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

Course Structure for F. Y. B. Sc. STATISTICS (2022 Pattern)

Name of the Programme: B.Sc. Statistics

Program Code: USST

Class: F.Y.B.Sc.

Semester: I

Paper Code	Title of Paper	No. of Credits
USST111	Descriptive Statistics – I	2
USST112	Discrete Probability and Probability Distributions – I	2
USST113	Practical – I	2
USST121	Descriptive Statistics – II	2
USST122	Discrete Probability and Probability Distributions – II	2
USST123	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, 2022)
(2022 Pattern)

Name of the Programme : B.Sc. Statistics
Program Code : USST
Class : F.Y.B.Sc.
Semester : I
Course Name : Descriptive Statistics – I
Course Code : USST111
No. of lectures : 36
Credit : 2 credits

A) Course Outcomes:

The students will acquire knowledge about the;

CO1. importance and scope of statistics

CO2. population and sample

CO3. central tendency and its various measures

CO4. Dispersion and its various measures

CO5. skewness and kurtosis

CO6. visualization of data

CO7. Summarize and organize data effectively using appropriate graphical representations and descriptive statistics techniques.

CO8. Interpret and analyze data sets accurately, identifying patterns and trends.

TOPICS/CONTENTS:

UNIT 1: Introduction   (4L)

1.1 Meaning

1.2 Importance and scope of statistics

1.3 Statistical organization in India

1.4 Glimpses of India's statistical Heritage

UNIT 2: Population and Sample   (5L)

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: Design of Questionnaire, 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.

2.5 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

UNIT 3: Measures of Central Tendency (10L)

3.1 Concept of central tendency of statistical data, statistical average, characteristics of a good statistical average.

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

3.3 Median: Definition, merits and demerits

3.4 Partition values: Quartiles deciles and percentiles (for ungrouped and grouped data).

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

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

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

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

UNIT 4: Measures of Dispersion (10L)

4.1 Concept of dispersion, characteristics of good measures of dispersion.

4.2 Range, semi-inter quartile range (quartile deviation): Definition, merits and demerits.

4.3 Mean deviation: Definition, merits and demerits, minimality property (without proof).

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

4.5 Mean squared deviation: Definition, minimality property of mean squared deviation (without proof), merits and demerits

4.6 measures of dispersion for comparison: coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation (CV)

UNIT 5: Moments, Skewness and Kurtosis   (7L)

5.1 Raw moments for ungrouped and grouped data.

5.2 Central moments for ungrouped and grouped data, effect of change of origin and scale.

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

5.4 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

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

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. Sharma 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								
CO4	3								
CO5		3							
CO6		3							
CO7		3	3						
CO8				3					

PO-1: Disciplinary Knowledge

CO1: Importance and scope of statistics

- **Weightage:** 3 (Strongly Related)
- **Justification:** Understanding the importance and scope of statistics is fundamental to disciplinary knowledge in data analysis.

CO2: Population and sample

- **Weightage:** 3 (Strongly Related)
- **Justification:** Knowledge of populations and samples is essential for a strong foundation in statistical principles.

CO3: Central tendency and its various measures

- **Weightage:** 3 (Strongly Related)
- **Justification:** Central tendency measures are core concepts in statistical analysis and contribute significantly to disciplinary knowledge.

CO4: Dispersion and its various measures

- **Weightage:** 3 (Strongly Related)
- **Justification:** Understanding dispersion is crucial for a comprehensive grasp of statistical concepts within the discipline.

PO-2: Critical Thinking and Problem Solving

CO5: Skewness and kurtosis

- **Weightage:** 3 (Strongly Related)
- **Justification:** Analyzing skewness and kurtosis involves critical thinking and problem-solving skills in interpreting data distribution.

CO6: Visualization of data

- **Weightage:** 3 (Strongly Related)
- **Justification:** Creating visual representations demands critical thinking skills to effectively communicate information from data.

CO7: Summarize and organize data effectively using appropriate graphical representations and descriptive statistics techniques

- **Weightage:** 3 (Strongly Related)
- **Justification:** This directly aligns with critical thinking in selecting appropriate techniques for data representation.

PO-3: Social Competence

CO7: Summarize and organize data effectively using appropriate graphical representations and descriptive statistics techniques

- **Weightage:** 2 (Moderately Related)
- **Justification:** Social competence involves effective communication, and summarizing data using visuals aligns with this competency.

PO-4: Research-related Skills and Scientific Temper

CO8: Interpret and analyze data sets accurately, identifying patterns and trends

- **Weightage:** 3 (Strongly Related)
- **Justification:** Analyzing data sets and identifying patterns directly contribute to research-related skills and scientific temper.

SYLLABUS (CBCS) FOR F. Y. B. Sc. STATISTICS
(w. e. from June, 2022)
(2022 Pattern)

Name of the Programme : B.Sc. Statistics
Program Code : USST
Class : F.Y.B.Sc.
Semester : I
Course Name : Discrete Probability and Probability Distributions - I
Course Code : USST112
No. of lectures : 36
Credit : 2 credits

Course Outcomes:

The students will acquire knowledge about the,

CO1. Random experiment, the difference between deterministic and nondeterministic experiments, sample space, an event, probability of an event, and the conditional probability of an event.

CO2. Computation of probabilities in case of nondeterministic experiments.

CO3. Application of the Bayes' theorem in real-life situations problems.

CO4. Univariate random variable, univariate discrete random variable and its probability distribution.

CO5. The Concepts of mean, median, and mode of a univariate discrete random variable

CO6. Find the probabilities of various events.

