Rayat Shikshan Sanstha's
Yashvantrao Chavan Institute of Science, Satara
(An Autonomous Institute)
Syllabus for Bachelor of Science Part-I

1. TITLE: Department of Statistics

2. YEAR OF IMPLEMENTATION: JUNE 2018

3. PREAMBLE:

4. GENERAL OBJECTIVES OF THE COURSES:

I. To emphasize the need for numerical summery for data analysis
II. To develop analysis skill of students to use appropriate statistical techniques to solve problems in real life.
III. To develop Placement Cell for the student of Statistics through campus interview.
IV. To introduce the job oriented courses that provide the skill required for various jobs in software/ industry/ Govt./Banking &finance and other.
V. Student may learn fundamental concept in the subject of statistics.
VI. To enrich the general scientific knowledge about the numerical data for solving the social problems.

5. DURATION:

6. PATTERN : SEMESTER CBCS

7. MEDIUM OF INSTRUCTION: ENGLISH

8. STRUCTURE OF COURSE:

(Course structure under Choice Based Credit System (CBCS))

A) **FIRST SEMESTER B.Sc.-I**

Sr. No.	Subject title	Paper No.	Teaching Scheme					
			Theory(TH)			PRACTICAL(PR)		
			No. of Lectures	Hours	Credits	No. of Lectures	Hours	Credits
1	DSC-1A	I & II	5	4	4	4	3.2	2
2	DSC-2A	I & II	5	4	4	4	3.2	2
3	DSC-3A	I & II	5	4	4	4	3.2	2
4	**DSC-4A (BST-101,102) (BSP-103)**	**I & II**	**5**	**4**	**4**	**4**	**3.2**	**2**
5	AECC-1A	I	4	3.2	2	..	..	..
	TOTAL OF SEM-I		**24**	**19.2**	**18**	**16**	**12.8**	**8**

B) **SECOND SEMESTER B.Sc.-I**

Sr. No.	Subject title	Paper No.	Teaching Scheme					
			Theory(TH)			PRACTICAL(PR)		
			No. of Lectures	Hours	Credits	No. of Lectures	Hours	Credits
1	DSC-1B	I & II	5	4	4	4	3.2	2
2	DSC-2B	I & II	5	4	4	4	3.2	2
3	DSC-3B	I & II	5	4	4	4	3.2	2
4	**DSC-4B (BST-201,202) (BSP-203)**	I & II	5	4	4	4	3.2	2
5	AECC-1A	I	4	3.2	2	..	..	..
	TOTAL OF SEM-II		**24**	**19.2**	**18**	**16**	**12.8**	**8**
	TOTAL OF SEM-I &II		**48**	**38.4**	**36**	**32**	**25.6**	**16**

- ✓ **Theory and Practical lectures of 48 minutes each.**
- ✓ **Total marks for B.Sc. part-I Including English=1100**
- ✓ **Total credits for B.Sc.-I Semester I & II = 52**
- ✓ **AECC – Ability Enhancement Compulsory Course (1A and 1B)**

Rayat Shikshan Sanstha's

Yashvantrao Chavan Institute of Science, Satara
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Shivaji University, Kolhapur

B.Sc. Part-I (Statistics) Syllabus with effect from June- 2018

BST-101

Semester I: Statistics Course –I

Statistics –BST-101: DESCRIPTIVE STATISTICS –I

Theory: 36 Lectures (30 Hours)

OBJECTIVES:

The main objectives of this course are:

1) To introduce the technique of data collection & its presentation.
2) To compute various measures of central tendencies, dispersion, moments,skewness, kurtosis and to interpret them.
3) To analyze data pertaining to attributes and to interpret the results.

Unit 1: Statistical Methods: (8L)

Definition and scope of Statistics,concept of statistical population sample,qualitative & quantitative data,variables.Scales of measurements:Nominal, Ordinal, Interval &Ratio.Collection and Summarization of univariate data and frequency distribution.

Data Presentation: Diagrammatic & graphical presentationwith real applications- Pie diagram, line diagram. Simple, multiple & partial bar diagram, histogram, ogive curves.

