St. Xavier's College (Autonomous), Mumbai
Department of Statistics

Programme: B.Sc. Statistics (Science)

Programme Specific Outcomes (PSOs) **for B.Sc. Statistics (Science)**

Sr. No.	On completing B.Sc. Statistics (Science), the student will be able to:
PSO 1	Recognize the importance and value of statistical thinking, training and approach to problem solving.
PSO 2	Recognize and appreciate the connection between theory and applications in a variety of disciplines.
PSO 3	Have the confidence to review statistical literature available in survey articles, scholarly books and online sources.
PSO 4	Use statistical techniques to work effectively in analytical, scientific, financial, actuarial, pharmaceutical, technical and other positions of government/non-government organizations.
PSO 5	Pursue academic research to widen the subject domain.
PSO 6	Be familiar with problem solving techniques.
PSO 7	Apply theoretical concepts to practical situations.
PSO 8	Use software to aid problem solving.

Course Outcomes (COs): B.Sc. Statistics (Science)

Semester I

Course Title: Descriptive Statistics (A)
Course Code: SSTA0101

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Use various techniques of data collection and presentation.	1, 2	U, Ap
CO 2	Understand different summary measures of location (averages) used for data analysis and the basis for their selection.	2	U, R
CO 3	Choose appropriate methods to present data.	4	Ap
CO 4	Select and calculate appropriate averages to represent data sets.	1, 2, 4	U, R, Ap, E
CO 5	Use of statistical tools to carry out elementary categorical data analysis.	4	Ap
CO 6	Know statistical organizations in India and their functions.	4, 5	U, R, Ap, An, E, C

Course Title: Statistical Methods (A)
Course Code: SSTA0102

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Comprehend the concept of probability and random variables.	1, 2	U, Ap
CO 2	Identify basic discrete distributions and know their properties.	2, 4	U, Ap
CO 3	Understand the properties and uses of various discrete distributions (Uniform, Bernoulli, Binomial, Poisson, Hypergeometric).	4	U, R, Ap, An, E, C

Course Title: Statistics Practicals – I
Course Code: SSTA01PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Classify and tabulate raw data and be proficient in using summary measures of location; use data visualization techniques effectively.	6, 7
CO 2	Solve probability problems and simple problems on discrete distributions.	6, 7

Semester II

Course Title: Descriptive Statistics (B)
Course Code: SSTA0201

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Use a wider range of summary measures available for data analysis.	2	U, R
CO 2	Select and calculate appropriate measures of dispersion for data sets.	1, 2, 4	U, R, Ap, E
CO 3	Measure simple correlation, regression and diagnostic regression in bivariate data sets.	4, 5	U, R, Ap, An, E
CO 4	Know specialized averages under the domain of index numbers.	4	U, E

Course Title: Statistical Methods (B)
Course Code: SSTA0202

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Identify some basic continuous distributions and know their properties.	2, 4	U, Ap
CO 2	Understand the theoretical 'normal' distribution, its properties and uses.	4	U, R, Ap, An, E, C
CO 3	Utilize the concept of 'testing of hypothesis' and in particular for 'test of hypothesis for large samples'.	2, 4	U, R, Ap, An, E

Course Title: Statistics Practicals – II
Course Code: SSTA02PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Analyse bivariate data sets using measures of variation and linear correlation and regression techniques; solve simple problems on continuous distributions.	6, 7, 8
CO 2	Construct basic index numbers.	6, 7
CO 3	Use large sample tests to test significance of means and proportions (single/ double samples).	6, 7

Semester III

Course Title: Probability and Sampling Distributions (A)
Course Code: SSTA0301

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Derive important statistical functions of variables, namely, moment generating function, cumulant generating function, joint probability mass functions, marginal densities, conditional distributions (expectation and variance).	1, 5	U
CO 2	Possess deeper understanding of the properties and uses of various discrete distributions (Uniform, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial) in terms of skewness and kurtosis; understand the relationships between the various distributions.	4	U, R, Ap, An, E, C
CO 3	Have deeper understanding of the properties, uses and applications of normal distribution; know the central limit theorem and its applications.	4	U, R, Ap, An, E, C

Course Title: Sampling Techniques
Course Code: SSTA0302

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Use the sampling methods available to estimate parameters of the population.	1, 5	U, Ap, An, E
CO 2	Prove (by derivation) the various properties of the estimators in each sampling scheme.	1	U, Ap, An, E, C
CO 3	Compare estimators of a population parameter with a view to select an appropriate one.	1, 2, 4	U, Ap, An, E, C

