I Semester Complementary Statistics - Course I

Basic Statistics

Hours per week 4

Module I

Introduction to Statistics, Population and Sample, Collection of Data, Various methods of data collection, Census and Sampling Methods of Sampling Simple Random Sampling (with and without replacement) stratified sampling systematic sampling (Method only), Types of data quantitative, qualitative, Classification and Tabulation, Diagrammatic representation Bar diagram, pie diagram; pictogram and cartogram, Graphical representation histogram; frequency polygon; frequency curve; ogives and stem and leaf chart.

Module II

Measures of Central Tendency Mean; Median; Mode; Geometric Mean; Harmonic Mean and Properties, Absolute and Relative measures of Dispersion Range, Quartile Deviation, Percentiles, Deciles, Box Plot, Mean Deviation, Standard Deviation, Coefficient of Variation.

Module III

Idea of Permutations and Combinations, Probability Concepts Random Experiment, Sample Space, Events, Probability Measure, Approaches to Probability Classical, Statistical and Axiomatic, Addition Theorem (upto 3 evens) Conditional Probability, Independence of events, Multiplication theorem (upto 3 events), Total Probability Law, Bayes Theorem and its
applications.

Module IV

Index Numbers definition, Simple Index Numbers; Weighted Index Numbers Laspeyers Paasches and Fishers Index Numbers, Test of Index Numbers, Construction of Index Numbers, Cost of Living Index Numbers Family Budget Method, Aggregate Expenditure Method.

Core Reference

1. S.P. Gupta: Statistical Methods (Sultan Chand & Sons Delhi).

2. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
3. B.L. Agarwal: Basic Statistics, New Age International (p) Ltd.

Additional References

1. Parimal Mukhopadhya: Mathematical Statistics, New Central Book Agency (p) Ltd, Calcutta
2. Murthy M.N.: Sampling theory and Methods, Statistical Publishing Society, Calcutta.

II Semester Complementary Statistics - Course II

Theory of Random Variables

Hours per week 4

Module I

Random Variables Discrete and Continuous, Probability Distributions Probability Mass Function; Probability Density Function and Cumulative (distribution) function and their properties, change of variables (Univariate only), Bivariate random variables Definition Discrete and Continuous, Joint Probability Density Functions, Marginal and Conditional Distributions, Independence of Random Variables.

Module II

Mathematical Expectations Expectation of a Random Variable, Moments in terms of Expectations, Moment Generating Functions (m.g.f.) and its properties. Characteristic Functions and its Simple Properties, Conditional Expectation

Module III

Raw Moments, Central Moments, Absolute Moments, Inter Relationships (First Four Moments), Skewness Measures Pearson, Bowley and Moment Measure Kurtosis-Measures of Kurtosis Moment Measure, Measure based on partition values.

Module IV

Introduction to bivariate data Method of Least Squares Curve Fitting Fitting of Straight Lines, Second Degree Equation, Exponential Curve, Power Curve, Linear Correlation Methods of Correlation Scatter Diagram, Covariance Method, Rank Correlation (equal ranks). Linear Regression Regression Equations Fitting and identification, properties.

Core Reference

1. John E. Freund: Mathematical Statistics, Prentice Hall of India
2. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3. S.P. Gupta: Statistical Methods, , Sultan Chand and Sons, New Delhi

Additional References

1. V.K. Rohatgi: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. Mood A.M., Graybill F.A. and Boes D.C. Introduction to Theory of Statistics, McGraw Hill.
3. B.R. Bhat, Modern Probability Theory, New Age International (p) Ltd.

III Semester Complementary Statistics - Course III

Probability Distributions

Hours per week 5

Module I

Discrete Distribution Uniform: Geometric Bernoulli; Binomial; Poisson; Fitting of Distributions (Binomial and Poisson). Properties Mean, Variance, m.g.f., Additive property; recurrence relation for moments (binomial and Poisson) Memory lessness property of Geometric distribution.

Module II

Continuous distributions Uniform; Exponential; Gamma; Beta (type I and II); Normal; Standard Normal definitions, Mean, Variance, m.g.f., Additive property, Memory lessness property of exponential distribution Fitting of Normal, Use of Standard Normal Tables for Computation of Various Probabilities.

Module III

Law of large Numbers, Tchebycheffs Inequality, Weak Law of Large Numbers, Bernoullis Law of Large Numbers, Central Limit Theorem (Lindberg-Levy form) without proof.

Module IV

Sampling Distributions definition, Statistic, Parameter, Standard Error, Sampling Distributions of Mean and Variance, χ^2, t and F (without derivation), properties, Inter relationships.

Core Reference

1. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons
2. Hogg, R.V. and Craig A.T. (1970). Introduction to Mathematical Statistics, Amerind Publishing Co, Pvt. Ltd.

Additional References

1. V.K. Rohatgi: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. Mood A.M., Graybill F.A. and Boes D.C. Introduction to Theory of Statistics, McGraw Hill.
3. Johnson, N.L, Kotz, S. and Balakrishnan N. (1994). Continuous Univariate Distribution, John Wiley, New York.
4. Johnson, N.L, Kotz, S. and Kemp, A.W. : Univariate Discrete Distributions, John Wiley, New York.

IV Semester Complementary Statistics - Course IV

Statistical Inference

Hours per week 5

Module I

Concepts of Estimation, Types of Estimation Point Estimation; Interval Estimation, Properties of Estimation Unbiasedness, Efficiency; Consistency; Sufficiency.

Module II

Methods of Estimation MLE, Methods of Moments, Method of Minimum Variance, Cramer Rao Inequality (without proof), Interval Estimation for Mean, Variance and Proportion.

Module III

Testing of hypothesis- Statistical hypothesis, Simple and composit hypothesis Null and Alternate hypothesis, Type I and Type II errors, Critical Region, Size of the test, P value, Power, Neyman Pearson approach , Large Sample test Z test, Chi-Square test-goodness of fit, test of independence.

Module IV

Small sample tests Normal, t test, Chi-square test, F test, analysis of Variance (one way classification).