

SHIVAJI UNIVERSITY, KOLHAPUR.

B.C.S. Part I : STATISTICS

Structure of the course.

To be implemented from June 2013.

Semester I

Objectives:

The main objective of this course is to provide basic knowledge of Statistical Techniques to the students. Some elementary statistical methods of analysis are introduced in the course as well as the basic concepts of probability, discrete probability distributions. At the end of the course the students are expected to be able

- i) To classify, tabulate and represent the data graphically.
- ii) To compute and interpret various measures of central tendency, dispersion, moments, skewness and kurtosis.
- iii) To compute probabilities by using definition and probability rules.
- iv) To compute probabilities by using discrete probability distributions.

Paper I : Descriptive Statistics I

- Unit-1** 1.1 Introduction: (10)
Definition, importance, scope and limitations of Statistics.
- 1.2 Population and Sample:
Concept of statistical population with illustrations, concept of sample with illustrations.
Methods of sampling: Simple Random Sampling and Stratified Random Sampling (description only).
- 1.3 Data Condensation: Raw data, Attributes and variables, discrete and continuous variables, classification and construction frequency distribution.
- 1.4 Graphical Representation: Histogram, Frequency polygon, Frequency curve, Ogive curves and their uses.
- 1.5 Examples and Problems.
- Unit-2** Measures of central tendency: (12)
- 2.1 Concept of central tendency, Criteria for good measures of central tendency.
- 2.2 Arithmetic mean: Definition, computation for ungrouped and grouped data, combined mean, weighted mean, merits and demerits.
- 2.3 Median: Definition, computation for ungrouped and grouped data, graphical method, merits and demerits.
- 2.4 Mode: Definition, computation for ungrouped and grouped data, graphical method, merits and demerits.
- 2.5 Quartiles: Definition, computation for ungrouped and grouped data graphical method.
- 2.6 Numerical problems.
- Unit-3** Measures of Dispersion (12)
- 3.1 Concept of dispersion and measures of dispersion, absolute and relative measures of dispersion.

- 3.2 Range and Quartile Deviation: definition for ungrouped and grouped data, and their coefficients, merits and demerits.
- 3.3 Mean Deviation: Definition for ungrouped and grouped data, minimal property (statement only).
- 3.4 Standard deviation and Variance: definition for ungrouped and grouped data, coefficient of variation, combined variance and s. d. for two groups, merits and demerits.
- 3.5 Numerical problems.

Unit-4 Moments, Skewness and Kurtosis: (11)

- 4.1 Raw and central moments: definition for ungrouped and grouped data (only first four moments), relation between central and raw moments (statements only).
- 4.2 Measures of skewness: Types of skewness. Pearson's and Bowley's coefficients of skewness. Measures of skewness based on moments.
- 4.3 Measures of kurtosis: Types of kurtosis. Measures of kurtosis based on moments.
- 4.4 Numerical problems.

Paper II : Probability and Discrete Probability Distributions

Unit-1 Probability: (13)

- 1.1 Idea of permutation and combination, concept of experiments and random experiments.
- 1.2 Definitions: sample space (finite and countably infinite), events, types of events, power set (sample space consisting at most 3 sample points).
- 1.3 Illustrative examples.
- 1.4 Classical (apriori) definition of probability of an event, equiprobable sample space, simple examples of probability of an events based on permutations and combinations, axiomatic definition of probability with reference to finite and countably infinite sample space.
- 1.5 Theorems on probability :
 - i) $P(\Phi) = 0$
 - ii) $P(A') = 1 - P(A)$
 - iii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
 - iv) If $A \subseteq B$, $P(A) \leq P(B)$
 - v) $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$
- 1.6 Illustrative examples.

Unit-2 Conditional probability and independence of events: (10)

- 2.1 Definition of conditional probability of an event, examples.
- 2.2 Partition of sample space, Baye's theorem (only statement) and examples.
- 2.3 Concept of independence of two events, examples.
- 2.4 Proof of the result that if A and B are independent events then i) A and B', ii) A' and B, iii) A' and B' are also independent.
- 2.5 Pairwise and complete independence of three events, examples.
- 2.6 Elementary examples.

- Unit-3** Univariate probability distributions (defined on finite and countably infinite sample space): (10)
- 3.1 Definitions: discrete random variable, probability mass function (p.m.f.), cumulative distribution function (c.d.f.), properties of c.d.f., median, mode and examples.
 - 3.2 Definition of expectation of a random variable, expectation of a function of random variable.
 - 3.3 Results on expectation : i) $E(c) = c$, where c is constant.
ii) $E(aX + b) = a E(X) + b$,
where a and b are the constants.
 - 3.4 Definition of mean and variance of univariate distributions.
 - 3.5 Examples.
- Unit-4** Some standard discrete probability distributions: (12)
- 4.1 Discrete uniform distribution: p.m.f., mean and variance, examples.
 - 4.2 Binomial distribution: p.m.f., mean and variance, additive property of binomial variates, recurrence relation for probabilities, examples.
 - 4.3 Poisson distribution: p.m.f., mean and variance, additive property, recurrence relation for probabilities, Poisson distribution as a limiting case of binomial distribution (without proof), examples.

