



# **Savitribai Phule Pune University**

*(Formerly University of Pune)*

**Faculty of Science & Technology**

## **F.Y.B.A. Statistical Pre-requisites**

**Choice Based Credit System Syllabus**

**To be implemented from Academic Year 2019-2020**

**Title of the Course : B.A. (STATISTICAL PRE-REQUISITES)**

**Preamble of the syllabus:**

The word *Statistics* is used in different ways in different contexts. To a cricket fan, Statistics is the information about runs scored or wickets taken by a player. To the manager of a manufacturing unit, Statistics may be the information about the process control. To a medical researcher investigating the effects of a new drug, Statistics are evidence of research efforts. For college student, Statistics are the grades or marks scored in a course. Thus, in all these illustrations Statistics word refers to quantitative data in the area under study. Statistics as a subject is an important branch of knowledge and is devoted to various techniques of collection, presentation, analysis and interpretation of data. It is a science of learning from data.

Statistics provides tools for making decisions when conditions of uncertainty prevail. Hence these tools and techniques are used in almost all fields. Statistics is indispensable for people working in fields like agriculture, business, management, economics, finance, insurance, education, biotechnology and medical science etc. Since last two decades, with the help of computers large amount of data can be handled and more sophisticated statistical techniques can be used in an effective manner. Knowledge of different aspects of Statistics has become crucial. There is a continuous demand for statisticians in every field – education, industry, software and research. The syllabus of the three Year B. A. degree course in Statistics is framed in such a way that the students at the end of the course can apply judiciously the statistical tools to a variety of data sets to arrive at some conclusions.

Statistics can be divided into two broad categories, (1) exploratory statistics or descriptive statistics, which is concerned with summarizing data and describing these data, and (2) confirmatory statistics or inferential statistics, which is concerned with making decisions about the population based on the sample. Up to higher secondary school, students are mostly exposed to descriptive statistics. At the first year a student can take any one of the four subjects related statistics, such as Statistics, Applied Statistics, Mathematical Statistics and Statistical Pre-requisites. If the student continues with these subjects at the second year and third year, it is expected that at the end of the degree course a student is able to apply the statistical tools to real life data.

Introduction: B. A. degree program is of three years' duration, with semester pattern for the second and third year and annual examination pattern for the first year.

The structure of **Bachelor of Arts (B. A.) is as follows.** The student joining the First Year B.A. Course has to take six subjects from 13 groups. The student cannot take more than one subject from one group. There are four subjects related to statistics. These are Statistics (Group L), Applied Statistics (Group L), Mathematical Statistics (Group J) and Statistical Pre-requisites (Group K).

**Structure of the Subject:**

Structure of the subject for first and subsequent three years and the pattern of examination and question papers are as specified below.

**Structure of F. Y. B. A. Statistics/Mathematical Statistics/Applied Statistics/  
Statistical-Prerequisites**

Semester	Subject	Subject code	Title	Credit	Marks
<b>I</b>	Statistics	ST- 13871	Descriptive Statistics I	3	100
	Mathematical Statistics	ST- 13271	Discrete Probability and Probability Distributions	3	100
	Applied Statistics	ST-14171	Descriptive Statistics I	3	100
	Statistical Pre-requisites	ST-13571	Descriptive Statistics I	3	100
<b>II</b>	Statistics	ST- 13872	Descriptive Statistics II	3	100
	Mathematical Statistics	ST- 13272	Discrete Probability Distributions	3	100
	Applied Statistics	ST-14172	Descriptive Statistics II	3	100
	Statistical Pre-requisites	ST-13572	Descriptive Statistics II	3	100

**EQUIVALENCE FOR THEORY PAPERS: (From June 2019)**

The 2013 pattern was an annual examination and 2019 pattern is CBCS hence equivalence cannot be given.

## Detailed Syllabus:

Proposed syllabus for the above mentioned course to be implemented from the Academic Year 2019-20 onwards.

The course in 'Statistical Pre-requisites' may be offered only by candidates offering one of the Social Sciences as their Special subject at the B.A. Degree Examination.

