



SOMAIYA
VIDYAVIHAR

K J Somaiya College of Science & Commerce

Department: Statistics



TRUST

F. Y. B.Sc. Syllabus

K. J. SOMAIYA COLLEGE OF SCIENCE AND COMMERCE

AUTONOMOUS – Affiliated to University of

Mumbai Re-accredited “A’ Grade by NAAC

Vidyanagar, Vidyavihar, Mumbai 400 077

Syllabus for F. Y. B. Sc.

Program: B.Sc.

Course: Statistics

Choice Based Credit System

(CBCS) From the academic year

2018-19

Semester I

Course (Paper)	Course Name	Course Code
I	Descriptive Statistics – I	18US1ST1
II	Statistical Methods - I	18US1ST2
Practical	Practical in Descriptive Statistics I and Statistical Method I	18US1STP

Semester II

Course (Paper)	Course Name	Course Code
I	Descriptive Statistics – II	18US2ST1
II	Statistical Methods - II	18US2ST2
Practical	Practical in Descriptive Statistics II and Statistical Method II	18US2STP

Structure of syllabus: F. Y. B. Sc. Statistics [from 2018-2019]

Sem. .	Course Number	Course Title	Course code	Credit	Hours	Periods (50 min)	Unit/ Mod ule	Lectures (50 min)	Examination		
									Int. Marks	Ext. Marks	Total Mark
THEORY											
I	I	Descriptive Statistics - I	18US1 ST1	2	30	36	1	12	40	60	100
							2	12			
							3	12			
	II	Statistical Methods – I	18US1 ST2	2	30	36	1	12	40	60	100
							2	12			
							3	12			
PRACTICALS											
I	I	Practicals based on 2 courses	18US1 STP	1	2.5	3			-	-	50
	II			1	2.5	3			-	-	50

Sem.	Course Number	Course Title	Course code	Credit	Hours	Periods (50 min)	Unit/ Mod ule	Lecture s (50 min)	Examination		
									Int. Marks	Ext. Marks	Total Mark
THEORY											
II	I	Descrip tive Statistics - I	18US2 ST1	2	30	36	1	12	40	60	100
							2	12			
							3	12			
	II	Statistic al Methods – I	18US2 ST2	2	30	36	1	12	40	60	100
							2	12			
							3	12			
PRACTICALS											
II	I	Practica ls based on 2 courses	18US2 STP	1	2.5	3			-	-	50
	II			1	2.5	3			-	-	50



F.Y. B.Sc. SEM I/II: Credits per Semester

Course	Credit
	Theory
I	02
II	02
Practical	02
Total	06
Per subject 6 credits	Total 2*6 = 12

**Evaluation pattern: Theory**

For each course I, II

External (60 M) + Internal (40M)

External: End Semester Examination

Paper Pattern: F. Y. B.Sc. Semester I/ II**External : 60 Marks****Duration: 2 hrs**

Question No.	Module	Marks (with max option)	Marks (Without option)
Q1	I	30	20
Q2	II	30	20
Q3	III	30	20

Internal: 40 Marks:

1. 25 marks – continuous evaluation
2. 15 marks – Project/ Presentation / Assignment

Evaluation pattern: Practical

Practical Evaluation: 50 Marks practical examination at the end of each semester per paper.

Semester I

Course-I (Paper I)

Course title: Descriptive Statistics - I

Course Credit: 2 (Teaching: 30 hrs/ 36 L)

Course code: 18US1ST1

After completion of this course the student should be able to

CO1: Identify the nature of the variable for further course of statistical analysis.

CO2: Present the data in tabular and graphical form

CO3: Calculate various measures of central tendency and variation

Module 1: Data: Types, Collection and Management

14L

Learning Objective:

- To make students realise about understanding and importance of the data along with the summarising and presenting the data in tabular / diagrammatic manner.
- To be able to decide what graphs are appropriate for displaying quantitative and categorical variables
- Given a variable of interest, identify whether the variable is categorical or quantitative (discrete, continuous)
- To analyse the categorical data

Learning Outcome:

- A student will be able to tabulate, classify and represent the data graphically

1.1 Types of data

1.1.1 Qualitative and Quantitative data

1.1.2 Time series data and Cross Sectional data

1.1.3 Data Source: Primary Data, Secondary Data

1.2 Measurement of Scale and Tabulation

1.2.1 Nominal scale, Ordinal scale, Interval scale, Ratio scale

1.2.2 Tabulation: One way, Two way, Three way table

1.3 Analysis of Categorical Data**6L**

1.3.1 Introduction to classes, Notations used, dichotomous classification, contingency tables for two and three attributes, order of the frequency, and proof of total number of frequencies in case of 'k' attributes is 3^k .

