

# **Sree Narayana Mangalam College Maliankara**

*(Affiliated to Mahatma Gandhi University, Kottayam)*



## **PROGRAMME OUTCOME**

**PROGRAMME SPECIFIC OUTCOME, COURSE OUTCOME**

## **Integrated M.Sc. Programme in Basic Sciences-Statistics**

Sree Narayana Mangalam College  
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## INTEGRATED PG PROGRAMME OUTCOMES

At the end of Integrated PG Programme at S.N.M College, Maliankara, a student will have developed:

<b>PO1:</b>	<b>Advanced Knowledge:</b> An in-depth understanding of their chosen field of study. By the end of the program, students should have acquired advanced knowledge and expertise in their specific subject area
<b>PO2:</b>	<b>Specialization:</b> The ability to specialize in a particular subfield or concentration within their discipline. This specialization enables students to develop a focused skill set and deep understanding of a specific area of their chosen field
<b>PO3:</b>	<b>Research Skills:</b> The ability to conduct independent research projects or contribute to ongoing research in their field. Students are expected to develop strong research skills, including critical thinking, data analysis, and academic writing
<b>PO4:</b>	<b>Communication and Presentation Skills:</b> The communication and presentation skills through presentations, seminars, group projects and written assignments
<b>PO5:</b>	<b>Co-operation/Team work:</b> The ability to work effectively and respectfully with diverse teams, facilitate cooperative or co-ordinated effort on the part of a group and act together as a group
<b>PO6:</b>	<b>Critical Thinking and Problem Solving:</b> Critical thinking skills that enable to analyse complex problems, evaluate evidence and generate innovative solutions and the ability to approach challenges from multiple perspectives and make informed decisions based on sound reasoning
<b>PO7:</b>	<b>Self-directed Learning:</b> The ability to work independently, identify appropriate resources for a project and manage a project through to completion

## PROGRAMME SPECIFIC OUTCOMES

At the end of Integrated M.Sc Programme in Basic Sciences-Statistics at S.N.M College, Maliankara, a student will have developed:

<b>PSO1:</b>	A solid understanding of mathematical concepts and methods, particularly those relevant to statistics, such as calculus, linear algebra, probability theory and mathematical statistics
<b>PSO2:</b>	An in-depth knowledge of statistical theory, methodologies and techniques and proficiency in areas such as data collection, analysis, interpretation and inference
<b>PSO3:</b>	Proficiency in using statistical software packages R and Python and the ability to apply these tools to analyse data and solve real world statistical problems
<b>PSO4:</b>	The ability to provide statistical consultation and to effectively collaborate with professionals from various disciplines
<b>PSO5:</b>	Critical thinking skills, enabling students to identify and analyse complex problems, formulate statistical models and develop innovative solutions based on sound statistical reasoning
<b>PSO6:</b>	The ability to apply statistical methods and techniques in a variety of fields including business, finance, economics, social sciences, healthcare, environment studies and engineering

## COURSE OUTCOMES

### SEMESTER-I

#### IST1CC01-ENGLISH I- COMMUNICATION SKILLS IN ENGLISH

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand Phonetics
<b>CO2:</b>	Understand new techniques of reading
<b>CO3:</b>	Have improved reading and listening skills
<b>CO4:</b>	Understand group discussion and its procedure

### **IST1CR02-BASIC STATISTICS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the concept of collection, classification tabulation and representation of data
<b>CO2:</b>	Calculate simple and weighted averages understand its applications in real life
<b>CO3:</b>	Compute the Partition values and different dispersion measures
<b>CO4:</b>	Find the moments, understand the concept of skewness and kurtosis and compute their various measures

### **IST1CR03-AN INTRODUCTION TO STATISTICAL COMPUTING USING EXCEL AND R**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Calculate various descriptive statistics using Excel
<b>CO2:</b>	Understand the basic concepts of R
<b>CO3:</b>	Do programming using R
<b>CO4:</b>	Get a basic knowledge of the package GNU Octave

### **IST1CR04-STATISTICAL COMPUTING USING EXCEL/R-I**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Draw types of bar diagram and Pie diagram in Excel and R
<b>CO2:</b>	Compute measures of central tendency, dispersion, skewness and kurtosis in Excel and R.
<b>CO3:</b>	Compute measures of skewness and kurtosis in Excel and R
<b>CO4:</b>	Draw Box diagram Lorenz curve in Excel and R

### **IST1CR05-MATHEMATICS I-LOGIC, SET THEORY AND DIFFERENTIAL EQUATIONS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the concepts of mathematical logic
<b>CO2:</b>	Understand the concepts of set theory.

