Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Syllabus at the F.Y. B.Sc. / B.A. In Statistics

With effect from the academic year 2009-2010

Class	Semester	Title of Paper	Paper No	Per week lectures	Total	Marks
First year B.Sc./ B.A.	I	Descriptive Statistics-I	I	04	45	50
	I	Probability Theory	II	04	45	50
	I	Practicals Based on Paper_ I	III	04	45	50
	I	Practicals Based on Paper-II	IV	04	45	50
	II	Descriptive Statistics-II	V	04	45	50
	II	Probability Distributions	VI	04	45	50
	II	Practical Based on Paper-V	VII	04	45	50
	II	Practical based on Paper-VI	VIII	04	45	50

First Year B.Sc. and First Year B.A. (Statistics)
Semester- I

Descriptive Statistics-I

Paper-I

Unit-I **(15 lectures)**

Introduction of some basic concepts

1.1 Introduction to statistics.
1.2 Scope and importance of Statistics.
1.3 Various definitions of Statistics.
1.4 Statistical Organisations
(ISI, NSSO, CSO, IIPS, IASRI)
1.5 Statisticians and their contributions.
(R.A Fisher, Mahalonobis, Pearson, C.R. Rao and Sukhatme)
1.6 Primary and Secondary data, Types of data : qualitative, quantitative, discrete, continuous, cross-section, time series, failure, industrial, directional data.
1.7 Presentation of data.
a. Graphical presentation: Histogram, frequency polygon, frequency curves, ogive curves, stem and leaf charts, check sheet.
b. Diagrammatic presentation: Bar diagrams, Pie diagram, Parato diagram, scatter diagram.
1.8 Different types of scales:
Qualitative data (Attributes): Nominal and ordinal scales
Quantitative data (Variables): Interval and ratio scales, linear and circular scales.
1.9 Classification of data: Discrete and continuous frequency distributions, inclusive and exclusive methods of classification, relative and cumulative frequency distributions.

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Unit II **(15 Lecturers)**

Measures of Central Tendency

2.1 Concept of central tendency. Prerequisites of ideal measure of central tendency.

2.2 Arithmetic mean (A.M.) for frequency and non frequency data (simple and weighted) trimmed mean, mean of pooled data.

2.3 Effect of change of origin and scale of A.M., properties of A.M. merits and demerits of A.M.

2.4 Mode: Computation for frequency and non-frequency data. Derivation of formula for mode. Computation of mode by graphical method. merits and demerits of mode.

2.5 Median: Computation for frequency and non-frequency data, computation by graphical method, merits & demerits of median. Empirical relation between mean, median and mode.

2.6 Geometric mean (G.M.) computation for G M for pooled data (for two groups.) G M for ratio of two variables. merits demerits and applications

2.7 Harmonic Mean (H M) computation for frequency, non-frequency data, merits, demerits,

2.8 Order relation between AM, GM, HM (with proof for n=2)

2.9 Selection of an average.

Unit-III **(15 Lecturers)**

Partition values & Measures of Dispersion

3.1 Concept of Dispersion and characteristics of good measure of dispersion.

3.2 Range and coefficient of range: merits, demerits and applications.

3.3 Partition values: Computation by formulae, computation by graphical method and Box plot.

Quartile deviation (QD), coefficient of quartile deviation

3.4 Mean deviation (MD) about mean, mode, and median, coefficient of MD minimality property (with proof)

3.5 Variance, standard deviation (S.D.) effect of change of origin and scale on variance

Variance for pooled data (Proof for two groups)

S.D. $\leq$ MD about mean

Merits, demerits & uses of S.D.

3.6 Coefficient of variation (C.V.) uses of C.V., merits & demerits

3.7 Covariance: for frequency & non frequency data. Effect of change origin and scale & properties

3.8 Variance of linear combination

First Year B.Sc. and First Year B.A. (Statistics)
Semester-I

Practical Based on Theory Paper-I

Paper-III

List of Practicals

1. Representation by frequency distribution & Analysis of real life data collected by students.
2. Graphical Representation of data
3. Diagrammatic Representation of data
4. Computation of Arithmetic Mean
5. Computation of arithmetic mean by change of origin and scale.
6. Computation of Median for ungrouped and grouped data and graphical location.
7. Computation of Mode for ungrouped and grouped data and graphical location.
8. Computation of Quartiles, Deciles and Percentiles and their graphical location.
9. Computation of Quartile deviation and Mean deviation.
10. Computation of Variance, s.d. and coefficient of variation (c.v.)

