



## **Sub Committee for Curriculum Development Faculty of Management Maths & Statistics**

**Institute:** Symbiosis School for Liberal Arts

**Course:** Mathematics and Statistics (Major/Minor)

### **Introduction:**

Mathematics and Statistics is one of the major/minor courses offered at SSLA. Students opting for a major in this subject study 10 papers whereas students opting for a minor study only the first six of these.

The 10 papers are as follows:

1. Foundation Course in Mathematics and Statistics
2. Calculus
3. Statistical Methods I
4. Statistical Methods II
5. Linear Algebra
6. Operation Research
7. Analysis
8. Fundamentals of Mathematics
9. A. Theory of Distributions  
B. Group Theory
10. A. Introduction to Statistical Software  
B. Graph Theory

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Minor Paper 1- Foundation Course in Mathematics and Statistics

**(UG/PG):** UG / Semester 3

**Number of Credits:** 4 (60 Hrs)

**Level:** 2

**Course Description:**

Mathematics and Statistics provide individuals with innumerable skills that are indispensable in problem-solving and decision making in the field of modern science, technology and industry, economics & finance etc.

As such, this interdisciplinary course attempts to teach students a few simple mathematical and statistical tools that will enhance their ability to deal with more complex, real-world problems. It will teach students to review the fundamental knowledge and understanding of the principles and nature of mathematics and statistics, identify the usage of mathematics and statistics in everyday life, and summarize mathematical and statistical information effectively.

This paper will cover concepts such as sets and functions, logic, matrices, permutations and combinations, and basic statistics.

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Minor Paper 2 - Foundation Course in Mathematics and Statistics

**(UG/PG):** UG / Semester 4

**Number of Credits:** 4 (60 hrs)

**Level:** 2

**Course Description:**

Calculus is the study of how things change. It provides a framework for modelling systems in which there is change, and a way to deduce the predictions of such models. Calculus has widespread uses in science, economics, and engineering, and can solve many problems that algebra alone cannot. Therefore, it is imperative for students to learn the basics of calculus.

The objective of this course, is to comprehend the concepts of limits and differentiation and their related applications. This is done by teaching students basic calculus concepts such as variables, univariate and multivariate functions, and linear and nonlinear functions. It also teaches students the concept of limits and continuity, and also differential calculus.

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Minor Paper 3- Statistical Methods I

**(UG/PG):** UG / Semester 5

**Number of Credits:** 4 (60 hrs)

**Level:** 3

**Course Description:**

The study of statistics is important as it aids in forming an evidence base for decision making, and helps to identify issues and opportunities, develop options and recommendations, monitor progress, evaluate outcomes, and understand the world. This paper will seek to aid students to identify the basic concepts of statistics and comprehend and infer the basic tools

in statistics. Students will also work with examples and apply the statistical methods to various problems in data analysis.

It will cover topics such as measures of dispersion, moments, measures of skewness and kurtosis, and correlation and regression for ungrouped data.

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Minor Paper 4 - Statistical Methods II

**(UG/PG):** UG / Semester 6

**Number of Credits:** 4 (60 hrs)

**Level:** 3

**Course Description:**

Understanding probability and statistics is essential in the modern world, where print and electronic media are full of statistical information and interpretation. Keeping this in mind, the objective of this paper is to make students understand the basic concepts of probability, and apply this knowledge in most nondeterministic situations. They are also taught to apply the knowledge of statistical inference in the field of research, and to judge the correctness of an argument supported by seemingly persuasive data.

This paper covers the major theories of probability, statistical inferences, the idea of estimation and testing of hypothesis, tests of probability, and time series.

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Minor Paper 5 - Linear Algebra

**(UG/PG):** UG / Semester 7

**Number of Credits:** 4 (60 hrs)

**Level:** 3

**Course Description:**

This paper is designed with the objective of helping students understand and comprehend the important concepts in linear algebra. They are also taught to apply these concepts to real world phenomena such as electrical networks, traffic flow, archaeological dating, economic interdependencies, population movement, communication networks, and weather prediction. Students will learn to illustrate and prove mathematical theorems, to demonstrate the ability to think logically, analytically, and abstractly, and the ability to communicate mathematics, both orally, and in writing.

This paper will cover topics such as systems of linear equations and their solutions, matrices and their properties, determinants and their properties, vector spaces, linear independence of vectors, subspaces, bases, and dimension of vector spaces, inner product spaces, linear transformations, and eigenvalues and eigenvectors.

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Minor Paper 6 - Operation Research

**(UG/PG):** UG / Semester 8

**Number of Credits:** 4 (60 hrs)

**Level:** 4

**Course Description:**

The aim of this paper is to make students consider real-world problems and determine whether or not linear programming is an appropriate modelling framework. It teaches them to apply linear programming models that consider the key elements of the real-world problem, employ the models for their optimal solutions, interpret the models' solutions, and infer solutions to the real-world problems.