CO7. Obtain probability distribution of univariate discrete random variables.

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 non-equiprobable sample space, Classical definition of probability, examples.

Probability model, probability of an event, examples. The axiomatic approach of probability.

2.2 Important results and their proofs 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) $(A \cup B) \leq (A) + P(B)$ (Boole's Inequality) and its generalization (Statement only).

2.3 Interpretation of probability in terms of odds ratio.

2.4 Illustrative examples.

Unit 3: Conditional Probability and Independence of Events (6L)

3.1 Definition of the 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 a 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 a function of a 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, the 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 the 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 Nature of probability distribution by using Pearsonian Coefficient of skewness and

kurtosis

5.7 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

10. Brase C. H. and Brase C. P., (2018), Understandable Statistics, Twelfth Edition, Cengage Learning.

11. Biston Moore D. S., Notz W. I., Flinger M. A., (2013), The Basic Practice of Statistics, Sixth Edition, Freeman and Company New York

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	3							
CO5	3	3							
CO6	2	2							
CO7				3					

PO-1: Disciplinary Knowledge

CO1: Random experiment, the difference between deterministic and nondeterministic experiments, sample space, an event, probability of an event, and the conditional probability of an event

Weightage: 3 (Strongly Related)

Justification: This CO covers fundamental concepts in probability theory, contributing significantly to disciplinary knowledge.

CO2: Computation of probabilities in case of nondeterministic experiments

Weightage: 3 (Strongly Related)

Justification: Computing probabilities in nondeterministic experiments is a key aspect of statistical knowledge within the discipline.

CO3: Application of the Bayes' theorem in real-life situations problems

Weightage: 3 (Strongly Related)

Justification: Applying Bayes' theorem demonstrates a deep understanding of probability theory and its practical applications within the discipline.

PO-2: Critical Thinking and Problem Solving

CO4: Univariate random variable, univariate discrete random variable and its probability distribution

Weightage: 3 (Strongly Related)

Justification: Analyzing and computing probabilities for random variables requires critical thinking and problem-solving skills.

CO5: The Concepts of mean, median, and mode of a univariate discrete random variable

Weightage: 3 (Strongly Related)

Justification: Calculating statistical measures for a random variable involves critical thinking in data analysis.

CO6: Find the probabilities of various events

Weightage: 2 (Moderately Related)

Justification: While it involves probability, the emphasis on computation may not directly align with critical thinking.

PO-4: Research-related Skills and Scientific Temper

CO7: Obtain probability distribution of univariate discrete random variables

Weightage: 3 (Strongly Related)

Justification: Obtaining probability distributions involves research-related skills and contributes to scientific temper.

SYLLABUS (CBCS) FOR F. Y. B. Sc. STATISTICS
(w. e. from June, 2022)
(2022 Pattern)

Name of the Programme : B.Sc. Statistics
Program Code : USST
Class : F.Y.B.Sc.
Semester : I
Course Name : **Practical – I**
Course Code : USST113
No. of lectures : 36
Credit : 2 credits

Course Outcomes:

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 and dispersion

CO3. Compute various measures of moments, skewness and kurtosis.

CO4. Compute correlation coefficient, regression coefficients and of interpret the results.

CO5. Interpret summary Statistics of computer output.

CO6. Use statistical tools like graphical representation, summary statistics of data with the help of MS-Excel

CO7. Examine spreadsheet concepts and explore the Microsoft Office Excel environment.

Sr . No	Title of Experiments
1	Use of Random Number Table
2	Graphical presentation of the frequency distribution (Histogram, frequency polygon, frequency curve, Location of Mode, Ogive curves, Location of partition values) using **R**- Software.
3	Measures of Central Tendency for both ungrouped and grouped data-I
4	Univariate Discrete Probability Distribution
5	Measures of the dispersion for both ungrouped and grouped data-I
6	Measures of the Dispersion for both ungrouped and grouped data-II
7	Moments, Skewness and Kurtosis for both ungrouped and grouped data
8	Correlation coefficient and Spearman's rank correlation (ungrouped)
9	Simple regression for both ungrouped and grouped data
10	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							
CO6		3							
CO7						2			

PO-1: Disciplinary Knowledge

CO1: Represent statistical data diagrammatically and graphically

Weightage: 3 (Strongly Related)

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

CO2: Compute various measures of central tendency and dispersion

Weightage: 3 (Strongly Related)

Justification: Computing measures of central tendency and dispersion is a core aspect of statistical analysis and contributes significantly to disciplinary knowledge.

CO3: Compute various measures of moments, skewness and kurtosis

Weightage: 3 (Strongly Related)

Justification: Calculating moments, skewness, and kurtosis involves advanced statistical concepts, enhancing disciplinary knowledge.

CO4: Compute correlation coefficient, regression coefficients and interpret the results

Weightage: 3 (Strongly Related)

Justification: Computing correlation and regression coefficients and interpreting results demonstrate a deep understanding of statistical relationships.

PO-2: Critical Thinking and Problem Solving

CO5: Interpret summary Statistics of computer output

Weightage: 3 (Strongly Related)

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

CO6: Use statistical tools like graphical representation, summary statistics of data with the help of MS-Excel

Weightage: 3 (Strongly Related)

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

PO-6: Personal and Professional Competence

CO7: Examine spreadsheet concepts and explore the Microsoft Office Excel environment

Weightage: 2 (Moderately Related)

Justification: While not directly related to personal competence, understanding spreadsheet concepts enhances professional competence in data management.