<b>CO3:</b>	Compute the limits and derivatives of functions.
<b>CO4:</b>	Understand the applications of derivatives and partial derivatives.

### **IST1CR06-COMPUTER SCIENCE I - FUNDAMENTALS OF COMPUTER SCIENCE**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand basic hardware peripherals and to know and use different number systems and the basics of software
<b>CO2:</b>	Enumerate different types of input/ output devices and types of memory and s to introduce principles of computer organization and the basic architectural concepts
<b>CO3:</b>	Build an understanding of the fundamental concepts of computer networking and to familiarize with the basic taxonomy and terminology of the computer networking area for the application in education and research purposes
<b>CO4:</b>	Explain the structure and functions of operating systems along with their components, types and working and Make use of appropriate Linux commands for memory management, file management and directory management

### **SEMESTER II**

#### **IML2CC01-KATHA, KAVITHA, ATHMAKATHA**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the essence of stories written by different authors
<b>CO2:</b>	Understand the essence of poems written by different authors
<b>CO3:</b>	Understand the dialects of Malayalam language through stories
<b>CO4:</b>	Explain the meaning of poems written by different authors

#### **IHN2CC01-KATHA AUR KAVITHA**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Learn Hindi language for effective communication
<b>CO2:</b>	Have conversation skill in Hindi
<b>CO3:</b>	Understand current issues in Modern Hindi poems and stories

<b>CO4:</b>	Understand the Hindi language through poems and stories
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### **IST1CR02-APPLIED STATISTICS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the concepts of principles of least squares and curve fitting
<b>CO2:</b>	Compute Correlation and regression coefficients
<b>CO3:</b>	Calculate Multiple and partial correlation coefficients
<b>CO4:</b>	Understand the applications of simple and weighted index numbers in day to day life and their construction
<b>CO5:</b>	Determine trend of time series data and able to construct seasonal indices.

### **IST2CR03-AN INTRODUCTION TO PROBABILITY THEORY**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand different probability approaches and able to solve problems involving uncertainty
<b>CO2:</b>	Understand the concept of Bayes' rule and its applications in real life
<b>CO3:</b>	Under the concept of random variables and compute distribution function
<b>CO4:</b>	Compute Marginal density from joint density and identify whether two random variables are stochastically independent

### **IST2CR04-DEMOGRAPHY, VITAL AND OFFICIAL STATISTICS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Check the completeness of registration data using Chandrasekaran-Deming formula and use Myer's and UN indices in evaluating age data.
<b>CO2:</b>	Compute the measures of mortality, fertility and understand the concept of life tables, their construction and uses.
<b>CO3:</b>	Compute the measures of population growth and morbidity
<b>CO4:</b>	Understand different types of official statistics and functions and roles of statistical system in India

### **IST2CM05-MATHEMATICS II-INTEGRAL CALCULUS AND TRIGONOMETRY**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the concepts of integration and study to integrate functions.
<b>CO2:</b>	Study different applications of integration and different techniques of integration.
<b>CO3:</b>	Understand the concept of trigonometry
<b>CO4:</b>	Find the summation of infinite series such as Geometric, Binomial, Exponential, Logarithmic and Trigonometric series based on $C + iS$ method.

