Department of Statistics
UNIVERSITY OF RAJASTHAN
JAIPUR
SYLLABUS

Course Curriculum As per NEP-2020

Subject : APPLIED STATISTICS

(Three/Four Year Under Graduate Programme in Science/Arts) Examination (2024-25)

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

DEPARTMENT OF STATISTICS
(Faculty of Science and Social Science)

UNIVERSITY OF RAJASTHAN
JAIPUR
SYLLABUS
(As per the University Guidelines under NEP-2020)
FOR

B.Sc. / B.A.
Subject: APPLIED STATISTICS
2024-2025

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SEMESTER-WISE PAPER TITLES

B.Sc. / B.A.

APPLIED STATISTICS

Course Code	Course Title	Course Type	LEVEL	Semester	Paper Title	Paper code	Credit			Classes/WK			Total Credit	Total Teaching Hours		Exam Duration	
							L	T	P	L	T	P		Theory	Practical	Theory	Practical
	Applied Statistics	Minor	5	I	Descriptive Statistics	AST-51T-101	4	0	0	4	0	0	4	60	-	3 Hours	-
			5	I	Applied Statistics Lab-I	AST-51P-102	0	0	2	0	0	4	2	-	60	-	4 Hours
			5	II	Applied Probability Theory	AST-52T-103	4	0	0	4	0	0	4	60	-	3 Hours	-
			5	II	Applied Statistics Lab-II	AST-52P-104	0	0	2	0	0	4	2	-	60	-	4 Hours
			6	III	Applied Distribution Theory and Vital Statistics	AST-63T-201	4	0	0	4	0	0	4	60	-	3 Hours	-
			6	III	Applied Statistics Lab-III	AST-63P-202	0	0	2	0	0	4	2	-	60	-	4 Hours
			6	IV	Statistical Inference	AST-64T-203	4	0	0	4	0	0	4	60	-	3 Hours	-
			6	IV	Applied Statistics Lab-IV	AST-64P-204	0	0	2	0	0	4	2	-	60	-	4 Hours
			7	V	Sample Surveys	AST-75T-301	4	0	0	4	0	0	4	60	-	3 Hours	-
			7	V	Applied Statistics Lab-V	AST-75P-302	0	0	2	0	0	4	2	-	60	-	4 Hours
			7	VI	Design of Experiments	AST-76T-303	4	0	0	4	0	0	4	60	-	3 Hours	-
			7	VI	Applied Statistics Lab-VI	AST-76P-304	0	0	2	0	0	4	2	-	60	-	4 Hours

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Name of University	**University of Rajasthan, Jaipur**
Name of Faculty	**Science:** B. Sc. **Social Sciences :** B.A.
Name of Discipline	**Applied Statistics**
Combination with Other Disciplines	**Science Faculty:** Mathematics, Physics, Geography, Economics, Geology, Psychology, Chemistry. **Social Science Faulty:** Mathematics, Geography, Economics, Psychology
Offered to Non-Collegiate Students	Yes

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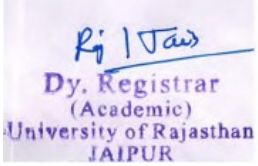
B.Sc. / B.A.
Subject: Applied Statistics

Semester -I



Subject – Applied Statistics
Theory Paper – Descriptive Statistics (AST-51T-101)
(Also common with Subject: Statistics Paper-STA-51T-101)

Objectives:

Overall, the objectives of descriptive statistics are to simplify and summarize complex data, reveal patterns and relationships, and provide a foundation for further analysis and interpretation. Some of the main objectives of descriptive statistics include:

1. To provide a concise summary of data through various statistical measures.
2. To develop the ability to present data through graphs, charts, and tables visually.
3. To have the ability to organize data in a meaningful way.
4. To understand various characteristics within data viz. shape, spread, and central values, make comparisons, draw conclusions, and comments on findings.
5. To explore relationships between variables.

Detailed Syllabus

Unit-I

Types and Presentation of Data: Concept of statistical population and data. Qualitative & Quantitative data, Discrete & Continuous data, Frequency & Non-Frequency data, Geographical & Chronological data, Primary data & Secondary data with suitable examples. Tabular presentation of data- Construction of tables, Types of tables. Frequency distribution —Discrete, grouped, continuous and cumulative. Graphical presentation of data- Histogram, frequency polygon, frequency curve, ogives, and Box-plot.

Unit-II

Statistical Analysis of Quantitative Data: Different types of scales-nominal, ordinal, interval and ratio, Univariate Data- Measures of central tendency, dispersion, moments and its computation from data. Absolute and relative measures of skewness and kurtosis based on quantiles and moments. Sheppard's Correction for moments (without Proof).

Unit-III

Curve fitting and Theory of Attributes: Principle of least squares, fitting of straight line, parabola and curves reducible to straight line(exponential and power curve). Class frequency, order of a class frequency, ultimate class frequency, consistency of data, independence and association of attributes. Various measures of association.