1.3.2 Consistency: Derivations of conditions of consistency of the data in case of two and three attributes

1.3.3 Independence of the attributes: Derivations of the conditions of the independence of the two attributes. Conditions for positive and negative association

1.3.4 Association of the two attributes: Coefficient of association, Yule's coefficient of colligation. Derivation of relationship between the two coefficients. Concept of partial coefficient of association

1.4 Frequency Distribution and Graphical Presentation

Univariate: Frequency distribution for continuous and discrete variable, Relative frequency, cumulative frequencies, ogives

1.4.1 Bivariate: Frequency distribution, marginal and conditional frequency distribution

1.4.2 Graphical representation: Histogram, Frequency polygon, Frequency curve and Ogives. Diagrammatic representation: Rectangle, Square, Pyramid, Stem and Leaf diagram.

Module 2: Measures of Central Tendency or Location**11L****Learning Objective:**

- The module is intended to introduce various measures of central tendency

Learning Outcome:

- A student will be able to identify the proper measure of central tendency to be used depending on the data which is to be analysed.

2.1. What is meant by Measure of Central Tendency, Requisites of good measure of central tendency

2.2. Arithmetic mean (A.M) and its properties, simple A.M, weighted A.M., Combined

mean, merits and demerits

2.3. Geometric Mean (G.M.), Harmonic Mean (H.M.), merits and demerits of G.M. and H.M.

2.4. relationship between A.M., G.M. and H.M.

2.5. Positional Averages: Quantiles (Median, Quartiles, Deciles, Percentiles), Mode

2.6. Empirical relationship between mean, median and mode, proper selection of an average.

Module 3: Absolute and Relative Measures of Dispersion.

11L

Learning Objectives:

- The module is intended to introduce various measures of variation

Learning Outcome:

- A student will understand the change in pH taking place at different stages of titration and interpretation of equivalence point using instrumental methods of analysis.

3.1 Range, Interquartile Range, Quartile Deviation, Box-Whisker Plot, Mean Absolute Deviation, Standard Deviation (Variance) and their relative measures, Combined variance

3.2 Raw and Central moments up to fourth order and the relationship between them (with proof)

3.3 Measures of Skewness and Kurtosis

Semester I

Course-II (Paper II)

Course title: Statistical Methods - I

Course Credit: 2 (Teaching: 30 hrs/ 36 L)

Course code: 18US1ST2

After completion of this course the student should be able to

CO1: Understand the concept of probability

CO2: Types of the random variable

CO3: Study some standard discrete distributions

Module 1: : Elementary probability theory

(12 L)

Learning Objectives:

- Understand difference between Classical, Empirical and Axiomatic definitions of probabilities and be able to identify which approach to be used to assign a probability in a given scenario.
- Identify from a probability scenario events that are simple, complementary, mutually exclusive, and independent.
- Explain the difference between events that are mutually exclusive and independent.
- Correctly apply the addition rule for union of two/three events, multiplication rule for two independent/dependent events, and the Bayes' rule.

Learning Outcome:

- A student will be able to calculate probabilities using various definitions and rules of the probabilities

1.1. Random Experiment, Sample Point & Sample Space

1.2. Definition of Event, Elementary Event, Algebra of Events (occurrence of at least one, none, all, exactly one event)

1.3. mutually exclusive events, exhaustive events

1.4. Classical, Empirical and Axiomatic definitions of probability

-
- 1.5. Conditional Probability, Independence of n Events ($n = 2, 3$), examples of pair-wise and complete independence
 - 1.6. Theorems on Addition & Multiplication of probabilities, Bayes' Theorem (All theorems with proofs)

Module 2: : Discrete Random variable**(12 L)****Learning Objectives:**

- Understand difference between discrete and continuous random variables.
- Properties of probability mass function and cumulative distribution function of discrete random variable. Prove various properties of expectations of univariate and bivariate discrete random variables

Learning Outcome:

- A student will be able to calculate probabilities using various definitions and rules of the probabilities
- 2.1. Definition: Univariate discrete random variable, probability mass function, cumulative distribution function,
 - 2.2. Theorems on Expectation and variance of a random variable, Raw & Central Moments and their relationship (with proof).
 - 2.3. Bivariate discrete random variable, Joint probability mass function of two random variables, Marginal and Conditional probability distributions, Independence of two random variables,
 - 2.4. Theorems on expectation, variance, covariance, correlation coefficient between two random variables

Module 3: Standard Discrete Probability Distributions**(12 L)****Learning Objectives:**

- Study various discrete probability distributions such as binomial, poisson, hypergeometric and uniform distributions; with their properties, applications and relationship amongst them.



Fitting of distribution.

