



Academic Year : 2020-2021 Institute/ Branch Name : Symbiosis Statistical Institute Programme Name : Master of Science (Applied Statistics)

Color Code Description:		
Global	National / Local	Regional / National

Sr. No.	GA No.	Graduate Attributes	PO No.	Programme Outcomes
1	GA1	Scholarship: research, inquiry and lifelong learning	PO1	Nurturing the curious minds towards translation and application of statistical knowledge to find solutions to real-world problems.
2	GA4	Employability: equipped with skills, attributes, leadership and entrepreneurial qualities that society needs; being capable of making a contribution to society through earning a living	PO2	Help in preparing the next generation statisticians ready for scientific decision-making, aided with advanced statistical software translating into sharp and extensive analytics, pertinent to various domains.
3	GA2	Global citizenship: ethical, social and professional understanding	PO3	Empower students to investigate, solve questions for which answer lies beyond the boundaries of conventional thinking.
4	GA4	Employability: equipped with skills, attributes, leadership and entrepreneurial qualities that society needs; being capable of making a contribution to society through earning a living	PO4	Support critical thinking for data-driven solution with advanced methodologies
5	GA1	Scholarship: research, inquiry and lifelong learning	PO5	Recognize the need and have the preparation and ability to engage in independent and continuous learning in the broadest context of technology.

Sr. No.	Semester	Institute Course Code	Catalog Course Code	Title	Course Outcome No	Course Outcome Statement	PO1	PO2	PO3	PO4	PO5
1	SEM I	606410101 - PP	T6684	Probability Distributions	CO1	Define the principal concepts of basic probability	Strong-H	Moderate-M	Strong-H	Strong-H	Moderate-M
1					CO2	Explain the concept of a random variable and the probability distributions	Strong-H	Moderate-M	Strong-H	Strong-H	Moderate-M
1					CO3	Identify an appropriate probability distribution for a given discrete or continuous random variable and use its properties to calculate probabilities	Strong-H	Moderate-M	Strong-H	Moderate-M	Strong-H
1					CO4	Solve the problems related to discrete and continuous probability distribution	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
1					CO5	Apply problem-solving techniques to solving real-world events	Strong-H	Strong-H	Moderate-M	Moderate-M	Moderate-M
1					CO6	Communicate concepts in probability using both technical and non-technical language	Strong-H	Strong-H	Moderate-M	Moderate-M	Moderate-M
2	SEM I	606410102 - PP	T6685	Linear Algebra	CO1	Demonstrate the underlying principles of the vector and matrix algebra	Strong-H	Moderate-M	Strong-H	Moderate-M	Strong-H
2					CO2	To address practical problems and give a sound scientific interpretation to the results	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
2					CO3	Apply linear algebra concepts to model, solve, and analyze real-world situations	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H