**The Course in 'Statistical Pre-requisites' cannot be offered by those who offer any of the Course in Statistics Group for their B.A Examination.**

**Note: Mathematical derivations and proofs are not expected:**

### Objective:

The main objective of this course is to acquaint students with some basic concepts in statistics. They will be introduced to some elementary statistical methods of analysis of data. At the end of this course students are expected to be able:

- (i) To compute various measurements of central tendency, dispersion, skewness and kurtosis.
- (ii) To compute the correlation coefficient from ungrouped bivariate data and interpret them.
- (iii) To analyze data pertaining to attributes and to interpret results.
- (iv) To analyze data pertaining to Index Numbers and to interpret the results.

## Semester-I

### ST-13571:Descriptive Statistics I

#### 1. Population and Sample:

(5L)

1.1 Notion of a statistical population: Finite population, infinite population, homogeneous population and heterogeneous population.

1.2 Notion of a sample, random sample. Methods of sampling: Simple random sampling with and without replacement (SRSWR & SRSWOR), Stratified random sampling, Systematic sampling.

#### 2. Type of Data and its Presentations:

(8L)

2.1 Types of characteristics, Attributes: Nominal scale and ordinal scale

2.2 Variable: Interval scale, ratio scale. Discrete and continuous variables.

2.3 Raw data, primary data and secondary data. Classification: Discrete frequency distribution, Inclusive and Exclusive methods of classification, Open-end classes, Cumulative frequency distributions and Relative frequency distribution.

2.4 Presentation of data: Bar Diagrams, Pie-Diagram. Histogram, frequency curve, Ogive curves, Stem and leaf chart.

#### 3. Statistical averages:

(12L)

3.1 Concepts of central tendency, characteristics of a good statistical average.

3.2 Arithmetic Mean (A.M.) Definition, Effects of change of origin and scale (only statement) Combined mean of two groups.

3.3 Geometric Mean (G.M.) Definition, Formulae. Harmonic Mean (H.M.) Definition, Formulae.

3.4 Mode: Definition, formula for computation, graphical method of determination of mode.  
3.5 Median: Definition, formula for computation, graphical method of determination of median.  
3.6 Partition values: Quartiles, Deciles and percentile, graphical method of determination of quartiles, deciles and percentiles.

#### **4. Measures of Dispersion:**

**(12L)**

- 4.1 Concepts of dispersion, characteristics of good measure of dispersion
- 4.2 Range: definition. Semi-interquartile range (Quartile deviation).
- 4.3 Mean deviation: definition, statement of minimal property.
- 4.4 Mean square deviation: Definition, statement of minimal property.
- 4.5 Variance and Standard deviation (S.D.): Definition.
- 4.6 Measures of dispersion for comparison: Coefficient of range, coefficient of quartile deviation, coefficient of mean deviation and coefficient of variation (C.V.).

#### **5. Moments:**

**(4L)**

- 5.1 Raw moments ( $m'_r$ ) for ungrouped and grouped data upto 4<sup>th</sup> order.
- 5.2 Central moments ( $m_r$ ) for ungrouped and grouped data upto 4<sup>th</sup> order. Effects of change of origin and scale (Only statement). Relation between central and raw moments upto 4<sup>th</sup> order.  
(Only statement).

#### **6. Skewness and Kurtosis:**

**(7L)**

- 6.1 Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution. interpretation using Box Plot.
- 6.2 Bowley's coefficient of skewness, Karl Pearson's coefficient of skewness, Measures of skewness based on moments.
- 6.3 Concepts of Kurtosis, Leptokurtic, Mesokurtic and Platykurtic frequency distribution.
- 6.4 Measures of Kurtosis based on moments.

#### **Reference Books**

1. Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. 1, The World Press Pvt. Ltd., Kolkata.
2. Miller and Freund: Modern Elementary Statistics.
3. Snedecor and Cochran: Statistical Methods, Oxford and IBH Publishers.
4. Mukhopadhyay, P: Mathematical Statistics (1996), New Central Book Agency, Calcutta.
5. Gupta and Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
6. Neil Weiss: Introductory Statistics: Pearson Publishers
7. Gupta and Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.

