Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

Autonomous

Course Structure for F. Y. B. Sc. STATISTICS

Semester	Paper Code	Title of Paper	No. of Credits
I	STAT1101	Descriptive Statistics- I	2
	STAT1102	Discrete Probability and Probability Distributions - I	2
	STAT1103	Practical-I	2
II	STAT1201	Descriptive Statistics-II	2
	STAT1202	Discrete Probability and Probability Distributions – II	2
	STAT1203	Practical-II	2

Programme Outcomes

PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	**Social competence:** Display the understanding, behavioural skills needed for successful social adaptation , work in groups, exhibit thoughts and ideas effectively in writing and orally
PO4	**Research-related skills and Scientific temper :** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	**Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem

PO6	**Personal and professional competence:** Performing dependently and also collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

SYLLABUS(CBCS) FOR F. Y. B. Sc. STATISTICS (w.e. from June, 2019)

Academic Year 2019-2020

Class : **F.Y. B. Sc. (Semester- I)**
Paper Code: **STAT-1101**
Paper : **I** Title of Paper: Descriptive Statistics- I
Credit : 2 credits No. of lectures: 36

A) Course Objectives:

1. Compute various measures of central tendency, dispersion, skewness and kurtosis.
2. Visualization of data.

B) Course Outcome:

By the end of the course, students will be able to:

CO1. Acquaint students with initial description of the data as part of a more extensive statistical analysis by using some elementary statistical methods.

CO2. Categorize different types of data accurately.

CO3. Data representation and visualization.

CO4. Recognize real-world examples of structured, unstructured, and semi-structured data.

CO5. Do computation of various measures of central tendency.

CO6. Do computation of various measures of dispersion. **.**

CO7. Grasp the significance of dispersion measures in data analysis.

TOPICS/CONTENTS:

UNIT1: Organization and presentation of data (4L)

1.1 Meaning, importance and scope of statistics.

1.2 Classification and tabulation.

1.3 Construction of frequency distribution.

UNIT2: Population and Sample (8L)

2.1 Types of characteristics :
Attributes : Nominal scale, ordinal scale
Variable : Interval scale, ratio scale, discrete and continuous variables

2.2 Types of data
(a) Primary data, secondary data
(b) Cross-sectional data, chronological data.

2.3 Notion of a statistical population: Finite population, infinite population, homogeneous population and heterogeneous population. Notion of a sample and a random sample.

2.4 Methods of sample (Description only): Simple random sampling with and without replacement (SRSWR and SRSWOR), stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.

UNIT3: Univariate data analysis (16L)

3.1 Classification : Raw data and its classification, ungrouped frequency distribution, Sturges' rule, method of classification inclusive and exclusive, open end classes , (grouped frequency distribution cumulative frequency distribution), relative frequency distribution

3.2 Measures of Central Tendency: Concept of central tendency of statistical data, statistical average, characteristics of a good statistical average.

Arithmetic Mean (AM): Definition effect of change of origin and scale, combined mean of a number of groups, merits and demerits, trimmed arithmetic mean.

Median: Definition, merits and demerits, Partition values: Quartiles deciles and percentiles (for ungrouped and grouped data).

Mode: Definition, merits and demerits, empirical relation between mean, median and mode (without proof)

Geometric Mean (GM): Definition, formula, merits and demerits

Harmonic Mean (HM): Definition, formula, merits and demerits

Relation between H.M., G.M. and A.M.

3.3 Measures of Dispersion: Concept of dispersion, characteristics of good measures of dispersion. Range, semi-interquartile range (quartile deviation): Definition, merits and demerits. Mean deviation Definition, merits and demerits, minimality property (without proof).

Variance and standard deviation: Definition merits and demerits, effect of change of origin and scale, combined variance for n groups (derivation for two groups).

Mean squared deviation: Definition, minimality property of mean squared deviation (without proof), merits and demerits measures of dispersion for comparison: coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation (CV)

UNIT4: Moments, Skewness and Kurtosis (8L)

Raw moments (μ_r') for ungrouped and grouped data.

Central moments (μ_r) for ungrouped and grouped data, effect of change of origin and scale.

Relations between central moments and raw moments, up to 4th order

Concept of skewness of frequency distribution: Definition, type of skewness, measures of skewness;

i. Karl Pearson coefficient of skewness
ii. Pearsonian coefficient of skewness
iii. Bowley's coefficient of skewness

Bowley's coefficient of skewness lies between -1 to 1 (with proof)

Interpretation using box plot

Concept of kurtosis of frequency distribution: Definition, types of kurtosis, measure of kurtosis based on moments and partition values. Examples and problem.

