PG & RESEARCH DEPARTMENT OF STATISTICS

GOVT ARTS AND SCIENCE COLLEGE CALICUT

PO's AND CO's

Name of Programme: M.Sc. (STATISTICS)

Duration: Two years with 4 Semesters

Total Credits: 80

The present program is intended to provide a platform for talented students to undergo higher studies in the subject as well as to train them to suit for the needs of the society. Apart from teaching core Statistics subjects the students can choose electives depending upon their interests, under the choice-based credit system. The students are also trained to handle real life problems through practical classes and project work. As a part of the course, the students are also exposed to various statistical software such as SPSS, MATLAB and R.

PROGRAM OUTCOMES (PO's)

On successful completion of M.Sc. Statistics program the students will be able to:

P.O.1: Use probability and statistics in solving real life problems;

P.O.2: Acquire the knowledge of modern statistical techniques relevant to today's scientific community;

P.O.3: Acquire skills and competencies in statistical computing methods and develop algorithms and computer programs for analyzing complex data sets;

P.O.4: Handle real life problems using suitable statistical tools as well as they will be able to work in any industry which deals with data;

P.O.5: Become professionally inclined statistics teachers/statistician/data scientist who have sound knowledge of the subject matter and specialized in knowledge discovery through statistical methods;

P.O.6: Understand basic theoretical and applied principles of statistics with adequate preparation to pursue a Doctoral (Ph,D,) degree or enter job force as an applied statistician;

P.O.7: Communicate key statistical concepts to non-statisticians;

P.O.8: Gain proficiency in using statistical software/utility for data analysis. Also, gain proficiency in R and Python programming;

P.O.9: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in statistical sciences;

P.O.10: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges;

P.O.11: Create awareness on recent developments in statistical theory and practice.

COURSE OUTCOMES

SEMESTER-I

MST1C01: ANALYTICAL TOOLS FOR STATISTICS–I (4Credits)

Course Outcomes: On completion of the course, students should be able to:

CO 1: Develop skills in generalizing the concepts in univariate calculus to multivariate setup

CO 2: Acquire the basic concepts of the complex plane

CO 3: Determine derivatives and integrals in the case of functions in the complex plane

CO 4: Determine Poles and residue of complex functions.

CO 5: Find the Laplace transform of a given function.

CO 6: Express a given function as a Fourier Series.

MST1C02: ANALYTICAL TOOLS FOR STATISTICS – II (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Illustrate vector space, subspaces, independence of vectors, basis and dimension, direct sum, complement and orthogonality with examples.

CO2: Examine linear independence and to construct orthogonal and orthonormal vectors.

CO3: Find rank and nullity, for analysis of matrices.

CO4: Determine eigen values and eigen vectors of a given matrix.

CO5: Establish the relation between algebraic and geometric multiplicity.

CO6: Execute the decomposition of a matrix.

CO7: Derive solution of homogeneous equations and their applications in real life situations and use of g inverse.

CO8: Classify quadratic forms.

MST1C03: DISTRIBUTION THEORY (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Describe different types of discrete probability distributions

CO2: Explain the properties and applications of continuous distributions

CO3: Derive probability distributions of the different functions of discrete and continuous random variables

CO4: Describe different Sampling distributions and their interrelations

CO5: Illustrate real data modeling using probability distributions.

MST1C04: PROBABILITY THEORY (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Use algebra of sets in statistics

CO2: Describe basic concepts of Random variables from measure point of view

CO3: Explain the concept of the distribution function, Characteristic function and their relationships and importance

CO4: Distinguish different types of convergence.

CO5: Acquire knowledge in some of the very important theorems like WLLN, CLT and their applications.

MST1L01: STATISTICAL COMPUTING-I (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Develop scientific and experimental skills.

CO2: Apply the principles of Analytical Tools for Statistics- II and Distribution Theory using real data sets.

CO3: Know the formulas to be applied for the analysis.

CO4: Write the R codes for the analysis of the given data.

CO5: To install and load the packages required to run the R codes.

CO6: Enter the data given for analysis

CO7: Explain how to make conclusions and write the inference for the data analysis based on the output obtained.

SEMESTER-II

MST2C05: DESIGN AND ANALYSIS OF EXPERIMENTS (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Explain the Principles of planning of an experiment.

CO2: Discuss and compare different complete block designs with and without ancillary variables. CO3: Analyze experiments with and without missing values.

CO4: Apply incomplete block designs and balanced incomplete block designs.

CO5: Explain factorial experiments, total confounding and partial confounding.

CO6: Describe the Response surface design and method of steepest ascent.

MST2C06: ESTIMATION THEORY (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Describe the properties of estimators: unbiasedness, consistency and sufficiency.

CO2: Explain exponential family and Pitman family of distributions, with illustrations.

CO3: Describe the method of finding sufficient statistics, minimum variance unbiased estimators, consistent estimators and consistent and asymptotically normal estimators.

CO4: Relate sufficient statistic and ancillary statistic using Basu's thorem.

CO5: Determine UMVUE using complete sufficient statistic using Rao- Blackwell, and Lehmann-Scheffe theorems.

CO6: Determine the estimators using method of moments, method of percentiles, maximum likelihood method and Bayesian method.

CO7: Explain the concept of interval estimation- SELCI, Bayesian and Fiducial Intervals.

MST2C07: SAMPLING THEORY (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Distinguish between Probability and Non-Probability Sampling

CO2: Apply the sampling methods: simple random sampling, systematic sampling, stratified sampling and cluster sampling.