First Year B.Sc. and First Year B.A. (Statistics)

Probability Theory

Paper II

Unit I **(15 lecturers)**

Basic concepts in probability theory

1.1 Concepts of experiments and random experiments

1.2 Definitions: Sample Space, Discrete sample space (finite and countably infinite) Event, Elementary event, complement of an event.

1.3 Algebra of events (Union, Intersection and Complementation)

1.4 Definitions: Exhaustive events, Favourable events, Mutually Exclusive events, Equally Likely events, Independent events, Impossible events and certain events.

1.5 Power Set P (Ω) (sample space consisting at least three sample points.)

1.6 Symbolic representation of given evens and description of events in symbolic forms.

1.7 Examples, based on 1.1 to 1.6

1.8 Apriori (Classical) definition of probability of an event. Equiprobable sample space, simple examples of computation of probability of the events based on Permutations & Combinations

1.9 Axiomatic definition of Probability (with reference to finite and countably infinite sample space)

1.10 Proof of the results

- i $P(Q) = 0$
- ii $P(A') = 1 - P(A)$
- iii $P(AUB) = P(A) + (B) - P(A \cap B)$ (with proof) and its generalization (statement only)
- iv if $A \subset B$, $P(A) \leq P(B)$
- v $O \leq P(A \cap B) \leq P(A) \leq P(AUB) \leq P(A) + P(B)$

1.11 Examples based on 1.10

Unit II **(15 lectures)**

Conditional Probability

2.1 Definition of conditional Probability

2.2 Multiplication theorem P (A∩ B) = P (A). P (B/A)

2.3 Partition of sample space.

2.4 Posteriori Probability

2.5 Statement and proof of Baye's Theorem

2.6 Elementary examples based on 2.1 to 2.5

2.7 Independence of events

2.8 Proof of the results that if A & B are independent then

i) A & B' ii) A'& B iii) A' & B' are independent

2.9 Pair wise & mutual independence of three events

2.10 Examples based on 2.7 to 2.9

Unit III **(15 lectures)**

Prerequisites of distribution functions

3.1 Definition of Discrete and continuous random variables.

3.2 Probability mass function (p.m.f.) and Probability density function.

(p.d.f.) cumulative distribution functions (discrete and continuous) their properties (Statements only)

3.3 Probability distribution function of a random variable

3.4 Median and Mode of univariate discrete & continuous Probability Distribution.

3.5 Examples based on 3.1 to 3.4

3.6 Expectation of a random variable and expectation of function of a random variable.

3.7 Properties of expectation.

3.8 Mean and variance of univariate distribution and effect of change of origin and scale on mean and variance.

3.9 Raw and Central moments of univariate distribution their relationship, skewness and kurtosis.

3.10 Probability generating function (p.g.f) of a random variable and computation of means and variance using p.g.f.

3.11 Examples based on 3.6 to 3.10

First Year B.Sc. and First Year B.A. (Statistics)
Semester-I

Practical Based on Theory Paper-II

Paper-IV

List of Practicals

1. Problems based on Probabilities
2. Problems based on various results in Probability (1.10 of theory paper-II)
3. Problems based on addition and multiplication theorems of probability.
4. Problems based on conditional probability.
5. Problems based on Baye's theorem.
6. Problems based on mathematical expectation and its properties.
7. Problems based on mathematical expectation.
8. Computation of measures of central tendency using mathematical expectations – I
9. Computation of measures of dispersion using mathematical expectation.
10. Computation of measures of skewness and Kurtosis.