Unit-IV

Statistical Analysis of Bivariate Data: Correlation analysis-scatter diagram, Karl-Pearson's coefficient of correlation and its properties. Correlation of bivariate frequency distribution, Spearman's rank correlation. Regression analysis- Fitting of regression lines, regression coefficients and their properties.

References:

1. Bhatt B.R., Srivenkatrainanna T. and Rao Madhava K.S. (1997): Statistics- A Beginner's Text, Vol-11, New Age lntl.(P) Ltd.
2. Croxton F.E., Cowden D.J. and Kelin S (1973) : Applied General Statistics ,PHI
3. Goon A.M.,Gupta M.K &.,Das Gupta B. (1991) : Fundamentals of Statistics , Vol-I, World Press, Kolkata.
4. Kapoor V.K. & Gupta S.C.: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, N. Delhi
5. Gupta S.P. : Statistical Methods , Sultan Chand and Sons, New Delhi
6. Elliance D.N. : Fundamentals of Statistics
7. कैलाश नाथ नगर: सांख्यिकी के मूल तत्व, मीनाक्षी प्रकाशन, मेरठ

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Programme Specific Outcome (PSOs): Paper- Descriptive Statistics (AST-51T-101):

Completing a course in descriptive statistics can provide several outcomes and benefits. Here are some common outcomes:

1. Students will gain a comprehensive knowledge and understanding of different types of data, data collection methods, and data measurement scales.
2. Students will acquire skills in analyzing and interpreting data using various descriptive statistical techniques.
3. Students will learn how to present data visually through graphs, charts, and tables.
4. Solving the complex process of the level of Descriptive statistics, will provide the ability to interpret and draw meaningful conclusions from data.
5. Descriptive statistics can enhance students' analytical reasoning with decision-making skills after analyzing and evaluating statistical data.
6. Completing a course in descriptive statistics, students will be equipped with the skills necessary to conduct data analysis for research projects, reports, and academic studies during practical hours.
7. Descriptive statistics serves as the foundation for more advanced statistical techniques and analysis. Once the student has a solid understanding of descriptive statistics, he/she can build upon this knowledge to explore inferential statistics, hypothesis testing, regression analysis, and other advanced statistical methods.

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Subject – Applied Statistics

Practical Paper: Applied Statistics Lab-I (AST-51P-102)

(Also common with Subject: Statistics Paper-STA-51P-102)

Objectives:

Overall, the objectives of descriptive statistics are to simplify and summarize complex data, reveal patterns and relationships, and provide a foundation for further analysis and interpretation. Some of the main objectives of descriptive statistics include:

1. To provide a concise summary of data through various statistical measures.
2. To develop the ability to present data through graphs, charts, and tables visually.
3. To have the ability to organize data in a meaningful way.
4. To understand various characteristics within data *viz.* shape, spread, and central values, make comparisons, draw conclusions, and comments on findings.
5. To explore relationships between variables.

Detailed Syllabus

1. Presentation of data through Frequency Table and Graphs.
2. Calculation of Measures of Central tendency, Dispersion, Moments, Skewness and Kurtosis.
3. Computation of Correlation Coefficient of bivariate data and bivariate frequency distribution table
4. Regression Analysis for Bivariate data.
5. Fitting of curves by least square method.
6. Computation of Spearman's Rank correlation.

Programme Specific Outcome (PSOs') : Paper- Statistical Lab-I (AST-51P-102):

Completing a course in descriptive statistics can provide several outcomes and benefits. Here are some common outcomes that you can expect

1. Students will be able to gain a comprehensive knowledge and understanding of different types of data, data collection methods, and data measurement scales.
2. Students will be able to acquire skills in analyzing and interpreting data using various descriptive statistical techniques.
3. Students will be able to learn how to present data visually through graphs, charts, and tables.
4. Solving the complex problem of the level of Descriptive statistics will provide the ability to interpret and draw meaningful conclusions from data.
5. Students will be able to gain analytical reasoning with decision-making skills after analyzing and evaluating statistical data.
6. Students will gain a solid understanding of descriptive statistics. As a result, they will be able to explore inferential statistics, hypothesis testing, regression analysis, and other advanced statistical methods in the future.