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2					CO4	Solve unseen mathematical problems involving an understanding of the concepts and applications of linear algebra	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
2					CO5	Evaluate mathematical expressions to compute quantities that deal with linear systems and eigenvalue problems	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
2					CO6	A solid base of understanding in elementary linear algebra as required for further course	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
3	SEM I	606410103 - PP	T6686	Mathematical Analysis	CO1	Describe the fundamental properties of the real numbers that underpin the formal development of real analysis	Strong-H	Weak-L	Strong-H	Strong-H	Strong-H
3					CO2	Demonstrate an understanding of the theory of sequences and series, continuity, differentiation and integration	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
3					CO3	Apply the theory in the course to solve a variety of problems at an appropriate level of difficulty	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
3					CO4	Demonstrate skills in constructing rigorous mathematical arguments	Strong-H	Moderate-M	Moderate-M	Strong-H	Strong-H
3					CO5	Explain the theoretical basis of differential and integral calculus including the formulation of central theorems and the main features of their proofs	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
3					CO6	Demonstrate skills in communicating mathematics	Strong-H	Moderate-M	Moderate-M	Strong-H	Strong-H
4	SEM I	606410104 - PP	T6687	Sampling Theory	CO1	Identify and recognize the appropriate sample survey design for related problems	Strong-H	Moderate-M	Moderate-M	Moderate-M	Strong-H
4					CO2	Understand the concepts of bias and sampling variability and strategies for reducing these	Strong-H	Moderate-M	Moderate-M	Moderate-M	Strong-H
4					CO3	Conduct sample survey for the wider range research problems	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
4					CO4	Determine an estimate of a population mean, total and proportion for various types of sampling schemes	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
4					CO5	Have an appreciation of the practical issues arising in sampling studies	Strong-H	Moderate-M	Moderate-M	Moderate-M	Strong-H
4					CO6	Address practical problems and give a sound scientific interpretation to the results	Strong-H	Moderate-M	Moderate-M	Moderate-M	Strong-H
5	SEM I	606410105 - PP	T6688	Statistical Computing	CO1	Understand the basic concepts and requisites of random number generation	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H
5					CO2	Understand some computer intensive methods for statistical inference	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H
5					CO3	Apply the basic concepts of computer programming to solve complex problems of statistics	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
5					CO4	Use a fundamental tool for computing in the practice of quantitative analytical methods	Moderate-M	Strong-H	Strong-H	Moderate-M	Strong-H
5					CO5	Students will be able to simulate random variables and random experiments	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H
5					CO6	Create quantitative models to solve real world problems in appropriate contexts	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
6	SEM I	606410106 - PP	T4725	Research Methodology	CO1	Understand some basic concepts of research and its methodologies	Moderate-M	Moderate-M	Strong-H	Strong-H	Moderate-M

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6					CO2	Select and define appropriate research problem and parameters	Moderate-M	Moderate-M	Moderate-M	Strong-H	Moderate-M
6					CO3	Evaluate different scientific research designs and methods	Moderate-M	Strong-H	Moderate-M	Strong-H	Strong-H
6					CO4	Organize and conduct research in a more appropriate manner	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
7	SEM II	0606410201 - PP	T6695	Probability Theory and Applications	CO1	Understand and use fundamental concepts of probability theory	Strong-H	Moderate-M	Moderate-M	Strong-H	Strong-H
7					CO2	Learn about some convergences that are used in Probability Theory	Strong-H	Moderate-M	Moderate-M	Strong-H	Strong-H
7					CO3	Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from probability theory	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
7					CO4	Solve problems using probabilistic methods and ideas	Strong-H	Moderate-M	Strong-H	Moderate-M	Strong-H
7					CO5	Demonstrate accurate and efficient use of probability theory techniques, including limiting processes	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
7					CO6	Deal with situations involving uncertainty and will provide a foundation for understanding statistical applications	Strong-H	Moderate-M	Moderate-M	Strong-H	Strong-H
8	SEM II	0606410202 - PP	T6696	Linear Models	CO1	Develop a deeper understanding of the linear regression model and its limitations	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
8					CO2	Develop the linear predictive models and their extensions in non-linear models, non-parametric models, generalized models	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
8					CO3	Diagnose and apply corrections to some problems with the generalized linear model found in real data	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
8					CO4	Address practical problems and give a sound scientific interpretation to the results	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
8					CO5	Assess the model using standard criteria	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
8					CO6	Use standard statistical software to develop models and analyze data that arise from different fields	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
9	SEM II	0606410203 - PP	T6697	Statistical Inference	CO1	Understand the principles of sufficiency and minimal sufficiency	Strong-H	Moderate-M	Moderate-M	Strong-H	Strong-H
9					CO2	Understand the concept of a family of probability distributions and the exponential family of distributions	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
9					CO3	Understand the concepts of accuracy, precision, and efficiency of estimators	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
9					CO4	Understand the role of likelihood function in testing of statistical hypotheses	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
9					CO5	Able to construct estimators having desirable statistical properties	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
9					CO6	Able to develop the best statistical test for a given statistical hypothesis	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
10	SEM II	0606410204 - PP	T6698	Stochastic Processes	CO1	Understand the concept of Markov dependence in a sequence of random variables	Strong-H	Moderate-M	Strong-H	Moderate-M	Strong-H
10					CO2	Understand statistical properties of finite Markov chains	Strong-H	Moderate-M	Moderate-M	Moderate-M	Strong-H