The topics covered under this paper will be the Linear Programming Problem including its definition, terminology, advantage and limitations, and the Transportation Problem including the initial solution by the northwest corner rule, Matrix Minima method, and VAM. It also includes assignment problems and the theory of games.

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Paper 7 - Analysis

**(UG/PG):** UG / Semester 5

**Number of Credits:** 4 (60 hrs)

**Level:** 3

**Course Description:**

Real analysis deals with the analytic properties of real functions and sequences, including convergence and limits of sequences of real numbers, the calculus of the real numbers, and continuity, smoothness, and related properties of real-valued functions. In this context, it is the objective of this paper to help students understand and apply the content of real analysis, to demonstrate skills to read and write rigorous proofs, and to employ good mathematical writing skills and style.

This paper will cover the Riemann Integral and topics under it, such as its definition and properties, and also fundamental theorem of integral calculus, and mean value theorems of integral calculus. It will also introduce to students the sequence and series of functions along with concepts under it, such as uniform convergence of series of functions, and integration and differentiation of series of functions. It also teaches them the basic notions of metric spaces.



**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Paper 8 - Fundamentals of Mathematics

**(UG/PG):** UG / Semester 6

**Number of Credits:** 4 (60 hours)

**Level:** 3

**Course Description:**

This course attempts to introduce students to some fundamentals concepts of discrete mathematics like finite induction, counting principles, and linear algebra topics like integers and complex numbers. The concepts taught here will aid students in developing a better foundation for dealing with advanced mathematics and statistics.

The objective of the course is to develop a better foundation for dealing with advanced mathematics and statistics and their application.

The topics covered under this paper are Finite Induction, Elementary Counting Principles, Recurrence Relations, Sets, Integers, and Complex Numbers.

**Name of Institute:** Symbiosis School for Liberal Arts

**Course Name:** SSLA Maths Major - Paper 9A - Theory of Distributions

**(UG/PG):** UG / Semester 7

**Number of Credits:** 4 (60 hours)

**Level:** 3

**Course Description:**

The aim of this paper is for students to demonstrate the understanding of advanced concepts in distribution theory. The objective is to learn the application of probability in data distributions, analysis, and simulation. Students are then expected to apply the knowledge of distribution theory and parametric simulation in the field of research.

The topics covered under this half of the paper are Discrete Random Variables, Standard Discrete Distributions, Continuous Random Variables, Standard Continuous Probability Distributions, and Simulation.

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Paper 9B – Group Theory

**(UG/PG):** UG / Semester 7

**Number of Credits:** 4 (60 hrs)

**Level:** 3

**Course Description:**

Group theory studies the algebraic structures known as groups. The concept of a group is central to abstract algebra.

Thus, the aim of this half of the paper is to understand the advanced concepts in group theory, and to learn the application of probability in data distributions, analysis, and simulation. The students are then expected to apply the knowledge of distribution theory and parametric simulation in the field of research.

The topics covered under this are the definition, properties and types of groups. It also covers subgroups, cosets, permutation groups, normal subgroups, and homomorphism and isomorphism.

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Paper 10A - Introduction to Statistical Software

**(UG/PG):** UG / Semester 8

**Number of Credits:** 4 (60 hours)

**Level:** 4

**Course Description:**

This course attempts to give students the opportunity to have a hands-on experience of how data is processed with the help of sophisticated software such as the SPSS, R, etc. It will give students an exposure to how statisticians carry out statistical investigation, in the real-world scenario, with the tools that they have learnt in the previous semesters.

This course will involve manual practical, introduction to statistical software, and developing C Programs.

**Name of Institute:** Symbiosis School of Liberal Arts

**Course Name:** SSLA Maths Major Paper 10B - Graph Theory

**(UG/PG):** UG / Semester 8

**Number of Credits:** 4 (60 hours)

**Level:** 4

**Course Description:**

Graph theory is the study of points and lines. In particular, it involves the ways in which sets of points, called vertices, can be connected by lines or arcs, called edges. Thus, it is used in dealing with problems which have a fairly natural graph/network structure, for example: road networks, communication networks, computer systems, and foreign exchange/multinational tax planning.

This course is designed with the objective of teaching students to write precise and accurate mathematical definitions of objects in graph theory. They are also taught to use mathematical definitions to identify and construct examples and to distinguish examples from non-examples. In addition, they learn to use a combination of theoretical knowledge, and independent mathematical thinking in creative investigation of questions in graph theory.

This paper teaches students concepts like operations on graphs, connected graphs, trees, and directed graphs.