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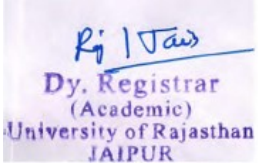
B.Sc. / B.A.
Subject: Applied Statistics

Semester -II



Subject – Applied Statistics
Theory Paper – Probability Theory (AST-52T-103)

Objectives:

Overall, the objectives of probability theory are to simplify and summarize complex data, reveal patterns and relationships, and provide a foundation for further analysis and interpretation. Some of the main objectives of probability theory include:

1. To develop a thorough understanding of random experiments, trials, events, and different types of events, including their definitions and examples.
2. To learn and apply various definitions of probability, construct sample spaces, and calculate probabilities. Also, to be able to calculate variance, moments, and moment generating function along with their properties.
3. To understand the definition and types of random variables, including discrete and continuous. Learn to use Probability Mass Functions (PMF), Probability Density Functions (PDF), and distribution functions.
4. To understand and compute the expectation of random variables, applying theorems of expectation, and exploring conditional expectation.
5. To develop a deep understanding of key discrete distributions such as Bernoulli, Binomial, Poisson, and Geometric distributions and gain a foundational understanding of the Hyper-geometric and Negative Binomial distributions.

Detailed Syllabus

Unit-I

Statistical Mathematics: Functional Relationship between two variables, Polynomials, Exponential, Logarithmic & Binomial Functions and their expansions. Idea of permutation and combination. Standard results for differential coefficients x^n, e^x, log x etc. (without proof). Rules for differentiation of sum, difference, product and quotient and function of a function (without proof). Maxima & Minima. Integral calculus- Indefinite and Definite integral.

Unit-II

Important Concepts of Probability: Random Experiment, Trial, Events and their types. Classical and Statistical definitions of Probability. Sample point and sample space. Axiomatic Approach to Probability and its properties. Addition and Multiplication theorems of probability. Conditional Probability. Bayes Theorem and its Applications. Chebychev's Inequality and its applications.

Unit-III

Random Variable: Probability Mass Function, Probability Density Function. Distribution Function and its properties (without proof), Joint Probability Distribution function, Marginal and Conditional Probability distribution (Continuous and Discrete case).

Unit-IV

Mathematical Expectation: Expectation of a random Variable and its properties. Addition and Multiplication Theorems of Expectation. Conditional Expectation. Definition of Variance and Covariance, Moments- Central and Raw Moments. Moment Generating Functions and their simple properties. Univariate Discrete Distributions and their properties: Bernoulli Distribution, Binomial Distribution, Poisson Distribution, Geometric Distribution. Definition of Hyper-geometric and Negative Binomial Distribution**.**

References:

1. Bhatt B.R., Srivenkatramanna T. and Rao Madhava K.S. (1997): Statistics- A Beginner's Text, Vol-II, New Age International (P) Ltd.
2. Goon A.M., GuptaM.K., Das Gupta B. (1991): Fundamentals of Statistics , Vol-II, World Press, Kolkata.
3. Kapoor V.K. & Gupta S.C.: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi
4. Mood A.M. Graybill F.A. Bose D.C. (1974): Introduction to the theory of statistics, McGraw Hill

Additional References:

1. Hoel P.G. (1971) : An introduction of Mathematical Statistics , Asia Publishing House..
2. David S. (1996): Elementary Probability., Oxford Press.
3. Cooke, Cramer and Clarke : Basic Statistical Computing , Chapman and Hall.

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4. Meyer P.L.(1970):Introductory Probability and statistical Applications. Addison Wesley.

Programme Specific Outcome (PSOs): Paper- Probability Theory (AST-52T-103):

Completing a course in probability theory can provide several outcomes and benefits. Here are some common outcomes-

1. Students will be able to gain a solid understanding of the basic concepts of probability, including random experiments, trials, and events and comprehend the various definitions of probability and construct sample spaces.
2. Students will be able to master the axiomatic approach to probability. They will be able to apply the theorems of probability to calculate conditional probabilities and effectively use Bayes theorem in practical scenarios.
3. Students will be able to learn about random variables and probability functions (PMF and PDF) as well as joint and conditional probability distributions.
4. Students will be able to compute expectation, variance, covariance, moments, and moment generating functions.
5. Students will be able to gain a comprehensive understanding of key univariate discrete distributions and apply the properties and characteristics of these distributions to solve real-world problems effectively.

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Subject – Applied Statistics
Practical Paper: Applied Statistics Lab-II(AST-52P-104)

Objectives:

Overall, the objectives of probability theory are to simplify and summarize complex data, reveal patterns and relationships, and provide a foundation for further analysis and interpretation. Some of the main objectives of probability theory include:

1. To develop a thorough understanding of random experiments, trials, events, and different types of events, including their definitions and examples.
2. To learn and apply various definitions of probability, construct sample spaces, and calculate probabilities. Also, to be able to calculate variance, moments, and moment generating function along with their properties.
3. To understand the definition and types of random variables, including discrete and continuous. Learn to use Probability Mass Functions (PMF), Probability Density Functions (PDF), and distribution functions.
4. To understand and compute the expectation of random variables, applying theorems of expectation, and exploring conditional expectation.
5. To develop a deep understanding of key discrete distributions such as Bernoulli, Binomial, Poisson, and Geometric distributions and gain a foundational understanding of the Hyper-geometric and Negative Binomial distributions.