References:

1. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol.II, World Press, Calcutta.
2. Gupta and Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

3. Sarma K. V. S. (2001) Statistics made it simple: Do it yourself on PC. Prentce Hall of India, New Delhi.
4. Gupta and Kapoor : Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
5. B. L. Agarwal : Programmed Statistics, New Age International Publishers, New Delhi.
6. David Freedman, Robert Pisani, Roger Purves: Statistics
7. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye: Probability & Statistics for Engineers & Scientists

Programme Outcomes and Course Outcomes Mapping:

Course Outcomes	**Programme Outcomes (POs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3								
CO2	3								
CO3		3				3			
CO4	2								
CO5		3							
CO6		3							
CO7		3		3					

PO-1: Disciplinary Knowledge

CO1: Acquaint students with the initial description of the data using elementary statistical methods.

Weightage: 3 (Strongly Related)

Justification: Understanding elementary statistical methods is fundamental to disciplinary knowledge in statistics.

CO2: Categorize different types of data accurately.

Weightage: 3 (Strongly Related)

Justification: Accurate categorization of data types is a basic skill in statistics and contributes significantly to disciplinary knowledge.

CO4: Recognize real-world examples of structured, unstructured, and semi-structured data.

Weightage: 2 (Moderately Related)

Justification: Recognizing data types is related to disciplinary knowledge, though not as strongly as other concepts.

PO-2: Critical Thinking and Problem Solving

CO3: Data representation and visualization.

Weightage: 3 (Strongly Related)

Justification: Representing and visualizing data requires critical thinking skills and problem-solving abilities.

CO5: Do computation of various measures of central tendency.

Weightage: 3 (Strongly Related)

Justification: Computing measures of central tendency involves critical thinking and problem-solving.

CO6: Do computation of various measures of dispersion.

Weightage: 3 (Strongly Related)

Justification: Computing measures of dispersion also involves critical thinking and problem-solving.

CO7: Grasp the significance of dispersion measures in data analysis.

Weightage: 3 (Strongly Related)

Justification: Understanding the significance of dispersion measures demonstrates critical thinking in data analysis.

PO-4: Research-related Skills and Scientific Temper

CO7: Grasp the significance of dispersion measures in data analysis.

Weightage: 3 (Strongly Related)

Justification: Understanding the significance of dispersion measures contributes to research-related skills and scientific temper.

PO-6: Personal and Professional Competence

CO3: Data representation and visualization.

Weightage: 3 (Strongly Related)

Justification: Effective data representation and visualization contribute to personal and professional competence.

SYLLABUS(CBCS) FOR F. Y. B. Sc. STATISTICS (w.e. from June, 2019)

Academic Year 2019-2020

Class : **F.Y. B. Sc. (Semester- I)**
Paper Code: **STAT-1102**
Paper : **II** Title of Paper : Discrete Probability and Probability Distributions - I

Credit : 2 credits No. of lectures: 36

B) Course Objectives:

The main objective of this course is to acquaint students with some basic concepts of probability, axiomatic theory of probability, concept of random variable, probability distribution (univariate) and visualization of nature of distribution.

C) Course Outcome:

By the end of the course, students will be able to:

CO1. Distinguish between random and non-random experiments.

CO2. Find the probabilities of various events.

CO3. Obtain probability distribution of univariate discrete random variables.

CO4. Studying probability will help children to develop critical thinking skills and to interpret the probability that surround us daily.

CO5. Probability Distributions give up the possible outcome of any random event.

CO6. Demonstrate critical thinking and problem-solving skills by applying discrete probability and probability distribution concepts to various applied problems.

CO7. Communicate probability concepts and findings effectively through well-structured written reports and clear oral presentations.

TOPICS/CONTENTS:

Unit-1. Sample space and Events: (6L)

1.1 Concepts of experiments, deterministic and nondeterministic experiments.

1.2 Definitions: Sample space, Types of sample space, Event, Types of Events: Elementary event, Complementary event, sure event, impossible event.