Learning Outcome:

- A student will be able to apply suitable distribution from binomial, poisson, hypergeometric and uniform distribution.
-
- 3.1. Bernoulli distribution, binomial distribution, poisson distribution, hypergeometric distribution, uniform distribution.
 - 3.2. Derivation of mean, & variance, Calculation of Expected frequencies,
 - 3.3. Poisson approximation to Binomial Distribution (with proof), Binomial approximation to Hypergeometric distribution, recurrence relation



Practical Sem-I

Course Code:18US1STP

Paper- I

1. Classification and tabulation
2. Attribute
3. Measures of central tendency
4. Measures of dispersion
5. Practical using excel

Paper- II

1. Probability-I
2. Probability-II
3. Discrete random variable and expectation
4. Binomial and Hypergeometric distribution
5. Poisson and Uniform distribution
6. Practical using excel

Semester II

Course-I (Paper I)

Course title: Descriptive Statistics - II

Course Credit: 2 (Teaching: 30 hrs/ 36 L)

Course code: 18US2ST1

After completion of this course the student should be able to

CO1: Understand the relationship between the two variables

CO2: Learn different methods to predict behavior of a variable which dependent on time

CO3: Have knowledge of various index numbers.

Module 4: Correlation and Regression analysis for bivariate data.

14 L

Learning Objectives:

- Visually determine from a scatter plot if linear relationship is negative or positive
- Determine from a given set of correlation values, which correlation indicates the strongest/weakest linear relationship between two quantitative variables
- Determine the direction of the slope of a regression equation from a given correlation, and vice-versa
- Fit straight line and quadratic curves using method of least squares

Learning Outcome:

- A student will be able to obtain the relationship between the two variables

4.1. Scatter diagram.

4.2. Covariance between two variables, Relationship between variance and covariance

4.3. Product Moment correlation coefficient and its properties, graphical interpretation

4.4. Rank correlation Spearman's measure.

4.5. Principle of least square fitting of a straight line, fitting of curves reducible to linear form by transformation and fitting of quadratic curve using method of least squares

-
- 4.6. Concept of linear regression, fitting of a linear regression line by method of least square.
Relation between regression coefficients and correlation coefficient, Coefficient of determination

Module 5: Time Series**11 L****Learning Objectives:**

- Understand different components of time series
- Various methods of estimating trend with their merits and demerits

Learning Outcome:

- A student will be able to segregate the various components of the time series data.

5.1. Definition of time series .Components of time series.Analysis of time series including different models of time series.

5.2. Methods of estimating trend with their merits and demerits

5.2.1. Freehand curve method

5.2.2. Semi average method

5.2.3. Moving Average method

5.2.4. Method of least squares(linear and parabolic trend)

5.3. Methods of estimating seasonal component with their merits and demerits

5.3.1. Method of simple average

5.3.2. Ratio to moving average

5.3.3. Ratio to trend method

Module 6: Index Numbers**11 L****Learning Objectives:**

- Understand the meaning of the term index number
- Get accustomed to use of some widely used index numbers
- Understand the concept of Price index number, quantity index number and value index number

-
- Learn time reversal test, factor reversal test and circular test

Learning Outcome:

- A student will be able to calculate the index numbers for various situations

- 6.1. Index number as a comparative tool, Stages in the construction of Index Numbers
- 6.2. Simple and Composite Index Numbers. Fixed base Index Numbers. Chain Base Index Numbers, Base shifting, Splicing and Deflating.
- 6.3. Composite index numbers, methods of computing composite index numbers, Some standard index numbers - Laspeyres', Paasche's, Marshal-Edgeworth's, Dorbisch-Bowley's and Fisher's Index Numbers.
- 6.4. Price and Quantity Index Numbers, Value Index Number
- 6.5. Time reversal test. Factor reversal test, Circular test
- 6.6. Cost of Living Index Number, Concept of Real Income based on the Consumer Price Index Number. Problems in the construction of Consumer Price Index Number
- 6.7. Applications of Index numbers

Semester II

Course-II (Paper II)

Course title: Statistical Methods - II

Course Credit: 2 (Teaching: 30 hrs/ 36 L)

Course code: 18US2ST2

After completion of this course the student should be able to

CO1: Learn some standard continuous distributions

CO2: Obtain their means and variances using expectation definition

CO3: Learn the technique of framing and testing the null hypothesis

Module 4: Continuous Random Variable (Univariate and Bivariate) and Standard

Univariate Continuous Probability Distributions

12L

Learning Objectives:

- Prove various properties of expectations of univariate and bivariate continuous random variables
- Properties of probability density function and cumulative distribution function of continuous random variable
- Study continuous probability distributions such as rectangular and exponential distributions; with their properties, applications

Learning Outcome:

