

## **Program Specific Outcome (PSO) : M.Sc. STATISTICS**

- PSO1.** Students will acquire both a conceptual and operational understanding of the core areas of statistics.
- PSO2.** Students will acquire both a conceptual and operational understanding in the applied fields like sample surveys, time series analysis, multivariate statistics, optimization, experimental design and analysis, quality control/reliability analysis, econometrics, demography, population dynamics/categorical data analysis, etc.
- PSO3.** Students will achieve the qualities of precision and clarity in the communication of statistical ideas, effective use of non-classroom resources to gain knowledge. Proficiency in the formulation and construction of statistical results, practice in analyzing, formulating, modeling, testing, and interpretation of the results.
- PSO4.** Students shall acquire effective skills in reasoning and report writing. They will be capable of using computer technologies and statistical software like SPSS, R, and MATLAB.

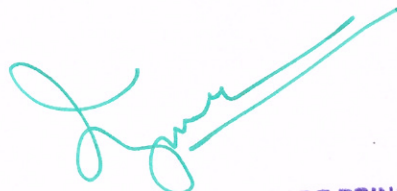
### **PG1STAC01 - MEASURE AND PROBABILITY**

- CO1. Students shall understand the basic ideas of measure theory and properties.
- CO2. Students will understand the basic probability concepts and thereby know how to construct a new probability measure from a general measure.
- CO3. Student will be able to know how to create a random variable in a particular situation. Also they will be able to split up a common distribution function into discrete and continuous distribution function.
- CO4. Understand the convergence of random variables, thereby enabling them to understand the central limit theorem easily.
- CO5. Overall this is a prerequisite for various courses like Advanced Probability Theory, Stochastic Processes, Distribution Theory, etc.

### **PG1STAC02 - DISTRIBUTION THEORY**

- CO1. Enables students to understand some well known discrete distributions and their properties.



  
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CO2. Enables students to understand most frequently used absolutely continuous distributions and their properties.

CO3. Enables students to find relationship between distributions using transformation of variables.

CO4. Enables students to cover foundations in sampling distributions and order statistics.

### **PG1STAC03 - ANALYTICAL TOOLS FOR STATISTICS**

CO1. Update knowledge about convergence properties of sequence and series of real functions.

CO2. Use the basic concepts of vector and matrix algebra, including linear independence, basis and dimension of a subspace, rank and nullity, for analysis of matrices and systems of linear equations.

CO3. Introduce and analyse the concepts in linear algebra like characteristic roots and vectors, generalized inverses useful in multivariate statistical analysis.

CO4. Detailed analysis of quadratic forms and spectral decomposition of matrices, which often arises in a multivariate data analysis.

### **PG1STAC04 - SAMPLING THEORY**

CO1. Understand essential concepts adopted in sample surveys.

CO2. Learn about different methods to estimate the parameters.

CO3. Learn about applications of various sampling methods.

CO4. Understand the concept of ratio and regression methods in estimation.

### **PG1STAC05 - STATISTICAL COMPUTING USING R**

CO1. Understand basics of R environment and perform various operations on data in R.

CO2. Compute probabilities and fitting of probability distribution with R environment.

CO3. Testing the ability of students in solving the practical problems based on courses covered in the first semester.



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CO4. To add competence and nourish employability of the students in the domain of Data Analytics.

#### **PG2STAC06 - ADVANCED PROBABILITY THEORY**

CO1. Investigate characteristic function and its properties in detail.

CO2. Understand the law of large numbers and its variants.

CO3. Understand the central limit theorem and its variants.

CO4. Describe theory for conditional probability and expectation from a measure-theoretic perspective.

#### **PG2STAC07 - MULTIVARIATE DISTRIBUTIONS**

CO1. Students understand about vector valued random variables and their distributional properties. They become acquainted with discrete and continuous multivariate distributions and their properties.

CO2. Enable the students to acquire a thorough understanding on multivariate normal distribution and its properties.

CO3. Student understands the sampling distributions of matrix variable statistics and their basic properties.

CO4. Students become familiar with the quadratic forms and their distribution. The concepts of simple, partial and multiple correlations, their properties and distributions are thoroughly investigated.

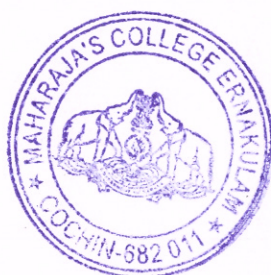
#### **PG2STAC08 - THEORY OF ESTIMATION**

CO1. Understand and analyze desirable properties of estimators .