Unit 2: Measures of Central Tendency and Dispersion: (10L)

Mathematical & positional averages: A.M, G.M, H.M, relation between them (proof for n =2 positive observations) and their properties.Median, mode and their derivation formula for grouped frequency distribution, partition values.

Measures of Dispersion: Range, Quartile deviation, Mean deviation, standard deviation, coefficient of variation. Various properties of these measures and their utility.

Unit 3: Moment, Skewness and Kurtosis: (10L)

Raw and central moments, factorial moments, central moments in terms of raw moment's up to 4^{th} order.

Skewness: Definition, Measures of skewness: Bowley's coefficient, Karl Pearson's coefficient, measure of skewness based on moments.

Kurtosis: Definition, measures of kurtosis, Sheppard's correction.

Unit 4: Theory of Attributes: (8L)

Notation, Dichotomous, class frequency, order of class, positive and negative class frequency, ultimate class frequency, fundamental set of class frequency.Relationship among class frequencies (up to three attributes).Concept of consistency, conditions of consistency (up to three attributes).Independent and association of two attributes, Yule's coefficient of association (Q), coefficient of colligation (Y) Relation between Q and Y.

Learning Outcomes:

Students are able to :

1) **Define-** Mathematical Averages (AM,GM,HM) , Positional Averages (Median, Mode Partition values), Absolute (Range, Q.D., M.D., S.D. and Relative measures of dispersion, Moments Skewness and Kurtosis, Characteristics of Attributes.
2) **Explain-** Constructions of Diagrams and Graphs , Mathematical Averages and Positional Averages, Absolute and Relative measures of dispersion, Moments Skewness and Kurtosis, Characteristics of Attributes.
3) **Write-** Relation between AM ,GM, HM,Derivation of Median and Mode, Properties of Measures of central tendency and dispersion, First four raw and central moments, measures of Skewness and Kurtosis, concept of consistency in attributes, Yules coefficient of association ,coefficient of colligation and relation between them.

Books Recommended

1. Agarwal B. L. Basic Statistics(2015); New Age International (P) Ltd. (for Unit-I , II, III, IV)
   Unit-I: P. No. 13-41
   Unit-II: P. No.42-97
   Unit-III: P.. No. 368-384

2. Goon A.M., Gupta M.K., and Dasgupta B.: Fundamentals of Statistics Vol. I and II, World Press, Calcutta. Unit-I : P. No- 42-89
   Unit-II ,III : P. No. 90-158
3. Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.
   Unit-I: P. No. 39-61, 127-176
   Unit-II: P. No. 177-335
   Unit-III: P. No.337-387
   Unit-IV: P. No. 495-535

4. Gupta (Dr), Statistics: Unit-I: P.No 150-205
   Unit-II: 240-330
   Unit-III: 420-453

5. Elhance D. N. , Fundamental of Statistics (1978), Unit-II : P. No. 87-177
   Unit- III: P. No. 236-249

Yashvantrao Chavan Institute of Science, Satara
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Shivaji University, Kolhapur
B.Sc. Part-I (Statistics) Syllabus with effect from June- 2018
BST-102
Semester I: Statistics Course –I
Statistics –BST-102: Elementary Probability Theory
Theory: 36 Lectures (30 Hours)

OBJECTIVES:

The main objective of this course is to acquaint students with some basic concepts of probability, axiomatic theory of probability, univariate probability distribution . By the end of this course students are expected to be able,

1) To distinguish between random and non-random experiments.
2) To find the probabilities of various events.

Unit-1. Sample space and Events: (9L)

Concepts of experiments and random experiments.

Definitions: Sample space, Discrete sample space (finite and countably infinite), Event, Elementary event, Compound event favorable event Definitions of Mutually exclusive events, Exhaustive events, Impossible events, certain event.Power set |P(Ω) (sample space consisting at most 3 sample points).Illustrative examples.

Equally likely outcomes (events), apriori (classical) definition of probability of an event. Equiprobable sample space, Simple examples of computation of probability of the events based on Permutations and Combinations.

