DEPARTMENT OF STATISTICS
PROGRAMME: M.SC.

Statement of Course Outcomes (COs)

M.Sc. sem-I Statistics paper-I (Elements of Mathematical Analysis):-

Students will learn-

- The real valued functions and Riemann Stieltjes Integral, etc.
- The Matrix Algebra.
- The set theory and measurable sets.
- The measurable functions, convergence and dominated convergence theorems and its applications.

M.Sc Sem I - Paper II :-

At the End of this Course Students will be able :

- To apply all the discrete distributions for analyzing the data.
- To use various continuous distributions whenever necessary.
- To describe the practical applications of truncated distribution.
- To apply order statistics for distribution theory.

M.Sc. Statistics Semester I Paper-III :- Estimation Theory

By the end of this Programme, the students will be able to:
- Understand problem of statistical inference, problem of point estimation
- Properties of point estimator such Consistency, Unbiasedness, Sufficiency
- Obtain minimum variance unbiased estimator
- Obtain estimators using estimation methods such as Maximum likelihood, Minimum chi square, method of moments. Method of scoring, Properties of maximum likelihood estimator.
- Quantify information in statistic using Fisher Information
- Constructminimal sufficient statistic and minimal sufficient statistic for exponential family.
- Understand concept of :Rao-Blackwell theorem and complete family
- Explain Pitman's family of distribution.
- Understand problem of statistical inference, problem of Interval estimation
- 10.   Construct Confidence Interval (one and two parameter case)

M.Sc Sem I - Paper IV (Sampling Theory)

At the End of this Course Students will be able :

- To apply various sampling methods for agricultural data.

- To explain and to compare various allocations using stratified random sampling.
- To draw a conclusion about the best sampling procedure.
- To use practical applications of ratio and regression method of estimation.

M.Sc. sem-II Statistics paper-I (Probability Theory):-

Students will learn-

- The different probability measures.
- The distribution functions and its properties.
- The different Weak laws and strong laws of large numbers.
- 4. The characteristics functions, inversion theorem, central limit theorem, etc.

M.Sc sem II - Paper II :-

At the End of this Course Students will be able :

- To apply stochastic models for different distributions.
- To use birth and death Poisson processes whenever necessary.
- To study the applications of Gambler's Ruin problems.
- To apply various inequalities in Mathematical as well as Statistical Analysis.

M.Sc. Statistics Semester II Paper-III :-Testing of Hypothesis

By the end of this Programme, the students will be able to:
- Understand problem of statistical inference, problem of testing of hypothesis
- Explain critical regions, test functions, two kinds of errors, size function and power function
- Construct Most Powerful test using NP Lemma
- Understand situation when UMP test exists
- Construct Uniformly Most Powerful testin one parameter exponential family and Pitman family.
- Understand the concept of Non-existence of UMP test.
- Explain Likelihood ratio test., Wald test, Rao's score test, Pearson's chi-square test for goodness of fit and Bartlett's test for homogeneity of variances.
- Understand Sequential testing. Sequential probability ratio test.
- Construct SPRT in case of Binomial, Poisson, Normal Distribution.
- Understand Generalized Neyman Pearson lemma ,unbiased test, UMPUT and their existence in case of exponential family and similar tests and tests with Neyman structure.

M.Sc sem II - Paper VI (Linear Models and Design of Experiments)

At the End of this Course Students will be able :

- To apply various designs for agricultural data/agricultural field.
- To explain which design will give the maximum yield of a crop.
- To use factorial experiment for agriculture data.

- To describe the concept of confounding for different experiment.

M Sc SEM III – Paper I MST 301
Decision Theory and Nonparametric Methods

At the end of third semester ,the students will have knowledge of

- Decision Problem , Bayes Rules and minimax rules
- Advantages and disadvantages of Non parametric tests (NPT)
- Various one sample tests NPT such as test of randomness ,Sign test ,Kolmogorov Smirnov (KS)test
- Various two sample tests such as KS test ,Mann - Whitney U test etc
- Concept of Censoring
- Kaplan –Meier Estimator