### **IST2CM06-COMPUTER SCIENCE II-SPREADSHEET AND DATABASE MANAGEMENT**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Handle huge volume of data, filtering, sorting, aggregating and summarizing those into categories and subcategories using Excel
<b>CO2:</b>	Understand advanced functions, formulas and deriving different statistical result using Excel
<b>CO3:</b>	Design database schema for a given real world problem-domain using standard design and modeling approaches.
<b>CO4:</b>	Construct queries using SQL for database creation, interaction, modification, and updation

### **IST2CM07-COMPUTER PRACTICAL I**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Create file, folder, copying, moving, deleting file, folder in Windows operating system
<b>CO2:</b>	Operate with linux operating system
<b>CO3:</b>	Perform different operations using MS Excel and formatting of cells
<b>CO4:</b>	Use SQL statement for creating, listing, dropping, checking, updating tables

## **SEMESTER III**

### **IST3CR01-PROBABILITY DISTRIBUTIONS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the concept of expectations and generating functions
<b>CO2:</b>	Find out the characterising properties of various discrete distributions
<b>CO3:</b>	Find out the characterising properties of different continuous distributions
<b>CO4:</b>	Understand applicability of various limit theorems

### **IST3CR02-ESTIMATION THEORY**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand different sampling distributions and their applications in statistical inference
<b>CO2:</b>	Explain Unbiasedness, Efficiency, Consistency & Sufficiency
<b>CO3:</b>	Find the Maximum likelihood, moment and minimum variance unbiased estimators of parameters of various distributions
<b>CO4:</b>	Find the point and interval estimates of different parameters of the population

### **IST3CR03-STATISTICAL COMPUTING USING EXCEL/R-II**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Plot scatter diagrams, fit regression lines and calculate correlation coefficient and rank correlation coefficient using Excel & R
<b>CO2:</b>	Construct index numbers and measure trend and seasonal variation using Excel & R
<b>CO3:</b>	Generate discrete and continuous random variables using Excel & R
<b>CO4:</b>	Compute point and interval estimates of parameters of different distributions using Excel & R

### **IST3CM04-VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORM**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Compute gradient of a scalar field, directional derivative and divergence and curl of vector fields
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<b>CO2:</b>	Obtain solutions of first order ordinary differential equations
<b>CO3:</b>	Form partial differential equations
<b>CO4:</b>	Compute Laplace transforms of elementary functions

### **IST3CM05-WEB TECHNOLOGY**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the fundamentals of Internet, and the principles of web design
<b>CO2:</b>	Explain markup languages features and create interactive web pages using them.
<b>CO3:</b>	Analyze a web page and identify its elements and attributes and Create web pages using HTML and Cascading Style Sheets
<b>CO4:</b>	Have a working knowledge of common internet features

### **SEMESTER IV**

#### **IEN4CC01-ENGLISH II-ENGLISH LANGUAGE SKILLS FOR ACADEMIC PURPOSES**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand more about tenses, active and passive voice and word formation
<b>CO2:</b>	Understand how to make notes and have a clear idea about reading and referencing
<b>CO3:</b>	Understand new methods of paragraph writing, story writing etc
<b>CO4:</b>	Have improved listening skills

#### **IST4CR02-INTRODUCTION TO SAMPLING THEORY**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Differentiate census and sampling methods
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<b>CO2:</b>	Understand sampling and non-sampling errors
<b>CO3:</b>	Differentiate different sampling methods: simple random sampling, stratified sampling, systematic sampling and cluster sampling
<b>CO4:</b>	Estimate the population mean, population total and their variances using different random sampling methods.

### **IST4CR03-TESTING OF HYPOTHESIS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the concept of testing of hypothesis:
<b>CO2:</b>	Apply test for population mean, equality of means, population proportion, equality of proportions, population variance, equality of variances in different practical situations
<b>CO3:</b>	Use Chi-square test for testing good of fit, homogeneity and independence of attributes and to do one way analysis of variance
<b>CO4:</b>	Understand different non parametric tests like sign test, Wilcoxon signed rank test, median test, Mann Whitney U test etc

### **IST4CM04-MATHEMATICS IV-LINEAR ALGEBRA, THEORY OF EQUATIONS, SPECIAL FUNCTIONS, NUMERICAL METHODS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Find rank and eigen values and eigen roots of a matrix
<b>CO2:</b>	Understand the relationship between roots and coefficients of equation
<b>CO3:</b>	Evaluate beta and gamma functions
<b>CO4:</b>	Understand the forward difference operator, backward difference operator, Shift operator and central difference operator and solving problems using Lefrange's formula and Newton's formula of interpolation