Unit-2. Probability: (9L)

Axiomatic definition of probability with reference to a finite and countably infinite sample space.Proof of the results:

i) $P(\Phi) = 0$, $P(A^c) = 1 - P(A)$,

ii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (with proof) and its generalization (Statement only).

iv) If $A \subset B$, $P(A) \leq P(B)$, v) $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq [P(A) + P(B)]$.

Definition of probability in terms of odd ratio.Illustrative examples based on results.

Unit-3. Conditional Probability and Independence of events: (11L)

Definition of conditional probability of an event.Multiplication theorem for two events..Partition of sample space.Idea of Posteriori probability, Statement and proof of Baye's theorem, examples on Baye's theorem. Elementary examples on probability and conditional probability .

Concept of Independence of two events.Proof of the result that if A and B are independent then, A and B^c, ii) A^c and B, iii) A^c and B^c are independent. Pairwise and Mutual Independence for three events.Elementary examples.

Unit-4. Univariate Probability Distributions (finite sample space): (7L)

Definition of discrete random variable.Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.) of a discrete random variable, Properties of c.d.f. (statements only).Probability distribution of function of random variable. Median and Mode of a univariate discrete probability distribution.

Learning Outcomes:

Students are able to;

1) **Define-** Sample space (Finite and countable infinite) , Power set, Axiomatic definition of probability, Probability Mass function (pmf), Cumulative distribution function (cdf).
2) **Explain-** Random experiment, events and types of events, Conditional Probability and Independence of events.
3) **Write-** Examples on sample space, simple examples on probability based on permutation and combination, Theorems on probability, Properties of cdf.

Books Recommended:

1. Gupta S. P. Statistical Methods; Sultan Publication.(2014); Unit-I,II,III, IV: P. No. 751-803
2. Agarwal B. L. , Basic Statistics (2015), Unit-I : 98-121.
3. Saxena S, Kapoor J. N.; Mathematical Statistics, S. Chand (2005)
   Unit-I: P. No. 69-85
   Unit-II: P. No. 86 -105
4. Kapoor V. k. , Gupat S. C. , Fundamental of Mathematical Statistics(2008) , S. Chand
   Unit-III, IV : 3.1 to 3.98
5. Mukhopadyay Parimal, Theory of Probability (1995),
   Unit-I, II : P. No. 7-84
6. Grewal P. S., Methods of Statistical Analysis, Sterling Publishers, (1990)
   Unit-III, IV : P. No. 744 – 825

B.Sc-I / Semester-I
BSP-103: Practical Paper-I

Objectives:

1. To represent statistical data.
2. To compute various measures of central tendency, dispersion, moments, Skewness and kurtosis.
3. To understand Consistency, Association and Independence of Attributes.

List of Practicals:

1. Diagrammatic & Graphical representation of the frequency distribution (Line diagram, Bar diagram, Pie diagram, Histogram, frequency polygon, frequency curve, Location of Mode, Ogive curves, Location of Partition values).
2. Measures of Central Tendency (ungrouped and grouped data).
3. Measures of Dispersion (ungrouped and grouped data).
4. Moments, Skewness and Kurtosis (ungrouped data).
5. Moments, Skewness and Kurtosis (grouped data).
6. Attributes (consistency, Association & Independence).
7. Applications of Probability-I (Elementary Examples based on definition of probability by using combination and permutation, examples based on expectations)
8. Applications of Probability-II (Examples based on Conditional expectation and Variance,
9. Applications on Bayes' theorem.
10. Applications on IndependenceProbability

(***Note**: Expt. No. 1 to 3 are expected to solve using MS-EXCEL/ R-Software)

Learning Outcomes:

1) Students are able to draw diagram and graphs based on frequency distribution
2) Students are understand how to summarized data and find averages as well as spread of the data from central value (average).
3) Students get the knowledge about to compute moments and find out symmetry and skew symmetry of data.
4) Students are become to find the probabilities of events and conditional probabilities.