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10					CO3	Understand different stochastic processes like branching process, birth-and-death process, and Poisson process	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
10					CO4	Understand a renewal process and its asymptotic properties	Strong-H	Moderate-M	Moderate-M	Strong-H	Strong-H
10					CO5	Use a stochastic process to describe and analyze and observed phenomenon statistical inference	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
10					CO6	Formulate simple stochastic process models in the time domain and provide qualitative and quantitative analyses of such models	Strong-H	Strong-H	Strong-H	Strong-H	Moderate-M
11	SEM II	0606410205 - PP	T6700	Design of Experiments	CO1	Understand the potential practical problems and applications of design of experiments in various fields	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
11					CO2	Build a deeper understanding, and tools for analysis of experiments	Strong-H	Moderate-M	Strong-H	Strong-H	Strong-H
11					CO3	Describe how the analysis of the data from the experiment should be carried out	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
11					CO4	Use a statistical computing package to analyse real-life data	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
11					CO5	Appreciate the advantages and disadvantages of a design for a particular experiments	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
11					CO6	Use software tools to create custom designs based on optimal design methodology for situations where standard designs are not easily applicable	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
12	SEM II	0606410206 - PP	T6699	Multivariate Statistics - 1	CO1	Explore and summarize multivariate data using graphical and numerical methods and techniques to uncover hidden information and patterns	Strong-H	Strong-H	Moderate-M	Moderate-M	Strong-H
12					CO2	Describe properties of multivariate distributions	Strong-H	Moderate-M	Moderate-M	Strong-H	Strong-H
12					CO3	Carry out multivariate statistical techniques and methods efficiently and effectively	Strong-H	Strong-H	Strong-H	Strong-H	Moderate-M
12					CO4	Develop the best statistical test for the mean vector of the multivariate normal distribution	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
12					CO5	Able to draw statistical inference on parameters of multivariate normal distribution	Strong-H	Strong-H	Moderate-M	Strong-H	Moderate-M
13	SEM III	60641301 - PP	T6717	Optimization Techniques	CO1	Formulate a range of operations research problems as linear programming problems, and be able to solve them computationally.	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H
13					CO2	Demonstrate an understanding how the most widely used linear programming algorithms work.	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H
13					CO3	Apply duality theory to prove the optimality of a solution.	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
13					CO4	Interpret the solutions of optimization problems, including analyzing the sensitivity of solutions.	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
13					CO5	Implement several iterative algorithms for solving constrained and unconstrained non-linear optimization problems and understand the mathematics behind these.	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
13					CO6	Formulate and solve general non-linear programs arising in engineering, data science and other areas.	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H

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14	SEM III	60641302 - PP	T6701	Multivariate Statistical Analysis-2	CO1	Comprehend the evolution of Multivariate Analysis and its significances in businesses research	Strong-H	Strong-H	Moderate-M	Strong-H	Strong-H
14					CO2	Understand the formulation of Multivariate Analysis models encountered in business research	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
14					CO3	Implement of Multivariate Analysis models to real data sets	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
14					CO4	Analyze business problems using the power of well- known multivariate analysis tools and techniques	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H
14					CO5	Evaluate the applicability of different models from a scientific perspective, and judge what multivariate analysis methods that are suitable to use in different situations	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
14					CO6	Summarize the most important results from a scientific report on some area in multivariate analysis	Strong-H	Strong-H	Strong-H	Strong-H	Moderate-M
15	SEM III	60641303 - PP	T6702	Computer Intensive Statistical Methods	CO1	Understand the necessity of resampling techniques	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
15					CO2	Identify the algorithms for intensively computational procedures	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H
15					CO3	Simulate random processes	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
15					CO4	Implement algorithms for numerical optimization and estimation	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H
15					CO5	Design and conduct appropriate resampling methods to estimate sampling variance for statistical estimates	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
16	SEM III	60641304 - PP	T6703	Statistical Learning and Data Mining	CO1	Recognize the importance of statistical learning, data mining, modeling, simulation & computing, and the role of approximation and mathematical approaches to analyze real world problems	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
16					CO2	Demonstrate the ability to use skills in Data Mining and its related areas of technology for formulating and tackling Data Mining related problems	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
16					CO3	Identifying and applying appropriate principles and methodologies to solve a wide range of problems associated with data mining	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
16					CO4	Interpret the contribution of data warehousing and data mining to the decision-support level of organizations	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
16					CO5	Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
16					CO6	Integrate machine learning libraries and mathematical and statistical tools with modern technologies like Hadoop and MapReduce	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
17	SEM III	60641307 - PP	T6705	Statistical Simulation	CO1	Understand the rationale for statistical simulation and its potential applications	Strong-H	Strong-H	Moderate-M	Strong-H	Strong-H
17					CO2	Understand the concept of a Markov Chain and its potential applications	Strong-H	Strong-H	Moderate-M	Strong-H	Strong-H
17					CO3	Understand Monte Carlo methods and their applications mathematical problems	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H

