

DEPARTMENT OF STATISTICS

B.Sc. (H) Statistics

SEM-1

Category-I

DISCIPLINE SPECIFIC CORE COURSE – 1: DESCRIPTIVE STATISTICS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course (if any) |
|------------------------|---------|-----------------------------------|----------|---------------------|---------------------------------|--------------------------------------|
| | | Lecture | Tutorial | Practical/ Practice | | |
| Descriptive Statistics | 4 | 3 | 0 | 1 | Class XII pass with Mathematics | Nil |

Learning Objectives

The Learning Objectives of this course are as follows:

1. Recognize the types of data: quantitative and qualitative, cross-sectional and time-series, discrete and continuous.
 2. Understand the definition and scope of statistics, including its purpose and applications.
 3. Familiarize yourself with stem-and-leaf displays, a visual representation that shows the distribution of data.
 4. To learn about the association of attributes
 5. Apply various statistical techniques such as constructing tables, frequency distribution and graphical representation and calculating measures of central tendency and dispersion.
 6. Understand the principle of least squares.
- ☐ To tabulate statistical information given in descriptive form and to use graphical techniques to interpret
 - ☐ To understand various measures of central tendency, dispersion, skewness and kurtosis. Moments and its properties.
 - ☐ Familiarize with quantitative and qualitative data and available statistical tools to analyse them.
 - ☐ Finding linear correlation between two variates using different measures and studying their properties. Least square method of fitting of curves, regression lines and their elementary properties.

Learning Outcomes:

The Learning Outcomes of this course are as follows:

- ☒ 1. Conduct complete enumeration: You will understand the concept of complete enumeration, which involves collecting data from the entire population rather than a sample.
- ☐ Understand concepts of sample vs. population and get acquainted with different types of data /scales. Distinguish between primary and secondary data. Tabulate and plot frequency

distribution. Deals with numerical and graphical ways to describe and display data using histograms, stem and leaf plot and box plots.

- ☐ Calculate measures of central locations like mean, geometric mean, harmonic mean, median and mode and explain their properties
- ☐ Calculate measures of the spread: variance, standard deviation, range and inter-quartile range and explain their properties.
- ☐ Understand the meaning of probability and probabilistic experiment. Familiarize with the four approaches to probability theory and particularly, the axiomatic approach and use and manipulate the four axioms of probability comfortably to derive the results of other set operations
- ☐ Understand and exploit Addition and Multiplicative laws of probability
- ☐ understand the meaning of conditional probability, conditioning, and reduced sample space, compute joint and conditional probabilities. independence, total probability, Bayes' rule and applications.
- ☐ Understand the concept of a random variable, differentiate between independent and uncorrelated random variables, distinguish between discrete, continuous, random variables and be able to represent them using probability mass, probability density, and cumulative distribution functions, Univariate transformation and its application.
- ☐ Understand expectation and its properties, Compute variance and covariance in terms of expectation. Solve problems based on expectation and its properties.

SYLLABUS OF DSC-1

Theory

Unit – 1

(09 hours)

Data Visualization

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Types of Data: Concepts of population and sample, quantitative and qualitative data, cross-sectional and time-series data, discrete and continuous data. Different types of scales: Nominal, ordinal, interval and ratio. Collection and Scrutiny of Data: Primary data. Secondary data – its major sources. Complete enumeration. Construction of tables with one or more factors of classification, frequency distributions and cumulative frequency distributions and their graphical representations (Histograms, frequency polygon), stem and leaf displays.

Unit – 2

(15 hours)

Data Summarization

Measures of Central Tendency: Mathematical and positional, partition values, Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, graphical representation of various measures of location and dispersion (Ogives, Histograms, Box Plot) Moments: Raw moments, Central moments, Absolute moments, Factorial moments, Sheppard's corrections, skewness and kurtosis, Types of frequency distributions.

Unit – 3

(06 hours)

Theory of Attributes

Theory of attributes: consistency and independence of data with special reference to attributes, Association of attributes: concept, Yules coefficient of Colligation and Coefficient of Colligation.