Semester II

Objectives:

The main object of this course is to introduce to the students the basic concepts of simple correlation, linear regression, multiple and partial correlation, multiple regression. Study of continuous univariate distributions, exact sampling distributions, testing of hypothesis and simulation techniques.

By the end of course students are expected to familiar with:

- 1) Relation between two and three variables.
- 2) Fitting of simple and multiple regression equations.
- 3) Finding of probabilities of various distributions.
- 4) Knowing the relations among the different distributions with real life situations.
- 5) Applying the small sample and large sample tests in various situations.
- 6) Simulation of various distributions.

Paper III : Descriptive Statistics II

- Unit-1** Correlation (for ungrouped data) (10)
- 1.1 Concept of bivariate data, scatter diagram. Concept of correlation, positive correlation, negative correlation, cause and effect relation.
 - 1.2 Karl Pearson's coefficient of correlation, properties of correlation coefficient, interpretation of correlation coefficient.
 - 1.3 Spearman's Rank Correlation coefficient (formula with and without ties).
 - 1.4 Numerical problems.

- Unit-2** Regression (for ungrouped data): (10)
- 2.1 Concept of regression. Derivation of lines of regression by method of least squares.
 - 2.2 Regression coefficients and their significance. Properties of regression coefficients.
 - 2.3 Point of intersection and acute angle between regression lines (without proof).
 - 2.4 Numerical problems. (12)
- Unit-3** Multiple Regression (For Trivariate Data):
- 3.1 Concept of multiple regressions. Yule's Notations.
 - 3.2 Residual: definition, order, properties, mean and variance of residual.
 - 3.3 Fitting of multiple regression planes. Partial regression coefficients, interpretations.
 - 3.4 Numerical Problems.
- Unit-4** Multiple and partial Correlation (For Trivariate Data): (13)
- 4.1 Concept of multiple correlation. Definition of multiple correlation coefficient and its formula.
 - 4.2 Properties of multiple correlation coefficient (statements only)
 - 4.3 Interpretation of multiple correlation coefficient when it is equal zero and one.
 - 4.4 Concept of partial correlation. Definition of partial correlation coefficient and its formula.
 - 4.5 Properties of partial correlation coefficient.
 - 4.6 Examples and problems.

Paper IV : Continuous Probability Distributions and Testing of Hypothesis

- Unit-1** Continuous Univariate Distributions: (15)
- 1.1 Definitions: infinite sample space with illustrations, continuous random variable, probability density function (p.d.f.), cumulative distribution function (c.d.f.), properties of c.d.f.
 - 1.2 Expectation of random variable, expectation of function of a random variable, mean, variance and examples.
 - 1.3 Uniform distribution: p.d.f., c.d.f., mean, variance and examples.
 - 1.4 Exponential distribution: p.d.f., c.d.f., mean, variance, lack of memory property and examples.
 - 1.5 Normal distribution: p.d.f., standard normal distribution, properties of normal curve, distribution of $aX+bY$, where X and Y are independent normal variates, normal distribution as a limiting case of Binomial and Poisson distributions (without proof), examples.
- Unit-2** Exact sampling distributions: (12)
- 2.1 Chi-square distribution: definition, chi-square variate as the sum of square of i.i.d. S.N.V., statement of p.d.f., mean, variance, additive property, approximation to normal distribution and examples.
 - 2.2 Student's t-distribution: definition, nature of probability curve, mean and variance, approximation to normal, examples.
 - 2.3 Snedecor's F-distribution: definition, mean and variance, inter-relationships between chi-square, t and F distributions, examples.

- Unit-3** Testing of hypothesis: (10)
- 3.1 Definitions: random samples, parameter, statistic, standard error of a statistic.
 - 3.2 Concept of null and alternative hypothesis, types of error, critical region, level of significance, one sided and two sided tests, general procedure of testing of hypothesis,.
 - 3.3 Large sample tests for: i) population mean, ii) Population proportion.
 - 3.4 Small sample tests: i) Test for population variance, Chi-square test for goodness of fit and test for independence of attributes using 2×2 contingency table,
ii) t-test for testing population mean.
iii) F test for equality of two population variances.
 - 3.5 Examples.
- Unit-4** Simulation: (8)
- 4.1 Introduction to simulation, merits and demerits.
 - 4.2 Pseudo-random number generator, model sampling from uniform and exponential distribution.
 - 4.3 Model sampling from normal distribution using Box-Muller transformation.
 - 4.4 Examples.