Sem III – 3T2- Linear and Nonlinear Modelling

- Regression analysis is the most common statistical modelling approach used in data analysis and it is the basis for advanced statistical modelling.
- In this course, students will learn the use of different useful tools used in regression analysis. They will learn about simple and multiple linear regression, non-linear regression and Generalise linear models (GLM) including logistic regression

After learning this course, students will be able to

- Understand the concept of linear and multiple regression
- Check for the violations of model assumptions using residual analysis and other statistical tests.
- Learn to interpret different types of plots such as residual plots, normal probability plots etc.
- Understand the problems of multicollinearity, variable selection and how to deal with them.
- Differentiate between linear and non-linear regression and how to apply them in real life situations.
- The use of R statistical software will be widely used for solving a wide range of problems. At the end of the course, students will become familiar with the implementation of regression models using R along with the interpretation of results using such implementation.

M.Sc. Statistics Semester III Paper-III :- Mathematical Programming

By the end of this Programme, the students will be able to:

- Understand the concept of Optimization problem, theory of duality .
- Explain and solve Linear programming problem using simplex method, dual simplex method and carry out sensitivity analysis of LPP. Solve optimization problems using

DPP approach.
- Solve Assignment and transportation problems to obtain optimum solution.
- Gain knowledge about concave function, convex function, NLPP, Lagrange's methods for optimality, KT conditions and Beal's and Wolfe's methods to solve QPP.
- Understand basic concepts of game theory and methods of solving game problems .

M Sc SEM III – Paper IV 304 (A)
Industrial Process and Quality Control

At the end of third semester ,the students
- Will be able to draw various types of control charts such as **X bar** and **R** ,**X bar** and **s**, **p** chart ,**EWMA**,**CUSUM** etc and draw conclusions therefrom. Will have knowledge about
- Different performance measures of control chart such as OC,ARL ,ATS etc
- c Chart , its modification ,Q chart
- Multivariate Hotelling's T^2 control chart and its applications.
- Concept of Six sigma, Evolution of six sigma ,DMAIC approach
- Various sampling inspection techniques.

M Sc SEM IV – Paper I MST 301
Multivariate Analysis

At the end of fourth semester , the students will know
- Multiple and Partial Correlation and their tests of significance
- Multivariate Normal Distribution and its properties
- Wishart Distribution -
- Wilks lambda
- Hotelling's T^2 statistic and its null distribution and its applications
- Classification and Discrimination problem
- Sample discriminant function
- Principal components and its applications
- Cannonical correlation and its applications

Sem IV – 4T2- Computational Statistics

Statistical analysis has gained importance over the years. Advanced methods and different types of models can be applied to many types of data. Different types of data including big data can be analyzed using advanced statistical methods applied to different types of models.

This course deals with different computational methods and algorithms necessary for analyzing data . These methods are particularly useful for simulating data from different distributions and analyzing them with the help of computers.

Course outcome: After learning this course, students would have learnt about
- Visualization of data and exploratory data analysis

- Stochastic simulation techniques including MCMC methods
- Jackknife, Bootstrap and other important methods for handling missing dataa nd incomplete data problems.
- Non-parametric Density estimation using kernels
- The use of R statistical software will be widely used for solving a wide range of problems based on the concepts learnt.

Besides, students will be able to work on and present a project on a chosen topic of relevance, under the guidance of a faculty allotted to them.

M.Sc. Statistics Semester IV Paper-III :-Operations Research

By the end of this Programme, the students will be able to:
- Understand basic concepts of inventory problems and solve various types of EOQ models .
- Gain knowledge about sequencing problems,travelling salesman problem and various methods to solve sequencing problems.
- Understand basic concepts of queuing models and will be able to write and solve the steady state equations for various queuing models.
- Understand different concepts of Network Analysis, Construct Network Diagrams, draw conclusion from Network using PERT analysis and CPM analysis.

M Sc SEM IV – Paper IV MST 304 (A)
Industrial Statistics

At the end of fourth semester ,the students
- Will be aware of Quality systems ISO 9000 and QS 9000
- Total Quality Management,PDSA cycle
- Will know how to use various statistical tools such Design of Experiment for quality improvement
- Process Capability Analysis ,various Capability indices
- Taguchi philosophy – system ,parameter and tolerance design
- Signal to Noise Ratio
- FMECA