Notes:

i) Students must complete all the practices to the satisfaction of the concerned teacher.
ii) Students must produce laboratory journal along with completion certificate signed by Head of the Department at the time of practical examination.
iii) Knowledge of MS-Excel spread sheet should be tested on computer at the time of viva-voce.

Laboratory Requirement:

Laboratory should be well equipped with sufficient number of scientific calculators and computers along with necessary software's, UPS, and printers.

Yashavantrao Chavan Institute of Science, Satara
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Shivaji University, Kolhapur
B.Sc. Part-I (Statistics) Syllabus with effect from June- 2018
BST- 201
Semester II: Statistics Course –II
Statistics –BST-201: Descriptive Statistics–II
Theory: 36 Lectures (30 Hours)

OBJECTIVES:

1. To compute correlation coefficient for bivariate data,interpreted it's value & use in Regression analysis
2. Understand the concept of Multivariate data

Unit 1: Correlation and Regression: (12L)

Bivariate Data, Covariance: Definition, Effect of change of origin and scale, Concept of correlation between two variables, Types of correlation. Scatter diagram and its utility.Karl Pearson's coefficient of correlation (r): Definition, Computation for ungrouped and grouped data, Properties: i) $-1 \leq r \leq 1$, ii) Effect of change of origin and scale. (iii) Interpretation when $r = -1, 0, 1$.

Spearman's rank correlation coefficient: Definition, Computation (with and without ties). Derivation of the formula for without ties (In case of ties students are expected to compute Karl Pearson Correlation Coefficient), Illustrative examples.

Simple linear regression: Concept of regression, Lines of regression, Fitting of lines of regression by the least squares method. Regression coefficients (b_{xy}, b_{yx}) and their geometric interpretations,

Properties: i) $b_{xy} \times b_{yx} = r^2$, ii) $b_{xy} \times b_{yx} \leq 1$, iii) $(b_{xy} + b_{yx}) / 2 \geq r$, iv) Effect of change of origin and scale on regression coefficients, v) the point of intersection of two regression lines. Derivation of acute angle between the two lines of regression. Coefficient of determination. Illustrative examples.

Unit-2. Multiple and Partial Correlation: (10L)

Concept of multiple correlations. Definition of multiple correlation coefficient $R_{i.jk}$, derivation of formula for multiple correlation coefficient.Properties of multiple correlation coefficient; i) $0 \leq R_{i.jk} \leq 1$, (ii) $R_{i.jk} > |r_{ij}|$, (iii) $R_{i.jk} > |r_{ik}|$ $i = j = k = 1, 2, 3$. $i \neq j$, $i \neq k$.

Interpretation of $R_{i.jk}=1$, $R_{i.jk}= 0$, coefficient of multiple determination $R_{1.23}$.

Concept of partial correlation. Definition of partial correlation coefficient $r_{ij.k}$, derivation of formula for $r_{ij.k.}$ Properties of partial correlation coefficient (i) $-1 \leq r_{ij.k} \leq 1$, (ii) $b_{ij.k} \cdot b_{ji.k} = r^2_{ij.k.,}$ relation between simple, multiple and partial correlation.

Illustrative Examples.

Unit-3 **(7L)**

Multiple Linear Regression (for trivariate data only): Concept of multiple linear regression, Plane of regression, Yule's notation, correlation matrix.Fitting of regression plane by method of least squares, definition of partial regression coefficients and their interpretation.Residual: definition, order, properties, derivation of mean and variance, Covariance between residuals.

Unit 4: Index Numbers: **(7L)**

Meaning and utility of index numbers, problems in construction of index numbers.

Types of index numbers: price, quantity and value. Unweighted and weighted index numbers using (i)aggregate method,(ii) average of price or quantity relative method. Index numbers using; Laspeyre's, Paasche's and Fisher's method. Tests of index numbers: unit test, time reversal test and factor reversal tests. Illustrative examples.

Learning Outcomes:

Students are able to :

Define- Types of correlation, fitting of line of Regression, Coefficient of Determination, Residual, Unweighted and Weighted index numbers.

Explain- Bivariate data, Correlation , Regression, Multiple and Partial correlation, Multiple Regression, Index Number, Types of Index Number.