CO2. Understand and evaluate theoretical support for the construction of good estimators.

CO3. Apply methods of estimation in inferential problems.

CO4. Understand theoretical support for Bayesian analysis and applications in inferential problems.



  
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### **PG2STAC09 - STOCHASTIC PROCESSES**

- CO1. Stochastic processes extend the concept of random variables to a space including time component.
- CO2. Learn about the notions like recurrence, transience and equilibrium in applied situations such as random walk and branching process.
- CO3. Analysis and interpretation of various stochastic processes and stationary processes are studied in detail.

### **PG2STAC10 - STATISTICAL COMPUTING USING MATLAB/R**

- CO1. Get familiar with MATLAB software and perform inferential statistical analysis through R.
- CO2. Testing the ability of students in solving the practical problems based on courses covered in second semester.
- CO3. To add competency and nourish employability of the students in the domain of Data Analytics.


### **PG3STAC11 - TESTING OF STATISTICAL HYPOTHESES**

- CO1. Students understand about formulation of hypothesis, properties of different test and application.
- CO2. Understand how to construct different confidence intervals and evaluate their properties.
- CO3. Acquire theoretical background for likelihood ratio test and its applications in inference.
- CO4. Acquire theoretical support for Non parametric test and apply them in real life problems of testing.

### **PG3STAC12 - DESIGN AND ANALYSIS OF EXPERIMENTS**

- CO1. Students acquire an in-depth knowledge of linear models, parametric estimation of the linear models and also testing of hypotheses which provides a fundamental portion of statistical inference. Students become acquainted with the concept of ANOVA.



  
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- CO2. Students acquire an understanding on various experimental designs and they could easily layout experiments using them and perform the analysis as well. Missing data problems and ANACOVA are also taken care of.
- CO3. Students acquire a solid understanding of incomplete block designs and their analysis.
- CO4. Students acquire an in-depth understanding on factorial experiments which suit many real life situations.

### **PG3STAC13 - MULTIVARIATE ANALYSIS**

- CO1. Understand Hotelling  $T^2$  and Mahalanobis  $D^2$  statistic and analyse multivariate data with mean vectors.
- CO2. Implement dimension reduction techniques like principal component and factor analysis on real life problems.
- CO3. Demonstrate knowledge and understanding of the basic ideas behind discriminant and clustering analysis techniques with applications.
- CO4. Understand MANOVA and analyse multivariate data with several mean vectors.

### **PG3STAC14 - STATISTICAL COMPUTING USING SPSS**

- CO1. Get familiar with SPSS software and perform inferential statistical analysis through SPSS.
- CO2. Testing the ability of students in solving the practical problems based on courses covered in third semester.
- CO3. To add competency and nourish employability of the students in the domain of Data Analytics.

### **PG3STAE01 - STATISTICAL QUALITY CONTROL**

- CO1. Students get a clear picture of application of various control charts and other statistical techniques to estimate the natural capability of a process.



  
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- CO2. Students acquire knowledge how to accept a good quality lot by studying acceptance sampling. Also they are acquainted with OC curve , ASN function, AOQL etc.
- CO3. Students get an idea on Process Capability Studies, ISO Standardisation etc which they could apply in real life situations.

### **PG3STAE03 - CATEGORICAL DATA ANALYSIS**

- CO1. Understand the association between attributes, categorical variables and their applications in generalized linear models
- CO2. Understand different probability models and GLMs. Applications of such models in real life situations are also introduced and familiarized
- CO3. Understand techniques of constructing the Poisson, Proportional hazards regression and Negative Binomial regression models and apply them in real life situations.
- CO4. Apply techniques of random number generation, simulation to MCMC and Gibbs sampler. Evaluate different random number techniques and to handle WinBUGS.

### **PG4STAC15 - TIME SERIES ANALYSIS**

- CO1. Understand the concept of time series with its components and able to apply various exponential smoothing methods.
- CO2. Analyse auto regressive, moving average, ARMA, ARIMA models and able to compute auto-covariance and autocorrelation of stationary time series models.
- CO3. Apply Box-Jenkins approach to forecast time-series data empirically and check and validate models with its residual analysis and diagnostic checking.
- CO4. Understand the concepts of spectral analysis of times series, Seasonal ARIMA, ARCH and GARCH models.

### **PG4STAC16 - ECONOMETRIC METHODS**



  
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- CO1. Understand different types of regression models and their applications in modelling and prediction.
- CO2. Understand and apply different diagnostic testing and remedial measures for constructed regression models.
- CO3. Understand and analyze the different micro-economic concepts and apply them in the mathematical models.
- CO4. Understand the concept of structural econometric models and their applications in econometric modelling.