## Semester-II

### ST-13572:Discriptive Statistics II

#### 1. Correlation:

(10L)

1.1 Concept of Bivariate data and objectives of studying Bivariate data, Concepts of correlation between two variables, positive correlation, negative correlation, no correlation.

1.2 Scatter diagram, conclusion about the type of correlation from scatter diagram.

1.3 Karl Pearson's coefficient of correlation (r): Definition, computation for ungrouped data and interpretation. Statement of properties:

(i)  $-1 \leq r \leq +1$  (ii) Effects of change of origin and scale.

1.4 Spearman's rank correlation coefficient: Definition, computation and interpretation (without ties), In case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)

#### 2. Linear Regression:

(10L)

2.1 Concept of regression, lines of regression, fitted equations of lines of regression by the least squares method (No derivation), interpretation of slope and intercept.

2.2 Regression coefficient ( $b_{yx}$ ,  $b_{xy}$ ): Definition, computation, properties (only statements):

i)  $b_{yx} \cdot b_{xy} = r^2$ , ii)  $b_{yx} \cdot b_{xy} \leq 1$ , iii) algebraic sign of regression coefficients are same,

iv) Effect of change of origin and scale, v)  $b_{yx} = r\sigma_y/\sigma_x$ , vi)  $b_{xy} = r\sigma_x/\sigma_y$ .

#### 3. Non-linear Regression:

(8L)

3.1 Concept of non-linear regression.

3.2 Fitting of second degree curve  $Y = a + bX + cX^2$  by the method of least squares (No derivation only procedure).

3.3 Fitting of exponential curves of the type  $Y = ab^X$  and  $Y = aX^b$  by the method of least squares (No derivation only procedure).

#### 4. Index Numbers:

(10L)

4.1 Introduction. Definition and Meaning. Brief discussion on construction of index numbers.

4.2 Simple and weighted price index numbers. Laspeyre's, Passche's and Fisher's Index numbers.

4.3 Simple average of price relative, weighted average of price relative.

4.4 Consumers price index numbers. Considerations in its construction. Methods of constructing consumer price index number: (i) family budget method, (ii) aggregate expenditure method.

4.5 Shifting of base, splicing, deflating, purchasing power.

#### 5. Theory of Attributes:

(10L)

**Statistics**

5.1 Attributes: Classification, Notion of dichotomy and manifold classification, class-frequency, order of class, positive class-frequency, negative class frequency, ultimate class-frequency, relationship among class-frequencies of different order (upto three attributes), dot operator, Fundamental set of class frequencies. Consistency of data upto 3 attributes.

5.2 Concepts of independence and association of two attributes. Yule's coefficient of association ( $Q$ ), interpretation on values of ( $Q$ ).

**Reference Books**

1. Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. 1, The World Press Pvt. Ltd., Kolkata.
2. Miller and Freund: Modern Elementary Statistics.
3. Snedecor and Cochran: Statistical Methods, Oxford and IBH Publishers.
4. Mukhopadhyay, P: Mathematical Statistics (1996), New Central Book Agency, Calcutta.
5. Gupta and Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
6. Neil Weiss: Introductory Statistics: Pearson Publishers
7. Gupta and Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.

**Reference Websites:**

1. [www.stats.unipune.ac.in](http://www.stats.unipune.ac.in) (100 Data sets for Statistics Education by Dr. Anil P. Gore, Dr. Mrs. S. A. Paranjpe and Madhav B. Kulkarni available in ISPS folder).
2. [www.freestatistics.tk](http://www.freestatistics.tk) (National Statistical Agencies)
3. [www.psychstat.smsu.edu/sbk00.htm](http://www.psychstat.smsu.edu/sbk00.htm) (Online book)
4. [www.bmj.bmjournals.com/collections/statsbk/index.shtml](http://www.bmj.bmjournals.com/collections/statsbk/index.shtml)
5. [www.statweb.calpoly.edu/bchance/stat-stuff.html](http://www.statweb.calpoly.edu/bchance/stat-stuff.html)
6. [www.amstat.org/publications/jse/jse-data-archive.html](http://www.amstat.org/publications/jse/jse-data-archive.html) (International journal on teaching and learning of statistics)

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