Write- Interpretation of r if r=1,r= -1, r= 0, Properties of correlation coefficient, Derivation of the formula for Spearman's rank correlation coefficient, Fitting of regression plan by method of least square, Properties of Multiple and Partial correlation coefficient, Price , Quantity and Value index number.

Books Recommended:

1. Gupta.S.P.2002: Statistical methods, Sultan Chand & Son's New Delhi.
   (Unit-I, II): P. No- 389-493
2. Gupta S. P. Statistical Methods; Sultan Publication.(2014); Unit-I,II,III, IV: P. No. 751-803
3. Agarwal B. L. , Basic Statistics (2015), Unit-I : 98-121.
4. Saxena S, Kapoor J. N.; Mathematical Statistics, S. Chand (2005)
   Unit-I, II: P. No. 377-383
5. Kapoor V. k. , Gupat S. C. , Fundamental of Mathematical Statistics(2008) , S. Chand
   Unit-I , II, III, IV : 10.1 – 11.26
6. Grewal P. S., Methods of Statistical Analysis, Sterling Publishers, (1990)
   Unit-I,II : P. No. 366-486

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B.Sc. Part-I (Statistics) Syllabus with effect from June- 2018

BST-202

Semester II: Statistics Course –II

Statistics –BST-202: Probability and Probability Distribution

Theory: 36 Lectures (30 Hours)

OBJECTIVES:

The main objective of this course is to acquaint students with standard probability discrete distributions, bivariate probability distribution.

1. To apply discrete probability distributions studied in this course in different situations.
2. Distinguish between discrete random variables based on finite and countably infinite sample space and study of their distributions.
3. Know some standard discrete probability distributions with real life situations.

Unit-1. Mathematical expectation (Univariate random variable): (8L)

Definition of expectation of a random variable, expectation of a function of a random variable. Results on expectation, i) E (c) = c, where c is a constant, ii) E (aX + b) = aE (X) + b, where a and b are constants.

Definitions of mean, variance of univariate distributions.Effect of change of origin and scale on mean and variance.

Definition of raw, central moments.Pearson's coefficient of skewness, kurtosis.

Definition of probability generating function (p.g.f.) of a random variable.Effect of change of origin and scale on p.g.f. Definition of mean and variance by using p.g.f.

Examples.

Unit-2. Some Standard Discrete Probability Distributions: (finite sample space): (10L)

Definition of discrete random variable (defined on finite sample space)

Idea of **one point**, **two point** distributions and their mean and variances.

Bernoulli Distribution: p.m.f., mean, variance, distribution of sum of independent and identically distributed Bernoulli variables.

Discrete Uniform Distribution: p.m.f., mean and variance.

Binomial Distribution: Binomial random variable, p.m.f. with parameters (n, p), Recurrence relation for successive probabilities, Computation of probabilities of different events, mean and variance, mode, skewness, p.g.f., Additive property of binomial variates. Examples.

Hyper geometric Distribution: p.m.f.with parameters (N, M, n), Computation of probability of different events, Recurrence relation for successive, probabilities, mean and variance of distribution assuming $n \leq N - M \leq M$, approximation of Hypergeometric to Binomial. Examples.

Unit-3. Some Standard Discrete Probability Distributions: (countably infinite sample space): Poisson, Geometric and Negative Binomial Distribution (8L)

Definition of discrete random variable (defined on countably infinite sample space)

Poisson Distribution: Definition of Poisson with parameter λ . Mean, variance**,** probability generating function (p.g.f.). Recurrence relation for successive Probabilities, Additive property of Poisson distribution.Poisson distribution as a limiting case of Binomial distribution, examples.

Geometric Distribution: Definition of Geometric with parameter p. Mean, Variance, distribution function, p.g.f., Lack of memory property, examples.

Negative Binomial Distribution: Definition of Negative Binomial with parameters (k, p), Geometric distribution is a particular case of Negative Binomial distribution, Mean, Variance, p.g.f., Recurrence relation for successive probabilities, examples.