#### **PG4STAC17 - OPERATIONS RESEARCH**

- CO1. Understand the basic concepts of Linear, Non-Linear and Integer Programming.
- CO2. Enable to develop and solve any type of Linear Programming Problem
- CO3. Application of Linear Programming in the field of Transportation and Assignment
- CO4. Able to construct and solve a general Non-Linear Programming problem in special cases.
- CO5. Able to apply the optimization technique to any Quadratic Programming Problem.
- CO6. Develop decision making skills under Inventory Models and Game Theory.

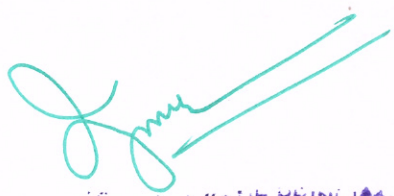
#### **PG4STAC18 - STATISTICAL COMPUTING USING SAS**

- CO1. Get familiar with SAS software and understand SAS environment.
- CO2. Testing the ability of students in solving the practical problems based on courses covered in fourth semester.
- CO3. To add competency and nourish employability of the students in the domain of Data Analytics.

#### **PG4STAE04 - POPULATION DYNAMICS**

- CO1. Students get a clear picture about sources of mortality data and about mortality measures, mortality rates, gradation of mortality data.
- CO2. Students get acquainted with Life tables and construction of life tables.
- CO3. They get an idea about fertility models and fertility indices which helps them for decision making.



  
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CO4. Students will be able to project population of any data using the techniques of survival probability.

#### **PG4STAE05 - RELIABILITY MODELING AND ANALYSIS**

CO1. Enables students to understand basic concepts of reliability and introduces well known life distributions.

CO2. Enables students to understand concepts of coherent system

CO3. Enables students to understand systematic study of various class of life distributions based on notion of ageing. Each such class of life distributions provides a realistic probabilistic description of physical property occurring in reliability context.

CO4. Enables students to cover foundations in reliability estimation.



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## **Courses Handled by Department of Statistics in Other Departments**

### **M. A Economics**

#### **PG1ECOC05 - QUANTITATIVE METHODS FOR ECONOMIC ANALYSIS -I**

- CO1. Gives basic mathematical techniques for economics students.
- CO2. To familiarize the concept of differential and integral calculus.
- CO3. To give an idea about how to utilize the optimum resources.
- CO4. To acquire proficiency in problem solving using linear programming.

#### **PG2ECOC10 - QUANTITATIVE METHODS FOR ECONOMIC ANALYSIS II**

- CO1. To provide an idea about probability and its application in real life.
- CO2. To get deeper understanding on various discrete and continuous probability distributions and their properties.
- CO3. To understand the concepts of hypotheses testing and estimation of parameters.

### **B. Sc Mathematics**

#### **STA1CMM01 - BASIC STATISTICS**

- CO1. Students acquire an understanding about different kinds of data, their analysis and representation. They could also apply various sampling techniques in real life situations know the general pulse of economy.
- CO2. The students become acquainted with the fundamental properties of data like central tendency, dispersion, skewness and kurtosis. With these they could summarise a large mass of data to a meaningful form.



  
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CO3. The students are exposed to statistical tools like index numbers which are very much useful to understand the general pulse of economy.

### **STA2CMM02 - THEORY OF RANDOM VARIABLES**

CO1. Students could acquire a thorough understanding of probability theory which forms the foundation of statistics. They also acquire an understanding of the meaning and theory of random variables.

CO2. Students could understand the bivariate data, nature and degree of their relationship and their analysis. They become familiar with the method of curve fitting for the bivariate data.

CO3. Students could acquire a deep knowledge on correlation and regression.

### **STA3CMM03 - PROBABILITY DISTRIBUTIONS**

CO1. It enables students to cover foundations of expectations.

CO2. Provide a solid introduction to well known discrete distributions.

CO3. It is aimed that students be acquainted with most frequently used continuous distributions and their important properties.

CO4. Enables students to understand limit theorems.

### **STA4CMM04 - STATISTICAL INFERENCE**


CO1. Enables students to cover foundations in sampling distributions and their applications

CO2. Enables students to understand methods of estimation.

CO3. Provide a solid base on testing of hypothesis introduction this enables students to understand the concepts and methods of statistical inference and to draw inferences whenever statistical decisions are meaningful.