### **IST4CM05-PYTHON PROGRAMMING**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the basics and usefulness of an algorithm, Analyse various algorithms, And understand a flowchart and its advantages and limitations, and steps involved in designing a program
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<b>CO2:</b>	Illustrate uses of conditional (if, if-else, and switch-case) and iterative (while and for) statements in Python programs
<b>CO3:</b>	Write, test and debug Python programs and Develop programs by utilizing the modules Lists, Tuples, Sets and Dictionaries in Python
<b>CO4:</b>	Write programs in Python to process data stored in files by utilizing the modules Numpy, Matplotlib, and Pandas

### **IST4CMP06-COMPUTER PRACTICAL II**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Write python code of different mathematical functions
<b>CO2:</b>	Demonstrate usage of of branching and looping statements, recursive functions, tuples and sets
<b>CO3:</b>	Demonstrate dictionaries, inheritance and exceptional handling
<b>CO4:</b>	Demonstrate Aggregation, indexing and sorting, handling of missing data

### **SEMESTER V**

#### **IST5CR01-REAL ANALYSIS I**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Explain real number system and its properties.
<b>CO2:</b>	Explain the concept of sequences and related theorems.
<b>CO3:</b>	Describe infinite series and its convergence.
<b>CO4:</b>	Discuss continuity and uniform continuity of real valued functions and prove associated theorems.
<b>CO5:</b>	Explain differentiation and supporting results.

#### **IST5CR02-OPERATIONS RESEARCH**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the formulation of LPP and find graphical solution of a LPP
<b>CO2:</b>	Solve LPP using simplex method, Two-phase method and Big M method
<b>CO3:</b>	Solve transportation problem and assignment problem
<b>CO4:</b>	Understand inventory models

### **IST5CR03-NUMERICAL ANALYSIS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Able to find solutions for different types equations
<b>CO2:</b>	Solve interpolation problems
<b>CO3:</b>	Apply Fourier series
<b>CO4:</b>	Apply numerical differentiation and integration

### **IST5CR04-STATISTICAL QUALITY CONTROL**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Draw different types of quality control charts.
<b>CO2:</b>	Have analysis skills on industrial experimentation.
<b>CO3:</b>	Understand acceptance sampling principles and methods.
<b>CO4:</b>	Analyse quality related data using advanced statistical methods.
<b>CO5:</b>	Separate the assignable causes of variation from the chance causes of variation in the production process.

### **IST5CR05-STATISTICAL COMPUTING USING PYTHON**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the fundamentals of python programming language and its applications in statistical analysis.
<b>CO2:</b>	Demonstrate proficiency in using python libraries such as NumPy, Pandas, and Matplotlib.
<b>CO3:</b>	Apply descriptive statistical techniques using python to summarize and interpret data sets
<b>CO4:</b>	Utilize python programming to conduct hypothesis tests and make statistical inferences based on sample data.

## **SEMESTER VI**

### **IST6CR01-REAL ANALYSIS-II**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Find the limit of a function and check the continuity of function
<b>CO2:</b>	Find the derivative of a function, apply L Hospital's Rule and understand the concept of Riemann Stieltjes integral
<b>CO3:</b>	Understand the concept of Riemann integration
<b>CO4:</b>	Understand the integration of vector valued functions

### **IST6CR02-COMPLEX ANALYSIS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Do algebraic operations of complex numbers
<b>CO2:</b>	Compute Cauchy Reimann equations and compute analytic functions
<b>CO3:</b>	Obtain the definite integrals of complex functions
<b>CO4:</b>	To calculate the singular points, poles and residues of a complex function

### **IST6CR03-MARKOV PROCESSES AND QUEUEING MODELS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the basics of Markov Processes
<b>CO2:</b>	Understand the applications of Markov processes in Queuing Theory
<b>CO3:</b>	Understand Markov chains, Transition probabilities, Classification of states, Poisson processes and Birth-death processes
<b>CO4:</b>	Understand different queuing models and their applications.