1.3 Concept of occurrence of an event, Equally-likely events

1.4 Algebra of events (Union, Intersection, Complementation).

1.5 Definitions of Mutually exclusive events, Exhaustive events.

1.6 Algebra of events and its representation of events in set theory notation:

Occurrence of the following events:

i) at least one of the given events

ii) none of the given events

iii) all of the given events

iv) mutually exclusive events

v) mutually exhaustive events

vi) exactly one event out of the given events.

1.7 Illustrative examples.

Unit-2. Probability: (8L)

2.1 Concept of Permutations and Combinations

Equiprobable and nonequiprobable sample space, Classical definition of probability, examples.

Probability model, probability of an event, examples. Axiomatic approach of probability.

2.2 Proof of the results:

i) $P(\Phi) = 0$,

ii) $P(A^c) = 1 - P(A)$,

iii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (Addition theorem of probability) and its generalization (Statement only).

iv) If $A \subset B$, $P(A) \leq P(B)$

v) $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$.

vi) $P(A \cup B) \leq P(A) + P(B)$ (Boole's Inequality) and its generalization (Statement only).

2.3 Definition of probability in terms of odd ratio.

2.4 Illustrative examples

Unit-3. Conditional Probability and Independence of events: (6L)

3.1 Definition of conditional probability of an event.

3.2 Multiplication theorem for two and three events.

3.4 Partition of sample space.

3.5 Idea of Posteriori probability, Statement and proof of Bayes' theorem, examples on Bayes' theorem.

3.6 Sensitivity and specificity

3.7 Concept of Independence of two events.

3.8 Proof of the result that if events A and B are independent then,

i) A and B^c,

ii) A^c and B

iii) A^c and B^c are independent.

3.9 Pairwise and Mutual Independence for three events.

3.10 Illustrative examples.

Unit-4. Univariate Probability Distributions (finite sample space): (8L)

4.1 Definition of discrete random variable.

4.2 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).

4.3 Probability distribution of function of random variable.

4.4 Median and Mode of a univariate discrete probability distribution.

4.5 Illustrative examples.

Unit-5 Mathematical expectation (Univariate random variable) (8L)

5.1 Definition of expectation of a random variable, expectation of a function of a random variable.

5.2 Definition of variance, standard deviation (s.d.), Effect of change of origin and scale on mean, variance and s.d.of random variable.

5.3 Definition of raw, central and factorial moments of univariate probability distributions and their interrelations

5.4 Definition of moment generating function (m.g.f.), deduction of moments from m.g.f.and properties of m.g.f.: i) $M_x(0) = 1$ ii) Effect of change of origin and scale on m.g.f. iii) Additive property of m.g.f.

5.5 Definition of cumulant generating function (c.g.f) deduction of cumulants from c.g.f. and properties of c.g.f.: ii) Effect of change of origin and scale on c.g.f. iii) Additive property of c.g.f.

5.6 Probability generating function (p.g.f)

5.7 Nature of probability distribution by using Pearsonian Coefficient of skewness and kurtosis
Raw moments, mean and variance by using m.g.f.

5.8 Illustrative examples.

References:

1. Bhat B. R., Srivenkatramana T and Madhava Rao K. S. (1997): Statistics: a Beginner's Text, Vol. II, New Age International (P) Ltd.
2. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol.II, World Press, Calcutta.
3. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
4. Gupta and Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
5. Meyer P.L.(1970): Introductory Probability and Statistical Applications, Edition Wesley.

6. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia)
7. Gupta and Kapoor : Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
8. B. L. Agarwal : Programmed Statistics, New Age International Publishers, New Delhi.
9. Wayne W. Daniel : Biostatistics

Programme Outcomes and Course Outcomes Mapping:

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3								
CO2	3								
CO3	3								
CO4		3							
CO5									
CO6		3							2
CO7						3			

PO-1: Disciplinary Knowledge

CO1: Distinguish between random and non-random experiments.

Weightage: 3 (Strongly Related)

Justification: Distinguishing between random and non-random experiments is foundational knowledge in probability and statistics.

CO2: Find the probabilities of various events.

Weightage: 3 (Strongly Related)

Justification: Calculating probabilities of events is a fundamental aspect of disciplinary knowledge in probability.

CO3: Obtain probability distribution of univariate discrete random variables.

Weightage: 3 (Strongly Related)

Justification: Understanding and obtaining probability distributions aligns directly with disciplinary knowledge.

PO-2: Critical Thinking and Problem Solving

CO4: Studying probability will help children to develop critical thinking skills and to interpret the probability that surrounds us daily.