First Year B.Sc. and First Year B.A. (Statistics)
Semester – II

Descriptive Statistics- II

paper-V

Unit-I **(15 lectures)**

Moments & different measures

1.1 Moments about x = a : definition, computation for raw and grouped data.

1.2 Raw moments: Definition, computation for raw and grouped data.

1.3 Central moments: Definition, computation for raw and grouped data.
Effect of change of origin and scale.
Sheppard's corrections

1.4 Relation between raw and central moments up to 4^{th} order (with proof)

1.5 Skewness : Concept, types of skewness, measures of skewness
- i Karl Pearson's
- ii Bowley's, show that it lies between -1 and +
- iii Pearsonian Coefficient of skewness (β_1,γ_1)

1.6 Kurtosis : Concept, types of Kurtosis, Pearsonian coefficients β_2, γ_2

1.7 The results
- i $\beta_2 \geq 1$
- ii $\beta_2 \geq \beta_1 + 1$ (with proof)

Unit-II **(15 Lecturers)**

Correlation & regression

2.1 Bivariate data, its frequency distribution

2.2 Correlation: Concepts, positive, negative correlation, interpretation of scatter diagram

2.3 Karl Pearson's Coefficient of correlation, computation for grouped, ungrouped data

2.4 Properties of Karl Pearson's Coefficient of correlation

i Effect of change of origin & scale

ii Limits (-1, +1)

iii $\mathbf{r}_{xy} = \mathbf{r}_{yx}$

2.5 Merits, demits, interpretation, applications, of correlation

2.6 Spearman's rank correlation : Derivation of formula (without repetition), for non repeated and repeated ranks computation- comparison of Karl Pearson's and Spearman's Correlation coefficient.

2.7 Regression : Concept, Independent and response variables, fitting of lines of regression by using principle of least squares (with derivation) Properties of lines of regression, Determination of angle between lines

2.8 Regression coefficient: Properties,
Difference between correlation and regression.

Unit-III **(15 Lecturers)**

a) Theory of attributes

3.1 Attributes: Notations and definitions of dichotomy, class frequency, positive & negative classes, ultimate class frequency, fundamental set, relationship among different class frequencies (up to three attributes)

3.2 Concept of consistency and conditions of consistency (up to three attributes.)

3.3 Independence and association of attributes.

3.4 Yule's coefficient of association, (Q), coefficient of colligation (y) and relation between Q & y.

b) Demand and supply analysis

3.5 Individual and market demand, law of demand, assumptions & exceptions of the law

3.6 Law of supply, determination of supply, exceptions of the law, equilibrium of demand and supply

3.7 Elasticity of demand, price elasticity, income and cross elasticity and interpretation, Different methods of computation Determinants of elasticity

3.8 Demand Forecasting, objective & need

First Year B.Sc. and First Year B.A. (Statistics)
Semester-II

Practicals Based on Theory Paper-V-

Paper-VII

List of Practicals

1. Computation of raw moments for ungrouped and grouped data.
2. Computation of central moments using raw moments for ungrouped and grouped data.
3. Computation of measures of skewness and Kurtosis.
4. Computation of Karl Pearson's coefficient of correlation for bivariate frequency distribution.
5. Computation of Spearman's Rank correlation
6. Fitting lines of regression
7. Verification of properties of regression coefficients
8. Attributes: Testing consistency of data
9. Computation of marginal, conditional frequency distributions from bivariate frequency distribution and their means and variances.
10. Demand Analysis.

Books Recommended (Paper I & V)

1. Bhat B.R. Srivenkataramana T. and Madhava Rao K.S., Statistics: A Beginner's Text Vol.II, New Age International (P) Ltd.
2. Goon A.M., Gupta M.K., Dasgupta B., Fundamental of Statistics Vol.I, The World Press Private Ltd. Calcutta.
3. S.C. Gupta and Kapoor V.K. Fundamentals of Mathematical Statistics, S.Chand Publications.
4. Parimal Mukhopadhyaya- Fundamentals of Mathematical Statistics.
5. Hoel P.G. Introduction to Mathematical Statistics, Asia Publishing Housing.
6. Mayer P.L. Introductory Probability and Statistical Applications- Addsionco.

First Year B.Sc. and First Year B.A. (Statistics)
Semester II

Probability Distributions

Paper- VI

Unit I **(15 lecturers)**

Bivariate probability distribution

1.1 Concept of Bivariate probability distribution (on finite sample space)

1.2 Definition of two dimensional discrete random variable, its joint probability mass function, distribution function and their properties.