Unit – 4

(15 hours)

Correlation and Regression

Bivariate data: Definition, scatter diagram, Karl Pearson's coefficient of correlation. Spearman's rank correlation coefficient (Introductory with interpretation). Principle of least squares and fitting of polynomials and exponential curves, lines of regression, properties of regression coefficients, angle between two regression lines, and residual variance.

Practical – 30

Hours List of

Practicals:

1. Graphical representation of data- frequency polygon, histogram and ogive.
2. Practical based on arithmetic mean and to find missing frequencies given arithmetic mean.
3. Practical based on median and partition values using formulae and to find them graphically also.
4. Practical based on mode by using formula, graphically, method of grouping.
5. Practical based on combined mean and combined variance.
6. Practical based on quartile deviation using formula and graphically.
7. Practical based on mean deviation and standard deviation.
8. Practical based on coefficient of variation.
9. Practical based on moments about origin and moments about any arbitrary point.
10. Practical on skewness based on mean, median, mode and standard deviation.
11. Practical based on central moments, skewness and kurtosis.
12. Practical based on fitting of polynomials.
13. Practical based on fitting of exponential curves, power curves.
14. Practical based on association and independence of attributes.
15. Practical based on fundamental set of class frequencies in attributes (find missing frequencies given fundamental set of class frequencies).
16. Practical based on Karl Pearson correlation coefficient.
17. Practical based on correlation coefficient for a bivariate frequency distribution.
18. Practical based on lines of regression, angle between lines and estimated values of variables.
19. Practical based on rank correlation with ties.
20. Practical based on rank correlation without ties.

Essential Readings

- ☐ Goon, A.M., Gupta, M.K. and Dasgupta, B. (2016). Fundamentals of Statistics, Vol. I, 8th Ed. The World Press, Kolkata.
- ☐ Gupta, S. C. and Kapoor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edn., S. Chand and Sons. Delhi.

- ❑ Bernstein, S. and Bernstein, R. (2020). Schaums: Outline of Elements of Statistics I Descriptive Statistics and Probability. McGraw Hill.
- ❑ Heumann, C., Schomaker, M. and Shalabh (2016). Introduction to Statistics and Data Analysis with Exercises, Solutions and Applications in R. Springer.

Suggestive Readings

- ❑ Tukey, J.W. (1977). Exploratory Data Analysis, Addison-Wesley Pub. Co. N.Y.
- ❑ Myatt, G, J. and Johnson, W.P. (2014). Making sense of data: A practical guide to exploratory data analysis and data mining. 2nd Edn, John Wiley & Sons, Inc. N. J.
- ❑ Agresti, A., Christine Franklin, C. and Klingenberg, B. (2017). Statistics: the art and science of learning from data. Pearson. Boston.
- ❑ Dudewicz, E. and Mishra, S. N. (1988). Modern Mathematical Statistics. Wiley.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

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| DISCIPLINE SPECIFIC CORE COURSE – 2: |
| INTRODUCTION TO PROBABILITY |

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course (if any) |
|-----------------------------|---------|-----------------------------------|----------|---------------------|---------------------------------|--------------------------------------|
| | | Lecture | Tutorial | Practical/ Practice | | |
| Introduction to Probability | 4 | 3 | 0 | 1 | Class XII pass with Mathematics | NIL |

Learning Objectives

The Learning Objectives of this course are as follows:

- ❑ Familiarize students with the mathematical basis of probability theory.
- ❑ Prepare students with important tools for statistical analyses at the undergraduate level.
- ❑ Promote understanding through real-world statistical applications.

Learning Outcomes

The Learning Outcomes of this course are as follows:

- ❑ Understand the meaning of probability and probabilistic experiment. Familiarize with the four approaches to probability theory and particularly, the axiomatic approach, use and manipulate the four axioms of probability comfortably to derive the results of other set operations.
- ❑ Understand and use addition and multiplicative laws of probability, understand the meaning of conditional probability, conditioning, and reduced sample space, compute joint and conditional