Detailed Syllabus

1. Construction of Binomial Probability distributions
2. Construction of Poisson Probability distributions
3. Problems based on probability mass functions and probability density functions
4. Exercise on mathematical expectation
5. Finding Mean, Variance, Skewness, and kurtosis of Univariate probability distributions.
6. Fitting of univariate discrete probability distributions.
7. Computation of Marginal and Conditional Distributions for univariate and bivariate distributions.

Programme Specific Outcome (PSOs): Paper- Statistical Lab-II (AST-52P-104): Completing a course in this paper can provide several outcomes and benefits. Here are some common outcomes that you can expect

1. Students will be able to gain a solid understanding of the basic concepts of probability, including random experiments, trials, and events, and comprehend the various definitions of probability and construct sample spaces.
2. Students will be able to master the axiomatic approach to probability. They will be able to apply the theorems of probability to calculate conditional probabilities and effectively use Bayes theorem in practical scenarios.
3. Students will be able to learn about random variables and probability functions (PMF and PDF) as well as joint and conditional probability distributions.
4. Students will be able to compute expectation, variance, covariance, moments, and moment generating functions.
5. Students will be able to gain a comprehensive understanding of key univariate discrete distributions and apply the properties and characteristics of these distributions to solve real-world problems effectively.

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Subject: Applied Statistics

Semester -III

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Subject: Applied Statistics
Theory Paper: Applied Distribution Theory and Vital Statistics (AST-63T-201)

Objectives:

The objectives of distribution theory are to provide students with a comprehensive understanding of univariate continuous distributions, their properties, and various associated statistical concepts. The objectives of the distribution theory are as follows:

1. To introduce and explore the properties of key univariate continuous distributions.
2. To learn the concept of a statistic and understand its sampling distribution.
3. To explore the Chi-square distribution, t-distributions, and F-distribution.
4. To understand the relationship between Chi-square distribution, t-distribution
5. To define and understand the concept of vital statistics

Detailed Syllabus

Unit-I

Univariate Continuous Distributions and their properties – Introduction of Rectangular Distribution, Normal Distribution, Exponential distribution, Gamma distribution, Beta distribution with their properties. Introduction to Bivariate Normal Distribution,.

Unit-II

Sampling from a distribution: Concept of statistic and its sampling distribution. Sampling distribution of sum of Binomial, Poisson and mean of Normal Distribution. Chi-square Distribution**:** Definition, Derivation, Moments, MGF, C.G.F., Mode & Skewness, Limiting and Additive Property and applications(statement only).

Unit-III

t-Distribution and F-Distribution: Definition of Student's–t & Fisher's–t Statistic with their distributions (without proof), Constants of t-distribution, probability curve. Limiting Property of t-distribution (Without Proof) and applications (statement only) . Definition of F-Distribution, pdf, Constants, Mode, probability curve, its properties (without proofs) and applications (statement only). Relationship among t, F and χ^2 Distributions(without proofs).

Unit-IV

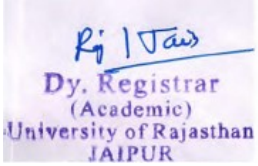
Vital Statistics : Measurement of Mortality- Crude death rates, Infant mortality rates, Death rate by cause, Standardized death rate. Complete life table- Construction and its main features, Mortality rate and probability of dying. Relation between different columns of life table uses of life table and its limitations. Measurement of fertility- Crude birth rate, General fertility rate, Specific fertility rate, Total fertility rate, Gross reproduction Rate, Net Reproduction Rate

References:

1. Goon A.M. Gupta M.K.,Das Gupta B.(1991): Fundamentals of Statistics, Vol.I, World Press, Calcutta
2. Hodges J.L. and Lehman E.L.(1964): Basic Concepts of Probability and statistics, Holden Day.
3. Mood A.M., Graybill F.A. and Boes D.C. (1974): Introduction to the Theory of Statistics, McGraw Hill.
4. Freund J.E. (2001): Mathematical Statistics, Prentice Hall of India**.**
5. S.C.Gupta & V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons. New Delhi.
6. S.C.Gupta & V.K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons. New Delhi.

Additional References:

1. Bhatt B.R. Srivenkatramana T and Rao Mahhava K.S. (1997): Statistics: A Beginner's Test, Vol.II New Age Intl (P)



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2. Rohatgi V.K. (1967):An introduction to Probability Theory and Mathematical statistics, John Wiley & Sons
3. Snedecor G.W. and Cochran W.G.(1967): Statistical Methods : Iowa State University Press.
4. E.J.Dudewicz & S.N.Mishra : Modern Mathematical Statistics, John Wiley and Sons.

