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

Name of the Programme: B.Sc. Statistics

Program Code: USST

Class: F.Y.B.Sc.

Semester: II

Paper Code	Title of Paper	No. of Credits
USST121	Descriptive Statistics – II	2
USST122	Discrete Probability and Probability Distributions – II	2
USST123	Practical – II	2

SYLLABUS (CBCS) FOR F. Y. B. Sc. STATISTICS

(w. e. from June, 2022)

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

Course Outcomes:

The students will acquire knowledge about the;

1. importance and scope of statistics
2. population and sample
3. central tendency and its various measures
4. Dispersion and its various measures
5. skewness and kurtosis
6. visualization of data.

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 (μ_r') for ungrouped and grouped data.

5.2 Central moments (μ_r) 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.

SYLLABUS (CBCS) FOR F. Y. B. Sc. STATISTICS

(w. e. from June, 2022)

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,

1) Random experiment, the difference between deterministic and nondeterministic experiments, sample space, an event, probability of an event, and the conditional probability of an event.
2) Computation of probabilities in case of nondeterministic experiments.
3) Application of the Bayes' theorem in real-life situations problems.
4) Univariate random variable, univariate discrete random variable and its probability distribution.
5) The Concepts of mean, median, and mode of a univariate discrete random variable

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

SYLLABUS (CBCS) FOR F. Y. B. Sc. STATISTICS

(w. e. from June, 2022)

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

1. Represent statistical data diagrammatically and graphically.
2. Compute various measures of central tendency and dispersion
3. Compute various measures of moments, skewness and kurtosis.
4. Compute correlation coefficient, regression coefficients and of interpret the results.
5. Interpret summary Statistics of computer output.

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.