CO4. It is aimed that students be acquainted with the sampling distribution and their applications.



  
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## **B. Sc Physics**

### **STA1CMP01 - DESCRIPTIVE STATISTICS**

- CO1. Students acquire an understanding about different kinds of data, their analysis and representation. They could also apply various sampling techniques in real life situations know the general pulse of economy.
- CO2. The students become acquainted with the fundamental properties of data like central tendency, dispersion, skewness and kurtosis. With these they could summarise a large mass of data to a meaningful form.
- CO3. Students could acquire a deep knowledge on correlation and regression.
- CO4. Students could understand the bivariate data, nature and degree of their relationship and their analysis. They become familiar with the method of curve fitting for the bivariate data.

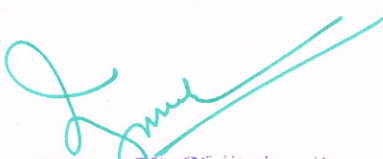
### **STA2CMP02 - PROBABILITY AND RANDOM VARIABLES**

- CO1. Students acquire a thorough understanding of probability theory which forms the foundation of Statistics.
- CO2. They also acquire an understanding of the meaning and theory of random variables.
- CO3. Students could understand the bivariate data, nature and degree of their relationship and their analysis.
- CO4. It enables students to cover foundations of expectations.

### **STA3CMP03 - STANDARD DISTRIBUTIONS**

- CO1. Learn about various types of discrete and continuous probability distributions.
- CO2. To understand Central limit theorem and its applications.
- CO3. Understand the concept of sampling distribution and their uses.



  
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#### **STA4CMP04 - STATISTICAL INFERENCE AND RANDOM PROCESSES**

- CO1. To learn the essential concepts in the theory of estimation of unknown parameters.
- CO2. Understand various types of hypothesis of testing including both small sample tests and large sample tests.
- CO3. To understand some basic concepts about random process, Markov Chain, Random walk.

### **B. A. Economics (Honours)**


#### **ECH1COR03 - STATISTICAL METHODS IN ECONOMICS I**

- CO1. Students will be able to understand the language and core concepts of data collection and data representation and descriptive statistics
- CO2. Student will be able to understand the concept of data summarization and study the distributional properties of data distributions
- CO3. Student will be able to analyze the relational properties of two or more variable and apply them in real life economic problems. Student will be master the concept linear regression deals with studying the linear relationship between two or more variables, which is needed to analyse the real life problems.
- CO4. Student will be able to detect and computer components of time series and use them for economic analysis. The student becomes an expert in applying statistics in forecasting economics and business problems.

#### **ECH2COR07 - STATISTICAL METHODS IN ECONOMICS II**

- CO1. Students will be able to understand probability concepts and their applications in economics.
- CO2. Student will be able to understand the theoretical probability distributions and apply them in various economic situations.
- CO3. Student will be able to understand the testing of hypothesis concept, analyse problems and apply the concept of testing of hypothesis when there exists uncertainty.



  
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- CO4. Student will be able to apply ANOVA techniques when a comparison of means of several categories required and extend the idea to applications in economics.

#### **ECH4COR15 - OPERATIONS RESEARCH**

- CO1. Develop theoretical understanding about various business optimisation models..
- CO2. Ability to construct and solve any type of Linear Programming Problem
- CO3. Application of Linear Programming in the field of Transportation and Assignment
- CO4. Understand and apply network analysis techniques for project implementation.
- CO5. Develop decision making skills under Inventory Models and Game Theory.

### **B. A. Economics**

#### **ECO5COR07 - QUANTITATIVE TECHNIQUES IN ECONOMIC ANALYSIS I**

- CO1. Students acquire an in depth knowledge about statistical data, their sources, presentation of data and sampling designs.
- CO2. Students get clear idea about fundamental properties of data such as measures of central tendency, dispersion, skewness and kurtosis. This helps them to condense large mass of data for statistical analysis.
- CO3. Students get deep knowledge about the statistical method like index numbers which is very useful to understand the pulse of economy.
- CO4. Students get acquainted with basic mathematical concepts which are useful for economic analysis.

#### **ECO6COR11 - QUANTITATIVE TECHNIQUES IN ECONOMIC ANALYSIS II**

- CO1. Students get an understanding about bivariate data, degree and nature of their relationships.
- CO2. Students acquire knowledge on time series data and its various components



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CO3. Students get an understanding on set theory and its basic operations.

CO4. Differential calculus helps the students to know rate of growth when different variables are involved in any study. Also helps to determine the maxima and minima of functions.



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