Programme Specific Outcome (PSOs') :

Paper- Distribution Theory and Vital Statistics (AST-63T-201):

Completing a course in distribution theory can provide several outcomes and benefits. Here are some common outcomes that student can expect:

1. Students will understand and apply key univariate continuous distributions such as Rectangular, Normal, Exponential, Gamma, and Beta to various statistical problems
2. Student will acquire skills in analyzing and interpreting data using various distributions.
3. Students will gain knowledge of statistic which will help them in creating base for the advanced statistical tools.
4. Student will develop a comprehensive knowledge of the sampling distributions.
5. Students will apply theoretical concepts of distribution theory to advanced statistical modeling, inference, and real-world data analysis.
6. Completing a course in distribution theory, student will be equipped with the skills necessary to conduct data analysis for research projects, reports, and academic studies during practical hours.
7. Distribution theory serves as the foundation for more advanced statistical techniques and analysis.
8. Once the student has a solid understanding of distribution theory, he/she can build upon this knowledge to explore inferential statistics, sample surveys, and other advanced statistical methods.
9. Students will understand the concept of vital statistics and they will know about NRR and GRR.

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Subject: Applied Statistics
Practical Paper: Applied Statistics Lab-III (AST-63P-202)

Objectives: Overall, the objectives of laboratory work in distribution theory, are to simplify and summarize complex data, reveal patterns and fitting of distributions. Some of the main objectives of statistical inference include:

1. Understand the process of fitting various distributions (normal) to empirical data sets.
2. Develop skills in estimating distribution parameters and assessing goodness-of-fit using statistical tests and visualization techniques.
3. Enhance proficiency in statistical modeling by applying theoretical distributions to real-world datasets.
4. Learn methods to evaluate the adequacy of fitted distributions through rigorous statistical tests.
5. Prepare for roles requiring data-driven decision-making by interpreting and applying statistical models effectively.
6. Gain practical skills applicable in research and professional settings across diverse fields.

Detailed Syllabus

1. Fitting of normal distribution.
2. Practical Problems based on Normal Distribution.
3. Practical Problems for Computation of Mortality rates
4. Practical Problems for Computation of Fertility rates.
5. Practical Problems for Construction of Life table
6. Practical Problems for computation of NRR,GRR

Programme Specific Outcome (PSOs) of the Paper: Statistics Lab-III(AST-63P-202):

Students completing the practical sessions in Distribution Theory will be able to:

1. Apply theoretical knowledge of various probability distributions (including rectangular, normal, exponential, Cauchy, Gamma and beta distributions.
2. Estimate parameters of distributions and evaluate the goodness-of-fit using appropriate statistical tests and techniques.
3. Demonstrate proficiency in using statistical software to fit distributions, calculate probabilities, and interpret results.
4. Effectively communicate statistical findings and recommendations through written reports and presentations.
5. Utilize distribution fitting techniques to solve practical problems in diverse fields such as finance, engineering, and social sciences.
6. Apply critical thinking and analytical skills to assess the applicability of different distribution models in various scenarios

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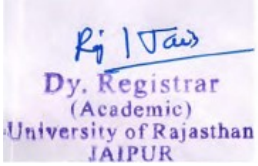
Semester -IV



Subject: Applied Statistics
Theory Paper: Statistical Inference (AST-64T-203)
(Also common with Subject: Statistics Paper-STA-64T-203)

Objectives:

The objectives of statistical inference are to provide a fundamental understanding of concepts and principles of inferential statistics to develop a solid understanding of estimation theory and testing of hypothesis and allow the use of testing of hypothesis in handling various problems arising from sampling. Some of the main objectives of statistical inference include:

1. Understand and apply concepts of point and interval estimation to estimate population parameters and construct reliable confidence intervals.
2. Formulate and test hypotheses effectively, minimizing errors in decision-making processes and differentiating between simple, composite, null, and alternative hypotheses.
3. Utilize chi-square, t, and F-distributions for various testing scenarios, including testing normal population variance, goodness of fit, and equality of variances.
4. Perform non-parametric tests, such as the sign test, run test, and median test, and understand their applications and limitations.
5. Enhance critical thinking and problem-solving skills in statistical analysis through numerical examples and practical applications.
6. Prepare for advanced studies and professional roles in statistics, data science, and related fields, equipped with essential research and data analysis skills.

Detailed Syllabus

Unit-I

Theory of Estimation: Point Estimation- Concept and Problem for Point Estimation; Criterion of a good estimator (Unbiasedness, Consistency, Efficiency, Sufficiency). MVUE, Maximum likelihood estimator (definition, numerical examples). Interval Estimation- Concept, Definitions of Confidence Interval, Confidence Coefficient. Construction of Confidence Interval for Population Mean, Variance, Difference of Population Means & Ratio of Variances of Normal Distributions.

Unit-II

Testing of Hypothesis: Simple, Composite, Null, and Alternative Hypotheses. Types of error, Procedure of hypothesis testing. Critical region: BCR, Neyman-Pearson's Lemma for BCR. BCR in case of Binomial, Poisson, Normal, and Exponential Population and other related simple numerical problems.