CO3: Estimate the population parameters for variables and attributes under the above procedures. CO4: Estimate the population parameters concerning the study variables under auxiliary information (Ratio and regression methods)

CO5: Discuss probability proportional to size (PPS) sampling strategies.

CO6: Explain the concepts of ordered and unordered estimators and their properties.

CO7: Discuss the multi-stage and multiphase sampling.

CO8: Describe non-sampling errors.

MST2C08: TESTING OF STATISTICAL HYPOTHESES (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Explain the problem of testing of hypotheses and the concept of p value.

CO2: Construct the most powerful tests using Neyman-Pearson lemma, one-sided and two-sided UMP tests and UMP unbiased tests.

CO3: Describe the concept of α-similar tests and construct such tests.

CO4: Apply nonparametric tests for testing goodness of fit, homogeneity and independence.

CO5: Develop SPRT for different problems.

MST2L02: STATISTICAL COMPUTING-II (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Develop scientific and experimental skills of the students.

CO2: Apply the principles of Design of experiments, Estimation Theory, Sampling Theory, and Testing of Statistical Hypotheses using real data sets.

CO3: Know the formulas to be applied for the analysis.

CO4: Write the R codes for the analysis of the given data.

CO5: Enter the data given for the analysis.

CO6: Explain how to make conclusions and write the inference for the data analysis based on the output obtained.

SEMESTER III

MST3C09: APPLIED REGRESSION ANALYSIS (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Illustrate the concept of linear regression model.

CO2: Estimate and test the significance of regression parameters and explain properties estimators. CO3: Check the model adequacy of regression models using residual analysis.

CO4: Discuss polynomial, step-wise, and non-parametric regression models.

CO5: Explain logistic and Poisson regression models for binary and count data and estimate their parameters.

CO6: Discuss generalized linear models and estimation of their parameters.

MST3C10: STOCHASTIC PROCESSES (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Recollect the basic concepts of random variables and conditional probabilities.

CO2: Explain the Markov Chain with illustrations.

CO3: Classify the States of a Given Markov Chain.

CO4: Describe inter-arrival time and waiting time distributions and their properties.

CO5: Explain the generalized Poisson process and its properties.

CO6: Describe the concept and applications of the renewal process.

CO7: Explain the basic characteristics of queues and the properties of Brownian motion.

MST3L03: STATISTICAL COMPUTING-III (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Develop scientific and experimental skills of the students.

CO2: Apply the principles of Design of experiments, Estimation Theory, Sampling Theory, and Testing of Statistical Hypotheses using real data sets.

CO3: Use the formulas to be applied for the analysis.

CO4: Write the R codes for the analysis of the given data.

CO5: Enter the data given for analysis. CO6: Explain how to make conclusions and write the inference for the data analysis based on the output obtained.

IV- SEMESTER

MST4C11: MULTIVARIATE ANALYSIS (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Describe the development and uses of multivariate normal distribution.

CO2: Learn the various characterization properties of multivariate normal distributions

CO3: Get an idea about sampling distributions of various multivariate statistics and know how the results are utilized in the inference procedure.

CO4: Apply different aspects of testing of statistical hypothesis in multivariate setup.

CO5: Identify the most appropriate statistical techniques for a multivariate dataset.

CO6: Apply commonly used multivariate data analysis techniques, and interpret the results

MST4P01: PROJECT/DISSERTATION (5 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Discuss the applications of various statistical techniques learned in the entire course in the form of project work.

CO2: Manage a real practical situation where a statistical analysis is sought.

CO3: Develop a professional approach towards writing and presenting an academic report.

CO4: Get more insight about the opportunities in research/career.

MST4V01: COMPREHENSIVE VIVA VOCE (3Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Communicate the concepts of each course precisely

CO2: Communicate the importance and applications of the subject Statistics in a broad sense

CO3: Get more insights into the subject areas.

CO4: Face interviews without fear and communicate their ideas effectively.

MST4L04: STATISTICAL COMPUTING-IV (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Develop scientific and experimental skills of the students and to correlate the theoretical with application-based studies.

CO2: Learn to apply multivariate techniques using R or Python.

CO3: Validate results by simulation of artificial data sets using R or Python.

CO4: Learn to import and analyze multivariate data from other source of data files like spreadsheets or web pages.

CO5: Prepare the complex raw data into a manageable format to analyze.

CO6: Get basic knowledge about the avenues of further improvement of R packages and frontiers of ever-growing research on statistical computing.

ELECTIVE COURSES

E02: TIME SERIES ANALYSIS (Credits: 4)

Course Outcomes: On completion of the course, students should be able to:

CO1: Describe the basics of time series data, its auto-covariance, auto-correlation, and stationarity.

CO2: Illustrate the test for trend and seasonality.

CO3: Explain the smoothing methods for determining the trend of the data.

CO4: Describe the properties of linear time series models.

CO5: Fit linear models for time series data sets.

CO6: Describe the maximum likelihood, Yule-Walker, and least square estimation methods.

C07: Learn to validate a model using residual analysis.

CO8: Define ARCH and GARCH models and derive their properties.

CO9: Analyse spectral density and periodogram.

E13: BIOSTATISTICS (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: Discuss types of Biological data and Principles of Bio Statistical design of medical studies.

CO2: Explain the concepts of survival time functions of important parametric models and compare two survival distributions using LR test and Cox's F-test.

CO3: Explain censoring and estimation of parameters using censored data.

CO4: Describe competing risk theory and estimate the probabilities of death by ML method.

CO6: Discuss the Basic biological concepts in genetics and clinical trials.

E18: DATA MINING TECHNIQUES (4 Credits)

Course Outcomes: On completion of the course, students should be able to:

CO1: 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.