### **IST6CR04-ACTUARIAL STATISTICS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the concept of life tables
<b>CO2:</b>	Compute benefit payable at the moment of death and end of year of death
<b>CO3:</b>	Compute annuities and premiums
<b>CO4:</b>	Understand the concept of reserves and multiple life contracts

### **IST6EL05-MATHEMATICAL ECONOMICS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the behaviour of consumers by studying utility functions and marginal utility analysis
<b>CO2:</b>	Understand demand and supply functions, elasticity of demand and how markets reach equilibrium
<b>CO3:</b>	Analyse dynamic market behaviour using the Cobweb model
<b>CO4:</b>	Identify and analyse heteroscedasticity, perform tests and apply remedial measures.
<b>CO5:</b>	Understand the rank and order conditions for estimation.
<b>CO6:</b>	Apply methods of estimation such as indirect least squares, instrumental variables and least variance ratio

### **SEMESTER VII**

### **IST7CR01-PROBABILITY THEORY**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand probability measure, monotone and continuity properties of probability measure
<b>CO2:</b>	Apply Bayes' theorem and total probability rule to find probabilities, explain and check the independence of events and independence of random variables
<b>CO3:</b>	Explain different types of convergence of random variables and understand different types of inequalities based on moments
<b>CO4:</b>	Explain and apply different law of large numbers and central limit theorem

### **IST7CR02-THEORY OF BIVARIATE AND MULTIVARIATE DISTRIBUTIONS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand and analyse bivariate distributions, including marginal and conditional distributions
<b>CO2:</b>	Analyse the properties and characteristics of the multivariate normal distribution, including marginal and conditional distributions, singular normal distribution, and additive property
<b>CO3:</b>	Apply hypothesis testing techniques to assess and make inferences about the mean vectors of multivariate normal distributions, including the implementation of Hotelling $T^2$ test and Mahalanobis $D^2$ test.
<b>CO4:</b>	Apply the theoretical concepts learned in the course to solve practical problems and analyse real-world datasets using appropriate statistical techniques.

### **IST7CR03-SAMPLING THEORY**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Compare census and sampling and discuss the organization and execution of sample surveys and associated errors.
<b>CO2:</b>	Explain the methods for simple random sampling and estimate the population mean, population total and their variances using simple random sampling methods.
<b>CO3:</b>	Explain stratified and systematic sampling methods and estimate the population mean, population total and their variances using these methods.
<b>CO4:</b>	Describe cluster sampling and estimate the population mean, population total and their variances using cluster sampling methods.
<b>CO5:</b>	Compare stratified, systematic and cluster sampling with simple random sampling.

### **IST7CR04-STATISTICAL INFERENCE I**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Explain properties of estimators and Exponential family of distributions
<b>CO2:</b>	Find UMVUE and BLUE of parameters and understand Cramer-Rao inequality, Chapman-Robbins inequality and Bhattacharyya's bounds
<b>CO3:</b>	Understand different methods of estimation and find estimator of parameters using these methods
<b>CO4:</b>	Understand the basic concepts of Bayesian inference and find loss function, risk function, Bayes estimators and minimax estimators

### **IST7CR05-DESIGN AND ANALYSIS OF EXPERIMENTS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand one-way and two-way ANOVA and explain random effects and fixed effects
<b>CO2:</b>	Explain basic principles of experimental design and understand the designs CRD, RBD and LSD
<b>CO3:</b>	Understand incomplete block designs BIBD and PBIBD
<b>CO4:</b>	Explain $2^n$ and $3^n$ factorial experiments and understand total confounding and partial confounding in $2^n$ designs in $2^p$ blocks

## **SEMESTER VIII**

### **IST8CR01-STATISTICAL INFERENCE II**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand Neyman-Person lemma and its applications, most powerful test , uniformly most powerful test and testing with MLR property
<b>CO2:</b>	Apply LR tests for testing equality of means and variances of several normal populations and construction of UMA and UMAU confidence sets using UMP and UMPU tests respectively
<b>CO3:</b>	Explain and apply SPRT and find OC and ASN functions
<b>CO4:</b>	Apply different non-parametric tests