Unit-III

Applications of χ^2 , t and F-distribution – Applications of χ^2 distribution -Testing Normal Population variance, Test for Goodness of fit; Contingency Table & Independence of attributes, Yate's correction. Applications of t-distribution-Testing of single mean; Difference of two means & paired t-test and sample correlation and regression coefficients. Application of F-distribution - Testing of equality of two population variances.

Unit-IV

Large Sample and Non-Parametric Tests- Large Sample Testing of single mean and proportion, difference of means and proportions. Non-Parametric Tests- Definition, Merits & Limitations. Sign test for Univariate and Bivariate distributions. Run Test and Median test for small and large samples.

References:

1. Goon A.M. Gupta M.K.,Das Gupta B.(1991): Fundamentals of Statistics, Vol.I, World Press, Calcutta
2. Hodges J.L. and Lehman E.L.(1964): Basic Concepts of Probability and Statistics, Holden Day.
3. Mood A.M., Graybill F.A. and Boes D.C. (1974): Introduction to the Theory of Statistics, McGraw Hill.
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Additional References:

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2. Rohatgi V.K. (1967):An introduction to Probability Theory and Mathematical statistics, John Wiley & Sons
3. Snedecor G.W. and Cochran W.G.(1967): Statistical Methods : Iowa State University Press.
4. E.J.Dudewicz & S.N.Mishra : Modern Mathematical Statistics John Wiley and Sons.

Programme Specific Outcome (PSOs): Paper-Statistical Inference (AST-64T-203):

The programme outcomes for the statistical inference syllabus aim to equip students with comprehensive knowledge and practical skills in statistical methods. Here are some common outcomes that you can expect.

1. Students will have a strong foundation in both point and interval estimation, as well as in formulating and testing hypotheses effectively.
2. Students will be adept at using chi-square, t, and F-distributions for various statistical tests, including normal population variance, goodness of fit, and equality of variances.
3. Students will understand the importance and application of non-parametric tests, such as the sign test, run test, and median test, especially when parametric test assumptions are not met.
4. Students will enhance their critical thinking and problem-solving abilities through extensive practice with numerical examples and real-data applications in statistical analysis.
5. Students will be prepared for advanced studies and professional roles in statistics and data science, equipped with essential research and data analysis skills.
6. Students will be well-prepared to apply statistical methods in various professional settings, contributing effectively to research and data-driven decision-making processes.

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Subject: Applied Statistics
Practical Paper: Applied Statistics Lab-IV (AST-64P-204)
(Also common with Subject: Statistics Paper-STA-64P-204)

Objectives:

1. Understand and apply t-tests, Chi-square tests, and F-tests for assessing significance in various statistical contexts.
2. Learn Z transformation for testing the significance of sample correlation coefficients and apply it effectively.
3. Understand large sample tests for means and proportions to analyze data efficiently and interpret test outcomes accurately.
4. Apply Chi-square tests to assess goodness of fit and independence in contingency tables, interpreting results for practical insights.
5. Explore and apply Sign tests, Run tests, and Median tests for large samples as robust alternatives in non-parametric testing.
6. Develop skills to interpret statistical tests' outcomes and make informed decisions based on data analysis results.

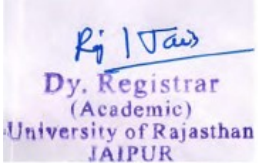
Detailed Syllabus

1. Single mean testing based on t distribution.(BCR & Confidence interval)
2. Difference of Means Testing based on t distribution.(BCR & Confidence interval)
3. Testing for Correlation coefficient
4. Testing for Regression Coefficient.
5. Testing of Variance based on Chi-square Distribution.(BCR & Confidence interval)
6. Goodness of fit test
7. Testing for Independence of Attributes
8. Testing of Hypothesis based on F Distribution. .(BCR & Confidence interval)
9. Large sample tests for mean.
10. Large sample tests for difference of means
11. Large sample tests for proportions
12. Large sample tests for difference of proportions
13. Non parametric tests: Sign, Run and Median.

Programme Specific Outcome (PSOs') of the Paper: Statistics Lab-IV (AST-64P-204):

Completing a course in statistical inference laboratory work, can provide several outcomes and benefits. Here are some common outcomes that you can expect:

1. Students will demonstrate proficiency in applying t-tests, Chi-square tests, and F-tests to assess significance in diverse statistical contexts.
2. Students will apply Z transformation effectively to test the significance of sample correlation coefficients.
3. Students will learn large sample tests for means and proportions, interpreting outcomes accurately for data analysis.
4. Students will utilize Chi-square tests to evaluate the goodness of fit and independence in contingency tables, drawing practical insights from results.
5. Students will employ Sign tests, Run tests, and Median tests for large samples as robust non-parametric alternatives in statistical analysis.
6. Students will interpret and communicate statistical test outcomes effectively to support data-driven decision-making processes.



