS (Theory) – Sem 4	Unit 1	Upon completion of the course, students will able to learn: • **Economic Time Series:** Components of time series, Decomposition of time series – Additive and multiplicative model with their merits and demerits, Illustration of time series.

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		• Measurement of trend by method of free hand curve, method of semi-averages and method of least squares (linear, quadratic and modified exponential). • Measurement of seasonal variations by method of ratio to trend.
	Unit 2	Upon completion of the course, students will able to learn: • **Index numbers:** Definition, Criteria for a good index number, different types of index numbers. • Construction of index numbers of prices and quantities, consumer price index number. • Uses and limitations of index numbers.
	Unit 3	Upon completion of the course, students will able to learn: • **Statistical quality control:** Importance of statistical methods in industrial research and practice. • Determination of tolerance limits. • **Causes of quality in variety:** chance and assignable. • General theory of control charts, process and product control. • **Control charts for variables:** X-bar and R-charts. • **Control charts for attributes:** p and c-charts
	Unit 4	Upon completion of the course, students will able to learn: • **Demographic Methods:** Introduction, measurement of population, rates and ratios of vital events. • **Measurement of mortality:** CDR, SDR(w.r.t Age and sex), IMR, standardized death rates. • **Life(mortality) tables:** definition of its main functions and uses. • **Measurement of fertility and reproduction:** CBR, GFR and TFR. • **Measurement of population growth:** GRR, NRR.

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STATHGGE-4-APPLIED STATISTICS (Practical) – Sem 4		Upon completion of the course, students will able to learn: **1. Measurement of trends:** Fitting of linear, quadratic trend, exponential curve and plotting of trend values and comparing with given data graphically. **2.** Measurement of seasonal indices by Ratio-to-trend method and plotting of trend values and comparing with given data graphically. **3.** Construction of price and quantity index numbers by Laspeyre's formula, Paasche's formula, Marshall-Edgeworth's formula, Fisher's formula. Comparison and interpretation. **4.** Construction of wholesale price index number, fixed base index number and consumer price index number with interpretation. **5.** Construction and interpretation of X bar and R chart. **6.** Construction and interpretation of p-chart (fixed sample size) and c-chart. **7.** Computation of measures of mortality. **8.** Completion of life table. **9.** Computation of measures of fertility and population growth.
		<u>UG (CBCS) Semester-V</u>
STATHDSE-2-OPERATION RESEARCH (Theory) – Sem 5	Unit 1	Upon completion of the course, students will able to learn: • Introduction of operation research, phases of O.R., model building, various types of O.R. problems, Linear programming problem, Mathematical formulation of the L.P.P., graphical solution of a L.P.P.. • Simplex method of solving L.P.P., Charne's M-technique for solving L.P.P., involving artificial variables, special cases of L.P.P., • **Concept of Duality of L.P.P.:** Dual simplex method. Post- optimality analysis.

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	Unit 2	Upon completion of the course, students will able to learn: • **Transportation problem:** Initial solution by North west corner rule, Least cost method and Vogel's approximation method (VAM), MODI's method to find the optimal solution, special cases of transportation problem. • **Assignment problem :** Hungarian method to find optimal assignment, special cases of assignment problem.
	Unit 3	Upon completion of the course, students will able to learn: • **Game theory:** Rectangular game, minimax-maximin principle, solution to rectangular game using graphical method, dominance and modified dominance property to reduce the game matrix and solution to rectangular game with mixed strategy. • **Networking:** Shortest route and minimal spanning tree problem.
	Unit 4	Upon completion of the course, students will able to learn: • **Inventory Management:** ABC inventory system, characteristics of inventory system. • EOQ Model and its variations, with and without shortages, Quantity Discount model with price breaks.
STATHDSE-2-OPERATION RESEARCH (Practical) – Sem 5		Upon completion of the course, students will able to learn: 1. Mathematical formulation of L.P.P. and solving the problem using graphical method, simplex technique and Charne's Big M method involving artificial variables. 2. Identifying Special cases by Graphical and Simplex method and interpretation: a) Degenerate solution, b) Unbounded solution, c) Alternate solution, d) Infeasible solution. 3. Allocation problem using Transportation model. 4. Allocation problem using Assignment problem.

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		5. Problems based on game matrix: a) Graphical solution to m*2/2*n rectangular game. b) Mixed strategy. 6. To find optimal inventory policy for EOQ models and its variations
		<u>UG (CBCS) Semester-VI</u>
STATHDSE-3- Stochastic Process and Queuing Theory (Theory) – Sem 6	Unit 1	Upon completion of the course, students will able to learn: • Probability distribution: Generating functions, Bivariate probability generating function. • Stochastic Process: Introduction, Stationary Process.
	Unit 2	Upon completion of the course, students will able to learn: • Markov Chain: Definition of Markov chain, transition probability matrix, order of Markov chain, Markov chain as graphs, higher transition probabilities. • Generalization of independent Bernoulli trials, Classification of states and chains, stability of Markov system.
	Unit 3	Upon completion of the course, students will able to learn: • Poisson Process: postulates of Poisson process, properties of Poisson process, inter-arrival time, pure birth process, Yule Furry process, Birth and death process, pure death process.
	Unit 4	Upon completion of the course, students will able to learn: • Queuing System: General concept, steady state distribution, queuing model, M/M/1 with finite and infinite system capacity, waiting time distribution (without proof). • Gambler's Ruin Problem: Classical ruin problem, expected duration of the game.

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STATHDSE-3- Stochastic Process and Queuing Theory (Practical) – Sem 6		Upon completion of the course, students will able to learn: 1. Calculation of transition probability matrix. 2. Identification of characteristics of reducible and irreducible chains. 3. Identification of types of classes. 4. Identification of ergodic transition probability matrix. 5. Stationarity of Markov chain and graphical representation of Markov chain. 6. Computation of probabilities in case of generalizations of independent Bernoulli trials. 7. Calculation of probabilities for given birth and death rates and vice versa. 8. Calculation of probabilities for Birth and Death process. 9. Calculation of probability for Yule Furry Process. 10. Computation of inter-arrival time for a Poisson process. 11. Calculation of probability and parameters for (M/M/1) model and change in behaviour of queue as N tends to infinity. 12. Calculation of generating function and expected duration for different amounts of stake. 13. Computing of probabilities and expected duration between players.