Course Title: Operations Research
Course Code: SSTA0303

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the concepts of 'operations research'.	1, 2, 4	U
CO 2	Understand the concept of formulating real life situations into mathematical models.	1, 2, 4	U, Ap
CO 3	Use techniques for solving linear programming problems (Graphical and Simplex).	1, 2, 4	U, Ap
CO 4	Use techniques to solve transportation and assignment problems.	1, 2, 4	U, Ap
CO 5	Know the techniques of 'decision making' in various scenarios in the field of operations research.	2, 4	U, Ap, An, E

Course Title: Statistics Practicals – III
Course Code: SSTA03PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Identify probability distributions and solve simple problems.	6, 7
CO 2	Use simple sampling techniques to estimate population parameters.	7
CO 3	Formulate Linear Programming Problems (LPP) and obtain optimal solutions for LPP, transportation and assignment problems.	6, 7, 8

Semester IV

Course Title: Probability and Sampling Distributions (B)
Course Code: SSTA0401

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand properties and uses of various continuous distributions (Rectangular, Exponential, Laplace, Gamma and Beta).	1, 5	U
CO 2	Calculate transformation of continuous (1D and 2D) random variables using Jacobian.	2, 4, 5	U, Ap
CO 3	Comprehend properties and uses of other continuous distributions (Chi-Square, t, F distribution).	2, 4	U, R, Ap, An, E, C

Course Title: Analysis of Variance and Design of Experiments
Course Code: SSTA0402

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand analysis of variance (one-way and two-way).	1	U
CO 2	Comprehend the principles of design of experiments, and how they are incorporated into various basic designs, namely, Completely Randomised design (CRD), Randomised Block design (RBD) and Latin Square design (LSD).	1	U, Ap, An, E
CO 3	Derive proofs of theorems pertaining to properties of estimators used in the above-mentioned designs.	5	U
CO 4	Handling the above designs in case of missing observations.	1	U
CO 5	Know the construction and procedure of factorial experiments (2^2 and 2^3).	1, 2	U, Ap

Course Title: Industrial Statistics
Course Code: SSTA0403

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand key aspects of statistical quality control (chance/assignable causes, process/product control, 3σ limits, process capability).	1, 2, 4	U, Ap, E
CO 2	Draw up and interprete various control charts ($\bar{X}$ and R, p, c, np).	1, 2, 4	U, Ap, E
CO 3	Know different aspects of 'acceptance sampling plans' by attributes (single and double sampling plans).	1, 2, 4	U, Ap, E
CO 4	Be introduced to the concept of 6σ.	4	U, Ap
CO 5	Know simple Project Management techniques (PERT and CPM).	1, 2, 4	U, Ap, E

Course Title: Statistics Practicals – IV
Course Code: SSTA04PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Use exact sampling distributions (Chi-square, t, F distribution) for testing the independence of attributes/ significance of single sample variance/ significance of means/ equality of variance.	6, 7
CO 2	Carry out Analysis of Variance for Completely Randomized Design, Randomized Block Design, Latin Square Design, 2^2 and 2^3 Factorial designs.	6, 7, 8
CO 3	Draw and interpret $\bar{X}$ and R, p, c, np control charts and use techniques of PERT and CPM.	6, 7, 8

Semester V

Course Title: Probability Theory
Course Code: SSTA0501

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Have a more in-depth understanding of the concept of probability and its applications.	1, 4	U, Ap, An
CO 2	Understand the concept of 'generating functions' in general, and its uses.	1, 5	U
CO 3	Obtain the 'generating functions' of the standard discrete distributions.	4, 5	U, R, Ap
CO 4	Know the concept of order statistics and its use in distribution theory.	1, 2, 4	U, Ap, An, E

Course Title: Statistical Estimation
Course Code: SSTA0502

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know various types of estimation (point and interval).	1, 2, 4	U, Ap
CO 2	Know various methods of estimation (MLE, method of moments, method of minimum/modified minimum Chi-square, Bayesian estimation).	1, 2, 3, 4, 5	U, Ap, E
CO 3	Utilize of the technique of Bayesian estimation.	1, 2, 3, 4, 5	U, Ap, E