### **IST8CR02-STOCHASTIC PROCESSES**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Explain Markov chain and classification of states, find limiting and absorption probabilities and understand random walk approximation of Brownian motion and diffusion process
<b>CO2:</b>	Understand Poisson process, interarrival distribution, birth and death process and Kolmogorov differential equations
<b>CO3:</b>	Explain renewal process and apply Key renewal theorem
<b>CO4:</b>	Explain ACF and PACF in Time series modelling and different time series models

### **IST8CR03-ADVANCED MULTIVARIATE ANALYSIS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand and apply likelihood ratio tests to analyse multivariate data.
<b>CO2:</b>	Use statistical measures like Hotelling's $T^2$ and Mahalanobis $D^2$ to examine relationships and properties of multivariate data.
<b>CO3:</b>	Identify and address the problem of symmetry in multivariate analysis.
<b>CO4:</b>	Understand and apply Multivariate General Linear Models, specifically Multivariate Analysis of Variance (MANOVA).

### **IST8CR04-DATA ANALYTICS USING R**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Find measures of dispersion, skewness, kurtosis and drawing P-P and Q-Q plot using R
<b>CO2:</b>	Do simple and multiple regression analysis, Principal component analysis and factor analysis using R
<b>CO3:</b>	Simulate different discrete and continuous distributions and understand different resampling techniques using R
<b>CO4:</b>	Understand MCMC methods and EM algorithms

### **IST8EL05-RELIABILITY ANALYSIS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand different reliability concepts
<b>CO2:</b>	Characterize different probability distributions based on failure rate and mean residual life function
<b>CO3:</b>	Understand different notions of ageing like IFR, IFRA, DMRL, NBU, NBUE, HNBUE and their mutual implications
<b>CO4:</b>	Understand reliability estimation using Maximum likelihood method

## **SEMESTER IX**

### **IST9CR01-TIME SERIES ANALYSIS & FORECASTING**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Explain the different components of time series and different methods of measuring trend and seasonal variations
<b>CO2:</b>	Understand Autoregressive, Moving average, Autoregressive Moving Average and Autoregressive Integrated Moving Average models
<b>CO3:</b>	Understand the estimation of ARMA models, forecasting using ARIMA models and residual analysis and diagnostic checking
<b>CO4:</b>	Explain Spectral density of stationary time series and its elementary properties and explain ARCH and GARCH models

### **IST9CR02-REGRESSION ANALYSIS & ECONOMETRICS**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand simple, partial and multiple regression, test for regression coefficients, do residual analysis and create residual plots
<b>CO2:</b>	Detect outliers and explain linearization and power transformations
<b>CO3:</b>	Explain cobweb model, Cobb-Douglas production function, draw indifference curves and understand input-output analysis
<b>CO4:</b>	Understand simple linear regression models and multiple linear regression models, estimate and test models parameters and understand multicollinearity and Heteroscedasticity

### **IST9CR03-NON-PARAMETRIC INFERENCE**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand order statistics, empirical distribution function and their properties
<b>CO2:</b>	Explain Kaplan-Meier estimator
<b>CO3:</b>	Do different non-parametric tests
<b>CO4:</b>	Understand non-parametric regression

#### **IST9CR04-BAYESIAN INFERENCE**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the concepts of Bayesian inference
<b>CO2:</b>	Do Bayesian analysis with subjective priors
<b>CO3:</b>	Apply different methods for constructing objective priors
<b>CO4:</b>	Understand the applications MCMC method

#### **IST9EL05-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

At the end of this course, a student will have developed ability to:

<b>CO1:</b>	Understand the concepts of neural networks
<b>CO2:</b>	Identify machine learning techniques suitable for a given problem
<b>CO3:</b>	Apply SVM techniques for a given problem
<b>CO4:</b>	Understand the concept of ensemble learning and random forests

#### **SEMESTER X**

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