Statistics Practical:

List of Statistics experiments to be performed

- 1) Construction of frequency distributions and graphical methods.
- 2) Measures of Central tendency (Ungrouped data)
- 3) Measures of Central tendency (Grouped data)
- 4) Measures of dispersion (Ungrouped data).
- 5) Measures of dispersion (Grouped data).
- 6) Moments, skewness, kurtosis (Ungrouped data).
- 7) Moments, skewness, kurtosis (Grouped data).
- 8) Fitting of Binomial distribution.
- 9) Fitting of Poisson distribution.
- 10) Model sampling from Binomial distribution.
- 11) Model sampling from Poisson distribution.
- 12) Computation of correlation coefficient and scatter diagram.
- 13) Fitting of lines of regression (Ungrouped data).
- 14) Fitting of regression planes and estimation.
- 15) Computation of partial and multiple correlation coefficients.
- 16) Fitting and sketch of Uniform distribution.
- 17) Fitting and sketch of Exponential distribution.
- 18) Fitting and sketch of Normal distribution.
- 19) Model sampling from Normal distribution using :
 - i) Normal table and
 - ii) Box-Muller transformation.

20) Model sampling from Uniform distribution and Exponential distribution.

- Note:** i) For the experiment numbers 16, 17 and 18 it is expected to sketch both observed and expected frequency distributions on the same graph.
- ii) Test of goodness of fit is necessary for every practical on fitting of distributions.
 - iii) All the practicals are to be done on computers using MS-EXCEL.
 - iv) Calculations (observation table) should be done by using Statistical formulae.
 - v) Computer printout is to be attached to the journal.
 - vi) Student must complete the entire practical to the satisfaction of the teacher concerned.
 - vii) Student must produce the Laboratory Journal along with the completion certificate signed by the Head of the department, at the time of practical examination.

Laboratory Requirements:

Laboratory should be well equipped with sufficient number of (20) computers along with necessary software, printers, UPS. Statistical tables should be provided to the students during practicals as per requirement.

Practical Examination will be conducted as :

- 1) Paper Work: In this session a student is expected to write formulae and format of required table.
- 2) Laboratory Work: A student is expected to execute the problems selected by him on computer by using MS-EXCEL.

Books Recommended:-

- 1. Fundamentals of Statistics by Goon, Gupta, Das Gupta.
- 2. Statistical Methods by S. P. Gupta.
- 3. Business Statistics by S. Saha.
- 4. Modern Elementary Statistics by J.E. Freund.
- 5. Fundamental of Statistics by S.C.Gupta.
- 6. Fundamentals of Mathematical Statistics by Gupta and Kapoor.
- 7. Statistical Methods (An introductory text by J. Medhi)
- 8. Probability and statistics with reliability queuing and computer science applications by K. S. Trivedi.
- 9. Fundamental of mathematical statistics by Gupta and Kapoor.
- 10. Non-uniform random variate generation by Devroye.
- 11. System simulation with digital computers by Narsingh Deo.

STRUCTURE OF COURSE :

FIRST YEAR B.C.S. (NO. OF PAPERS four and one practical)

No of theory papers : 2 (per semester)
 No of Practical : 1 (per year)

Sr. No.	Papers / Practical No.	Name	Marks
Semester I			
1.	Paper I	Descriptive Statistics I	50
2.	Paper II	Probability and Discrete Probability Distributions	50
Semester II			
1.	Paper III	Descriptive Statistics II	50
2.	Paper IV	Continuous Probability Distributions and Testing of Hypothesis	50
3.	Practical	Statistics Practical	100
		Total	300

SCHEME OF TEACHING AND EXAMINATION :

FIRST YEAR B.C.S. (Sem. I)

Sr. No.	Subject / Paper	Teaching Scheme (Hrs/Week)				Examination Scheme (Marks)		
		L	T	P	Total	Theory	Practical	Total
1	Descriptive Statistics I	3	--	--	3	50	--	50
2	Probability and Discrete Probability Distributions	3	--	--	3	50	--	50
3	Statistics Practical	--	--	4 per batch		--	---	--
4	Total	6	--	4 per batch	6+4 per batch	100	---	100

Note : A practical batch will consist of 20 students.

FIRST YEAR B.C.S. (Sem. II)

Sr. No.	Subject / Paper	Teaching Scheme (Hrs/Week)				Examination Scheme (Marks)		
		L	T	P	Total	Theory	Practical	Total
1	Descriptive Statistics II	3	--	--	3	50	--	50
2	Continuous Probability Distributions and Testing of Hypothesis	3	--	--	3	50	--	50
3	Statistics Practical	--	--	4 per batch	--	--	100	100
4	Total	6	--	4 per batch	6+4 per batch	100	100	200

Note : A practical batch will consist of 20 students.

EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAP-ERS
(For revised syllabus From June-2010)

Old Syllabus		Revised Syllabus
Sr. No.	Title of old Paper	Title of new Paper
1.	Sem.-I Descriptive Statistics I Sem.-II Descriptive Statistics II	Sem.-I Descriptive Statistics I Sem.-II Descriptive Statistics II
2.	Sem.-I Probability and Discrete Probability Distributions Sem.-II Continuous Probability Distributions and Testing of Hypothesis	Sem.-I Probability and Discrete Probability Distributions Sem.-II Continuous Probability Distributions and Testing of Hypothesis
3.	Statistics Practical I	Statistics Practical

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