- A student will be able to obtain mean, variance using expectation to continuous distribution
- 4.1. Definition: Univariate continuous random variable, probability density function, cumulative distribution function, Theorems on Expectation and variance of a random variable, Raw & Central Moments, Median, Mode and measures of location

-
- 4.2. Rectangular distribution, exponential distribution: Derivation of cumulative distribution function, mean, variance for rectangular, exponential distribution.
- 4.3. Bivariate continuous random variable, Joint probability mass function of two random variables, Marginal and Conditional probability distributions, Independence of two random variables, Theorems on expectation and variance

Module 5: Normal Distribution, Sampling distribution & Estimation**12L****Learning Objectives:**

- Explain normal probability distribution, properties of normal probability curve
- Calculate normal probabilities using standard normal probability table
- Explain additive property of independent normal variates and Central limit theorem
- Study normal approximation to binomial and poisson distribution
- Recognize the difference between a population and a sample, between a parameter and a statistic
- Understand a concept of point estimation and interval estimation for large sample. Properties of good estimator

Learning Outcome:

- A student will be able to obtain the probabilities in case of normal distribution using normal distribution table
- Apply central limit theorem to the data with large sample size

- 5.1. Properties of normal distribution, normal curve (without proof), Normal Approximation to binomial and poisson distributions (without proof)
- 5.2. Concept of Parameter, Statistic, Estimator and bias, Sampling distribution of estimator, Standard error, Central Limit Theorem (Statement only), Sampling distribution of sample mean and sample proportion for large samples.
- 5.3. Point estimation and interval estimation of single and double population mean and proportion for large sample
- 5.4. Properties of a good estimator: Unbiasedness, Efficiency

Module 6: Testing of hypothesis, Large sample test and Chi-square distribution **12 L****Learning Objectives:**

- Correctly identify the appropriate null and alternative hypotheses, including one or two sided, for a given problem
- From a given set of summary statistics, calculate the Z test statistic and p-value, and make the appropriate statistical decision for single population proportion, single population mean, and equality of two population means and proportions.
- Study the relation between normal distribution and chi-square distribution.
- Study applications of chi-square distribution.

Learning Outcome:

- A student will be able to test the null hypothesis and draw proper conclusion
 - A student will be able to apply chi square test to the suitable null hypothesis
-
- 6.1. Statistical tests - Concept of Hypotheses. (Null and alternative hypotheses, Simple and composite hypothesis), Types of Errors, Critical Region, Level of Significance, size of the test, p-value, power of the test, power function, power curve
 - 6.2. Large Sample Tests (using Central Limit Theorem, if necessary): For testing specified value of population mean, difference of two populations means, population proportion, difference of two population proportions
 - 6.3. Introduction to chi-square distribution and its applications



Practical Sem- II

Course Code:18US2STP

Paper- I

1. Correlation analysis
2. Regression analysis, fitting a straight line and curve
3. Time series
4. Index number
5. Practical using Excel

Paper- II

1. Continuous random variable
2. Rectangular and exponential distribution
3. Normal distribution and estimation
4. Sampling distribution
5. Large Sample test
6. Chi-square distribution
7. Practical using Excel

Reference Books

1. Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. 1, The World Press Pvt. Ltd., Kolkata.
2. Goon A.M., Gupta M.K., Dasgupta B. : Fundamentals of Statistics, Volume II : The World Press Private Limited, Calcutta.
3. Miller and Freund: Modern Elementary Statistics.
4. Spiegel M.R.: Theory and Problems of Statistics, Schaum's Publications series Tata McGraw-Hill.
5. Neil Weiss: Introductory Statistics : Pearson Publishers
6. B. L. Agarwal: Programmed Statistics, New Age International Publishers, New Delhi
7. K. V. S. Sarma: Statistics Made Simple: Do it yourself on PC. Prentice Hall of India Pvt. Ltd., New Delhi.
8. Medhi J. : Statistical Methods, An Introductory Text, Second Edition, New Age International Ltd.
9. Agarwal B.L. : Basic Statistics, New Age International Ltd.
10. Kothari C.R. : Research Methodology, Wiley Eastern Limited.
11. David S. : Elementary Probability, Cambridge University Press.
12. Hoel P.G. : Introduction to Mathematical Statistics, Asia Publishing House.
13. Hogg R.V. and Tannis E.P.: Probability and Statistical Inference. McMillan Publishing Co. Inc.
14. PitanJim : Probability, Narosa Publishing House.

Reference Websites:

1. www.statsci.org/datasets.html
2. www.statweb.calpoly.edu/bchance/stat-stuff.html
3. www.amstat.org/publications/jse/jse-data-archive.html
4. www.amstat.org/publications/chance
5. www.math.uah.edu/stat
6. www.amstat.org/publications/stats
7. www.stat.ucla.edu/cases
8. <https://data.gov.in/>