Unit-4. Bivariate Discrete Distribution:

(10L)

Definition of bivariate discrete random variable (X,Y) on finite sample space, Joint p.m.f., and c.d.f., Properties of c.d.f. (without proof). Computation of probabilities of events in bivariate probability distribution, concept of marginal and conditional probability distribution, independence of two discrete r.v.s, Examples.

Mathematical Expectation: Definition of expectation of function of r.v. in bivariate distribution, Theorems on expectations: (i) $E(X+Y) = E(X) + E(Y)$ (ii)$E(XY) = E(X)\cdot E(Y)$ when X and Y are independent, expectation and variance of linear combination of two discrete r.v.s., definition of conditional mean, conditional variance, covariance and correlation coefficient, $Cov(aX+bY,cX+dY)$, distinction between uncorrelated and independent variables, jointp.g.f, proof of the p.g.f. of sum of two independent r.v.as the product of their p.g.f. examples.

Learning Outcomes:

Students are able to ;

Define- Random Variable**,** Expectation of random variable , Mean, Variance, Raw and central moments based on expectation of random variable, pgf, Bernoulli , Binomial, Discrete Uniform, Hypergeometric distributions, Poisson distribution, Geometric and Negative Binomial Distribution, Bivariate discrete random variable.

Explain- Results on expectation of random variable, Mean and variance by using pgf.

Write- Properties of pgf, Probability mass function-Mean-Variance-moments- cdf for standard discrete probability distribution , Recurrence relation, concept of marginal and conditional probability, Theorems on expectation, conditional mean and conditional variance.

Books Recommended:

1. Gupta S. P. Statistical Methods; Sultan Publication.(2014); Unit-I,II,III, IV: P. No. 751-803
2. Agarwal B. L. , Basic Statistics (2015), Unit-I : 98-121.
3. Saxena S, Kapoor J. N.; Mathematical Statistics, S. Chand (2005)
   Unit-I: P. No. 126-140
   Unit-II: P. No. 179-190
4. Kapoor V. K. , Gupat S. C. , Fundamental of Mathematical Statistics(2008) , S. Chand
   Unit-III, IV : 4.1 – 5.72
5. Mukhopadyay Parimal, Theory of Probability (1995),
   Unit-I, II, III : P. No. 183-213
6. Grewal P. S., Methods of Statistical Analysis, Sterling Publishers, (1990)
   Unit-III, IV : P. No. 828-890
7. Gupta.S.P.2002: Statistical methods, Sultan Chand & Son's New Delhi.
   Unit-I, II, III: P. No.- 751 to 803, 805-858

B.Sc.-I / Semester –II
BSP-203: Practical Paper-II

List of Practicals:

1. Correlation coefficient (ungrouped data and grouped data)
2. Regression (ungrouped data and grouped data).
3. Multiple and partial correlation coefficients.
4. Multiple regressions.
5. Index Number
6. Bivariate Discrete distribution I. (Marginal & conditional distribution, computation of probabilities of events).
7. Bivariate Discrete distribution II (Expectations /conditional expectations / variances / conditional variance /covariance / correlation coefficient)
8. Applications of Binomial and PoissonDistributions.
9. Applications of Hypergeometric Distribution.
10. Applications of Geometric and Negative Binomial Distributions.

(*Note: Expt. No. 8,9,10 are expected to solve using MS-EXCEL/ R-Software)

Learning Outcomes:

1) Students are able to find the coefficient of correlation between two and more variables.
2) Students are predicts value of one variable when other is known by using technique of regression analysis
3) To compute the price and quantity index number.
4) Students must get knowledge about the how to use probability distribution to evaluate examples.

Notes:

i) Students must complete all the practices to the satisfaction of the concerned teacher.
ii) Students must produce laboratory journal along with completion certificate signed by Head of the Department at the time of practical examination.
iii) Knowledge of MS-Excel spread sheet should be tested on computer at the time of viva-voce.

Laboratory Requirement:

Laboratory should be well equipped with sufficient number of scientific calculators and computers along with necessary software's, UPS, and printers.