Weightage: 3 (Strongly Related)

Justification: Studying probability enhances critical thinking skills and problem-solving abilities.

CO6: Demonstrate critical thinking and problem-solving skills by applying discrete probability and probability distribution concepts to various applied problems.

Weightage: 3 (Strongly Related)

Justification: Applying probability and distribution concepts to real-world problems directly demonstrates critical thinking and problem-solving.

PO-6: Personal and Professional Competence

CO7: Communicate probability concepts and findings effectively through well-structured written reports and clear oral presentations.

Weightage: 3 (Strongly Related)

Justification: Effective communication of probability concepts contributes to personal and professional competence.

PO-9: Self-directed and Life-long Learning

CO6: Demonstrate critical thinking and problem-solving skills by applying discrete probability and probability distribution concepts to various applied problems.

Weightage: 2 (Moderately Related)

Justification: Applying probability concepts in various scenarios encourages self-directed and lifelong learning.

SYLLABUS (CBCS) FOR F. Y. B. Sc. STATISTICS (w.e. from June, 2019)

Academic Year 2019-2020

Class : **F.Y. B. Sc. (Sem-I)**
Paper Code: **STAT-1103**
Paper : **III** Title of Paper: Practical-I

Credit : 2 credits No. of lectures: 40

Pre requisites: Knowledge of the topics in the theory papers.

A) Course Objectives:

The main objective of this course is to acquaint students with concept of developing computing abilities.

B) Course Outcome:

At the end of this course students are expected to be able

CO1. Represent statistical data diagrammatically and graphically.

CO2. Compute various measures of central tendency, dispersion, moments, skewness and kurtosis.

CO3. Compute correlation coefficient, regression coefficients and to interpret the results.

CO4. Interpret summary Statistics of computer output.

CO5. Use statistical tools like graphical representation, summary statistics of data with the help of MS-Excel

CO6. Examine spreadsheet concepts and explore the Microsoft Office Excel environment.

CO7. Gather information in a measured and systematic manner to ensure accuracy and facilitate data analysis.

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6	Moments, Skewness and Kurtosis for both ungrouped and grouped data.
7	Correlation coefficient and Spearman's Rank correlation (ungrouped)
8	Simple Regression for both ungrouped.
9	Finding A.M., G.M., H.M., Variance, C.V., M.D. Moments using **R** software.

Programme Outcomes and Course Outcomes Mapping:

Course Outcomes	**Programme Outcomes (POs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3								
CO2	3								
CO3	3								
CO4		3							
CO5		3				3			
CO6		2							
CO7				3					

PO-1: Disciplinary Knowledge

CO1: Represent statistical data diagrammatically and graphically.

Weightage: 3 (Strongly Related)

Justification: Diagrammatic and graphical representation of statistical data is fundamental to disciplinary knowledge in statistics.

CO2: Compute various measures of central tendency, dispersion, moments, skewness, and kurtosis.

Weightage: 3 (Strongly Related)

Justification: Computing various statistical measures is a core aspect of disciplinary knowledge in statistics.

CO3: Compute correlation coefficient, regression coefficients and to interpret the results.

Weightage: 3 (Strongly Related)

Justification: Computing and interpreting correlation and regression coefficients is fundamental to statistical analysis.

PO-2: Critical Thinking and Problem Solving

CO4: Interpret summary Statistics of computer output.

Weightage: 3 (Strongly Related)

Justification: Interpreting computer output requires critical thinking skills in understanding and analyzing statistical results.

CO5: Use statistical tools like graphical representation, summary statistics of data with the help of MS-Excel.

Weightage: 3 (Strongly Related)

Justification: Using statistical tools in MS-Excel involves critical thinking and problem-solving in data analysis.

CO6: Examine spreadsheet concepts and explore the Microsoft Office Excel environment.

Weightage: 2 (Moderately Related)

Justification: While exploring Excel involves practical skills, it is moderately related to critical thinking in data analysis.

PO-4: Research-related Skills and Scientific Temper

CO7: Gather information in a measured and systematic manner to ensure accuracy and facilitate data analysis.

Weightage: 3 (Strongly Related)

Justification: Gathering information systematically contributes to research-related skills and scientific temper.

PO-6: Personal and Professional Competence

CO5: Use statistical tools like graphical representation, summary statistics of data with the help of MS-Excel.

Weightage: 3 (Strongly Related)

Justification: Utilizing statistical tools in MS-Excel enhances personal and professional competence in data management.