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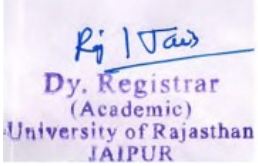
Semester -V



Subject: Applied Statistics

Theory Paper: Sample Surveys (AST-75T-301)

(Also common with Subject: Statistics Paper-STA-75T-301)

Objectives:

Overall, the objective of sample surveys is to provide students with a comprehensive understanding on various nuances of sample surveys, its comparison with conventional complete enumeration along with introduction to several forms of sampling techniques and sample drawing procedures. The objectives of the Sample Surveys are as follows:

1. To introduce and explore planning, execution and analyses of sample surveys.
2. To learn the concept of determination of sample size.
3. To understand Simple random sampling, Stratified random sampling, Systematic sampling and their comparisons
4. To comprehend concept of Cluster sampling.
5. To define and understand use of auxiliary information in Ratio, Product and Regression methods of estimation

Detailed Syllabus

Unit-I

Introduction-Planning, execution and analyses of sample surveys. Advantages of sample surveys over complete enumerations, Principles of sample surveys, Principal steps in a sample survey, Sampling Frame, Limitations of Sampling. Probability and non-probability sampling: Sampling and non-sampling errors, Methods of drawing a random sample from finite population, accuracy and precision of an estimator.

Unit-II

Simple Random Sampling- Simple Random Sampling with replacement (SRSWR) and without replacement (SRSWOR), probability of selecting any specified unit in the sample, Determination of sample size. Estimation of the population mean and its variance for SRSWOR and SRSWR. Simple Random Sampling of attributes, size of simple random sample for a specified precision.

Unit-III

Stratified random sampling-Meaning and advantages of Stratified Random Sampling, Estimation of the population mean and its variance. Optimum and proportional allocation and their comparison with SRSWR & SRSWOR. **Systematic sampling**- Definition, Method, Estimation of the population mean and its variance. Comparison with (i) SRSWOR and (ii) Stratified Random Sampling.

Unit-IV

Use of Auxiliary Information- Definition Ratio, Product and Regression methods of estimation, their comparisons among them, and with sample mean under SRSWOR. **Cluster Sampling** (with equal cluster size)- Definition, Estimation of mean and its variance, its comparison with SRSWOR.

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2. Murthy, M.N.(1967): Sampling Theory and Methods. Statistical Publishing Society, Calcutta.
3. Singh, Daroga and Chaudhary. F.S.(1989): Theory and Analysis of Sample Surveys Designs. Wiley Eastern Ltd.
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2. Chaudhuri, A. and Mukerjee, R.(1988):Randomized Responses .Theory and Techniques, New York : Marcel Dekker Inc.
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Programme Specific Outcome (PSOs) :Paper- Sample Surveys (AST-75T-301):

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Completing a course in Sample Surveys will provide several outcomes and benefits. Here are some common outcomes that student can expect:

1. Students will understand planning, execution and analysis of sample surveys.
2. Student will acquire skills concept of determination of sample size. Students will learn how to design effective surveys, including the formulation of clear and unbiased questions, the layout of questionnaires, and the pre-testing of surveys instruments to ensure reliability and validity.
3. Students will gain knowledge of Simple random sampling, Stratified random sampling, Systematic sampling and their comparisons
4. Student will develop understanding for concept of Cluster sampling.
5. Completing a course in Sample Surveys, students will develop critical thinking and problem-solving skills, enabling them to identify potential biases in surveys data, address challenges in surveys implementation, and improve surveys methodologies

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Subject: Applied Statistics

Practical Paper: Applied Statistics Lab-V (AST-75P-302)

(Also common with Subject: Statistics Paper-STA-75P-302)

Objectives:

The course aims to provide practical knowledge on various nuances of sample surveys and sample drawing procedures. The objectives of the paper are as follows:

1. To learn the concept of determination of sample size.
2. To understand practical questions of Simple random sampling, Stratified random sampling, Systematic sampling and their comparisons
3. To comprehend concept of Cluster sampling.
4. To define and understand use of auxiliary information in Ratio, Product and Regression methods of estimation

Detailed Syllabus

1. Practical problems for Simple Random Sampling with & without replacement
2. Practical problems for Stratified random sampling with various forms of allocations
3. Practical problems for Systematic sampling
4. Practical problems for Cluster, Ratio, Product and Regression methods of estimation.

Programme Specific Outcome (PSOs): Paper:-Statistics Lab-V (AST-75P-302):

Students completing the practical sessions in Sample Surveys will be able to do the following:

1. Students will gain knowledge of Simple random sampling, Stratified random sampling, Systematic sampling and their comparisons.
2. Student will develop understanding for concept of Cluster sampling.
3. Completing a course in Sample Surveys, students will develop critical thinking and problem-solving skills, enabling them to identify potential biases in surveys data, address challenges in surveys implementation, and improve surveys methodologies.