1.3 Computation of probabilities of events in Bivariate probability distribution

1.4 Marginal and conditional probability distributions

1.5 Independence of two discrete random variables.

1.6 Examples based on 1.1 to 1.5

1.7 Mathematical expectation of jointly distributed random variables.

1.8 Conditional expectation, Conditional mean and variance

1.9 Raw and Central moments

1.10 Covariance, Coefficient of correlation, variance of linear combination

1.11 Examples based on 1.7 to 1.10

Unit II **(15 Lecturers)**

Some standard discrete probability distributions

2.1 Definition of Bernoulli distribution and moments of the distribution

2.2 Additive property of Bernoulli distribution (Two variables)

2.3 Definition of Binomial distribution and applications of Binomial distribution

2.4 Mode of Binomial distribution

Moments and recurrence relation in moments of Binomial distribution.

2.5 Additive property of Binomial distribution

Fitting of Binomial distribution

2.6 Examples based on 2.1 to 2.5

2.7 Definition of Poisson distribution and applications.

2.8 Mode of Poisson distribution

Moments of Poisson distribution.

(Poisson distribution as a limiting form of Binomial distribution.)

2.9 Additive property and its generalization for Poisson distribution and fitting of Poisson distribution

2.10 Examples based on 2.7 to 2.9

Unit III **(15 Lecturers)**

Some standard continuous probability distributions.

3.1 Definition of Uniform distribution for continuous random variable, mean and variance of Uniform distribution

3.2 Definition of normal distribution.
Chief characteristics of normal distribution

3.3 Mode and median of normal distribution

3.4 Moment Generating function of Normal distribution

3.5 Additive property of Normal distribution

3.6 Area property of Normal distribution

3.7 Problems based on 3.1. to 3.6

3.8 Fitting of Normal distribution

First Year B.Sc. and First Year B.A. (Statistics)
Semester-II

Practical Based on Theory Paper – VI

Paper-VIII

List of Practicals

1. Problems based on uninvariate random variables.
2. Problems based on Binomial distribution.
3. Fitting of Binomial distribution
4. Problems based on Poisson distribution
5. Fitting of Poisson distribution
6. Computation of marginal, conditional probability distributions from bivariate probability distribution
7. Independence of two discrete random variables from a Bivariate Probability distribution.
8. Problems of based on Uniform (Continuous) distribution.
9. Problems based on Normal distribution.
10. Fitting of Normal distribution.

Books Recommended (Paper II & VI)

1. Bhat B.R. Srivenkataramana T and Madhava Rao K.S., Statistics: A Begginer's Text Vol.1, New Age International (P) Ltd.
2. Goon A.M., Gupta M.K., Dasgupta B., Fundamental of Statistics Vol.I, The World Press Private Ltd. Calcutta.
3. S.P.Gupta : Statistical Methods, S.Chand Publication.
4. S.C. Gupta and Kapoor V.K. Fundamentals of Mathematical Statistics, S.Chand Publications.
5. Neil Weiss: Introductory Statistics, Pearson Publishers.
6. Gupta S.C. and Kapoor V.K., Fundamentals of Applied Statistics.

Pattern of Theory question-papers (Paper-I,II,V,VI) for
First Year B.Sc. and First Year B.A. (Statistics)
for Semester I and Semester II
Marks 50 each paper

Question 1 : Compulsory Objective (Fill in the blanks)

Questions II, III, IV and V each of 10 marks and pattern of these questions is as follows

Subquestions (a) 10 marks
or
Subquestions (b) 10 marks
10 marks of subquestions may be divided into bits of (5+5, 6+4, 8+2 etc)

Pattern of Practical question papers
First Year B.Sc. and First Year B.A. (Statistics)
(Paper Numbers III, IV, VII & VIII)

Maximum Marks	**50 each paper**
Record Book	**05**
Viva-voce	**05**
Question paper	**40**

Question paper will contain two questions of 20 marks each.

For each paper

Question I **based on Practical 1,2,3,4,5 of respective paper**

Question II **based on Practicals 6,7,8,9, 10 of respective paper**