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17					CO4	Use statistical software to perform a simulation study and then report the results in a manner suitable for publication	Strong-H	Strong-H	Strong-H	Moderate-M	Strong-H
17					CO5	Perform of simulation studies for assessing statistical methods	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
17					CO6	Identify and interpret relevant information in the output of the simulation study	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
18	SEM III	60641308 - PP	T6725	Time Series Analysis	CO1	Describe and verify mathematical considerations for analyzing time series, including concepts of white noise, stationarity, autocovariance and autocorrelation	Strong-H	Strong-H	Moderate-M	Moderate-M	Strong-H
18					CO2	Understand the differences between cross-sections and time series	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
18					CO3	Apply various techniques for the modeling including parameter estimation	Strong-H	Strong-H	Moderate-M	Moderate-M	Strong-H
18					CO4	Use time series models for predicting future observations and/or estimating unobservable components	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
18					CO5	Validate assumptions, and residual sequence diagnosis	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
18					CO6	Address practical problems and give a sound scientific interpretation to the results	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
19	SEM III	60641309 - PP	T0100	Research Publication	CO1		-	-	-	-	-
19					CO2		-	-	-	-	-
19					CO3		-	-	-	-	-
19					CO4		-	-	-	-	-
19					CO5		-	-	-	-	-
19					CO6		-	-	-	-	-
20	SEM IV	060641401 - PP	T6721	Big Data Analytics	CO1	Identify the characteristics of datasets and compare the trivial data and big data for various applications	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
20					CO2	Select machine learning techniques and computing environment that are suitable for the applications under consideration	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
20					CO3	Understand and apply scaling up machine learning techniques and associated computing techniques and technologies	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
20					CO4	Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
20					CO5	Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
20					CO6	Integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
21	SEM IV	060641402 - PP	T6706	Statistical Machine Learning	CO1	Distinguish between supervised learning and unsupervised learning	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H

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21					CO2	Apply common probability distributions in machine learning applications	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
21					CO3	Use maximum likelihood estimation for parameter estimation	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
21					CO4	Implement efficient machine learning algorithms on a computer for a wider range of problems	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
21					CO5	Use cross validation for selecting parameters and appropriate model	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
21					CO6	Implement fundamental and advanced learning algorithms	Strong-H	Strong-H	Strong-H	Strong-H	Strong-H
22	SEM IV	060641404 - PP	T6708	Scientific and Report Writing	CO1	Structure a piece of scientific writing effectively	Moderate-M	Strong-H	Strong-H	Strong-H	Moderate-M
22					CO2	Understand some of the common features of scientific style	Strong-H	Moderate-M	Moderate-M	Strong-H	Moderate-M
22					CO3	Write more critically and identify the difference between description and analysis	Moderate-M	Strong-H	Moderate-M	Strong-H	Strong-H
22					CO4	Avoid plagiarism and be able to paraphrase scientific ideas	Strong-H	Strong-H	Strong-H	Strong-H	Moderate-M
22					CO5	Write a scientific report according to typical conventions	Strong-H	Strong-H	Moderate-M	Strong-H	Moderate-M