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Semester -VI

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Subject: Applied Statistics
Theory Paper: Design of Experiments (AST-76T-303)
(Also common with Subject: Statistics Paper-STA-76P-303)

Objectives:

Overall, the objective of this paper is to provide students with a comprehensive understanding on various nuances of Analysis of Variance, Design of Experiments, and Factorial experiments. The objectives of the paper are as follows:

1. To introduce and explore concept of Linear Models.
2. To understand Analysis of Variance technique for One way Anova and Two way Anova.
3. To learn the concept of Design of experiments and its need in analysis.
4. Further, to comprehend various designs like CRD, RBD and LSD along with their statistical analysis.
5. To make students able to develop flowcharts and algorithms of simple mathematical and statistical problems.

Detailed Syllabus

Unit-I

Introduction: Linear model & its different types (only introduction), Analysis of Variance technique: Basic Assumptions and its violation, Types of transformations, ANOVA for one-way and two-way classified data (with one observation per cell & fixed effects model). Least Square Estimates of various effects, Critical Difference.

Unit-II

Design of Experiments: Need for design of experiments, fundamental principles of design of experiments, Uniformity Trials, Choice of size and shape of plots, Basic designs (with one observation per cell & fixed effects model)-Completely randomized design (CRD), Randomized block design (RBD)-Their advantages and disadvantages & usage. Expectation of sum of squares.

Unit-III

Latin square design (LSD)- Analysis; least square estimates; expectation of sum of squares; efficiency of LSD over CRD & RBD, Efficiency of RBD over CRD. Missing plot technique- Estimation of single missing value in RBD & LSD.

Unit-IV

Basics of Programming- Structured Programming- Sequence, Control structures, Looping, Modular programming concepts. Arrays and their usages. Overview of different programming languages and generations, Algorithm & Flowchart- Introduction, comparison, construction for simple mathematical and statistical problems. Number systems- Binary, Octal, Decimal, Hexadecimal and their interchangeability. Operating systems- Definition, Functions and types.

References:

1. Das M.N. & Giri N.C.(1986) :Design and Analysis of Experiments. Springer Verlag
2. Goon A.M, Gupta M.K. Das Gupta B (1986) ; Fundamentals of Statistics, Vol-II World Press Kolkata
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Programme Specific Outcome (PSOs') : Paper- Design of Experiments (AST-76T-303):

Completing a course in Design of Experiments will provide several outcomes and benefits. Here are some common outcomes that student can expect:

1. Students will have the understanding about need, concepts and principles of experimental design.
2. Student will acquire skills in application of statistical methods to design experiments, analyze data, and interpret results.
3. They will be able to utilize design of experiments to optimize processes and improve product quality as well as performance in industrial and research settings.
4. Completing a course in Design of Experiments, students will develop the ability to design and conduct experiments in various fields, ensuring the collection of reliable and valid data.
5. Students will be friendly to understand the application of Flowcharts and algorithms of mathematical and statistical problems.
6. They will understand the need of computers in the field of Statistics.
7. They will have the knowledge of basics of computer system and its applications.

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Subject: Applied Statistics

Practical Paper: Applied Statistics Lab-VI (AST-76P-304)

(Also common with Subject: Statistics Paper-STA-76P-304)

Objectives:

The course aims to provide practical knowledge of analysis of different designs to provide students with a comprehensive understanding on various nuances of Analysis of Variance, Design of Experiments and Factorial experiments. The objectives of the paper are as follows:

1. To understand the application of Analysis of Variance technique for One way and Two way classification.
2. To do practical questions of CRD, RBD and LSD along with their statistical analysis.
3. To do practical questions to find missing values in various designs.
4. To do applications of flowcharts and algorithms of simple mathematical and statistical problems.

Detailed Syllabus

1. Practical problems based on Analysis of variance for one-way classification.
2. Practical problems based on Analysis of variance for two-way classification.
3. Practical problems based on Analysis of variance for CRD, RBD and LSD.
4. Practical problems based on Estimation of missing values
5. Practical problems based on Efficiency of RBD over CRD
6. Practical problems based on Efficiency of LSD over CRD & RBD.
7. Construction of Flowcharts for various mathematical and statistical problems.
8. Construction of Algorithms for various mathematical and statistical problems.

Programme Specific Outcome (PSOs): Paper- Statistics Lab-VI (AST-76P-304)

Students completing the practical sessions in Design of Experiment will be able to:

1. Apply theoretical knowledge of various analysis of variance techniques for One way and Two way classification.
2. Understand Practical questions of CRD, RBD and LSD along with their statistical analysis
3. Understand Practical questions to find missing values in various designs.
4. Students will understand the construction of flowcharts and algorithms for applicable mathematical and statistical problems.

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