Course Title: Applied Statistics (IA)
Course Code: SSTA0503

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Comprehend deterministic and stochastic models used in the study of an epidemic.	1, 2, 3, 4	U, Ap, An, E
CO 2	Understand the meaning, scope and types of bioassays commonly used in analysis of health data.	1, 2, 3, 4	U, Ap, An, E
CO 3	Understand of the concept of clinical trials and issues pertaining to it.	1, 2, 3, 4	U, Ap, An, E

Course Title: Applied Statistics (IIA)
Course Code: SSTA0504

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the concept of vital statistics and mortality tables.	2, 3, 4	U, Ap, An, E
CO 2	Understand and calculate several quantities pertaining to the field of actuarial science (compound interest and annuities certain, life annuities, assurance benefits).	2, 3, 4	U, Ap, An, E

Course Title: Statistics Practicals – V
Course Code: SSTA05PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Solve more in-depth problems of probability and simple problems of Order Statistics, estimation and biostatistics models.	6, 7
CO 2	Calculate various mortality rates of vital statistics.	6, 7, 8,
CO 3	Calculate premiums in the field of actuarial science.	6, 7, 8

Semester VI

Course Title: Probability Distributions and Stochastic Processes
Course Code: SSTA0601

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know bivariate moment generating function, and the definition and properties of the trinomial and multinomial distributions.	2, 4, 5	U, Ap
CO 2	Grasp the bivariate normal distribution and its properties.	2, 4, 5	U, Ap, An
CO 3	Use a procedure to test the significance of the population correlation coefficient.	4	U, Ap
CO 4	Know several stochastic processes, such as Poisson process, birth and death process, Yule' process, linear growth model and their applications.	4	U, Ap, An
CO 5	View the queuing system as a stochastic process and obtain estimates for the various measures of effectiveness (performance measures) of the queuing model.	2, 5	U, Ap, An, E

Course Title: Statistical Inference
Course Code: SSTA0602

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Have an in-depth knowledge of the nuances of testing of a statistical hypothesis.	1, 4	U, Ap
CO 2	Comprehend the concept/ construction/ interpretation of the p-value, most powerful test, Neyman-Pearson fundamental lemma, uniformly most powerful test.	1, 5	U, Ap
CO 3	Know about 'likelihood ratio test' and the 'sequential probability ratio test'.	1, 5	U, Ap
CO 4	Understand the need for, types and uses of non-parametric tests.	1, 2, 4	U, Ap, An

Course Title: Applied Statistics (IB)
Course Code: SSTA0603

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the scope of Operations Research (OR) and its application to various industrial situations.	1, 2, 4	U, Ap, An
CO 2	Know how to represent the problem of 'amount of inventory to be stocked' as a statistical problem based on the underlying assumptions and solve it to obtain optimal results.	2, 4	U, Ap, An, E
CO 3	Appreciate how the problem of 'when to replace an item' can be considered as a statistical problem which can be solved, under a given set of assumptions to achieve an optimal solution.	2, 4	U, Ap, An, E
CO 4	Know the techniques of decision making in the topic of Game Theory (decisions in situations involving competitive strategies).	2, 4	U, Ap, An, E
CO 5	Use the concept of simulation, and apply it to problems in the area of inventory, queuing and replacement.	2, 4	U, Ap, An, E

Course Title: Applied Statistics (IIB)
Course Code: SSTA0604

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know of the fitting of a multiple linear regression (MLR) model with two independent variables.	1, 2, 4	U, Ap, An, E, C
CO 2	Understand the concept of autocorrelation, heteroscedasticity and multi-collinearity, the methods to detect the presence of these when fitting an MLR, and the consequences of using Ordinary Least Squares in its place.	4	U, Ap, An, E, C
CO 3	Have clarity regarding the concept of a 'time series', and employ commonly used methods to estimate trend and seasonal component.	2, 4	U, Ap, An, E
CO 4	Understand the concept of reliability (survival function) and its use in various situations.	2, 4	U, Ap, An, E

Course Title: Statistics Practicals – VI
Course Code: SSTA06PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Solve simple problems on Queueing Theory and applications of bivariate normal distribution; interpret the p-value and solve problems using Neyman-Pearson lemma; solve simple problems on SPRT and non-parametric tests.	6, 7
CO 2	Apply techniques of Operations Research to improve business operations; analyse multivariate data sets (with two independent variables) using OLS technique.	6, 7, 8
CO 3	Estimate trend and seasonal component in Time Series.	6, 7, 8