



T.Y.B.Sc. (Mathematics) Semester-V

Minor Course – IV (Statistics)

COURSE NAME: Continuous Probability distributions and Introduction to Sampling

COURSE CODE: STMN-S5PR4-2CR26 [CREDITS - 02]

Course learning outcome		
At the end of this course, Students will be able to		
1. demonstrate the need of identifying the real-life situation to apply Normal and Exponential Distribution Probability Distributions and compute related probabilities & expected values. 2. apply the knowledge of Uniform and Gamma Probability Distributions for handling the real- life situations demanding computation of related probabilities and expected value. 3. apply the skill of drawing Simple Random Sample from the population and compute various estimates with their standard errors. 4. apply the skill of drawing Stratified and Systematic random sampling from the population and compute various estimates with their standard errors.		
Module 1	Continuous Probability distributions	[15L]
Learning Objective		
1. Understand the definitions and mathematical formulations of key continuous probability distributions. 2. Compute and interpret statistical measures (mean, variance, skewness, kurtosis) for various continuous distributions. 3. Derive moment-generating functions (MGFs) for different distributions and use them to find moments. 4. Apply these distributions to solve real-life problems in statistics, engineering, economics, and related fields.		
Learning Outcomes:		
At the end of this module the learner will be able to		
1. define and explain the Normal, Exponential, Gamma, and Continuous Uniform distributions. 2. derive and calculate the mean, variance, and moment-generating function (MGF) for each distribution. 3. compute and interpret higher-order moments: β_1 (skewness measure), β_2 (kurtosis measure), γ_1 (skewness), and γ_2 (kurtosis) 4. select and apply the appropriate distribution model to solve theoretical and applied probability problems.		
1.1	• Normal distribution: Definition, Mean, Variance, M.G.F. about origin and mean, β_1, β_2, γ_1 and γ_2, Different	[6L]



	properties	
1.2	• Exponential distribution: Definition, Mean, Variance, M.G.F. about origin, β_1, β_2, γ_1 and γ_2	[3L]
1.3	• Gamma distribution: Definition, Mean, Variance, M.G.F. about origin, β_1, β_2, γ_1 and γ_2	[3L]
1.4	• Continuous uniform distribution: Definition, Mean, Variance, M.G.F. about origin, β_1, β_2, γ_1 and γ_2	[3L]
Module 2	Introduction to sampling	[15L]
Learning Objective 1. provide a fundamental understanding of sampling techniques. 2. learn Simple random, stratified random and systematic sampling along with methods to estimate population parameters and analyze sampling errors. 3. understanding the concepts involved in planning and designing their surveys, presentation of survey data analysis of survey data and presentation of results.		
Learning Outcomes: At the end of this module the learner will be able to 1. understand the principal steps in sample survey, how to use random number tables, basic principle of sample survey, errors in sampling, complete enumeration versus sampling. 2. understanding of simple random sampling with and without replacement, procedure of selecting a sample and determination of sample size. 3. know the concept of stratified random sampling and systematic sampling and estimation of mean and variance.		
2.1	• Terminology & Simple Random Sampling: ○ Define terms: Population, Sample, Complete enumeration, Sampling, Sampling unit, Sampling frame, Sampling and non-sampling errors, population study and sample study ○ Advantages and limitations of sampling ○ Characteristics of an ideal sample ○ Random sampling	[3L]
2.2	• Simple random sampling (SRS) also for attributes: ○ Simple random sampling with replacement (SRSWR) and Simple random sampling without replacement (SRSWOR) ○ Method of Selection of sample ○ Mean and variance (without proof) ○ Advantages and limitations ○ Examples of above topics	[6L]
2.3	• Stratified random sampling: ○ Concept of stratified random sampling	[4L]



	○ Method of Selection of sample ○ Mean and variance (without proof) ○ Advantages and limitations ○ Examples of above topics	
2.4	● Systematic random sampling: ○ Concept of systematic random sampling ○ Method of Selection of sample ○ Advantages and limitations ○ Examples of above topics	[2L]

References:

1. S. C. Gupta, V. K. Kapoor: Fundamentals of Mathematical Statistics -12/e, Sultan Chand & Sons.
2. Gupta S.P: Statistical Methods -34/e, S. Chand & Sons., New Delhi.
3. Goon A.M., Gupta M. K. and Dasgupta 8: Fundamentals of Statistics, Vol. I & 11, 8/e. The world press, Kolkata.
4. Neil Weiss: Introductory Statistics – 10/e, Pearson.
5. Roxy Peck, Chris Olsen, Jay L. Devore: Introduction to Statistics and Data Analysis – 5/e, Cengage Learning
6. Cochran W.G.1977. Sampling Techniques. John Wiley.
7. Murthy M. N. 1977. Sampling Theory and Methods. 2/e. Statistical Publ. Soc., Calcutta.
8. Des Raj 1968. Sampling theory. TATA McGraw-Hill Publishing Company Ltd. New Delhi.
9. Deming W.E. 1950. Some Theory of Sampling. Dover Publications, Inc. New York.



Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Demonstrate the need of identifying the real-life situation to apply Normal and Exponential Distribution Probability Distributions and compute related probabilities & expected values.	X		X	X	X	
Apply the knowledge of Uniform and Gamma Probability Distributions for handling the real- life situations demanding computation of related probabilities and expected value.	X	X	X	X	X	
Apply the skill of drawing Simple Random Sample from the population and compute various estimates with their standard errors.	X	X	X	X	X	
Apply the skill of drawing Stratified and Systematic random sampling from the population and compute various estimates with their standard errors.	X	X	X	X	X	

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	10%	35%	25%	-	30%	-	100%
II	25%	25%	30%	-	20%	-	100%



SEMESTER VI

COURSE NAME: Minor Lab Course IV (Statistics practical)

COURSE CODE: STME-S5PR4-2CRC26 Credit- 02

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. understand and apply the properties of continuous probability distributions such as Normal, Exponential, and Gamma distribution.
2. apply appropriate random sampling techniques for data collection and analysis.

PRACTICAL Minor STMN-S5PR4-2CR26 (Lab Course - IV)

- 1 Examples of Normal distribution using area properties.
- 2 Test goodness of fit for the Normal Distribution with area method.
- 3 Test goodness of fit for the Normal Distribution with ordinate method.
- 4 Find parameter of Normal Distribution
- 5 Test goodness of fit for the Exponential distribution.
- 6 Examples of Gamma distribution.
- 7 Examples of Simple random sampling with replacement.
- 8 Examples of Simple random sampling without replacement.
- 9 Examples of Stratified random sampling.
- 10 Examples of Systemic random sampling.

Minimum number of experiments: 08



T.Y.B.Sc. (Mathematics) Semester-V
Minor Course – V (Statistics)

COURSE NAME: Testing of Hypothesis
COURSE CODE: STMN-S5PR5-2CR26 [CREDITS - 02]

Course learning outcome		
At the end of this course, Students will be able to		
1. define and explain statistical terms and concepts such as parameter, statistic, hypothesis, types of errors, p-value, test statistic, and significance levels used in hypothesis testing. 2. apply the procedure of hypothesis testing to formulate null and alternative hypotheses, determine critical regions, and make statistical decisions. 3. conduct and interpret significance tests for attributes and variables, including tests for proportions, means, and standard deviations for large sample test. 4. perform and interpret chi-square tests for goodness of fit, independence of attributes, and population variance, including using Yate's correction when applicable. 5. apply t-tests for means, paired and unpaired data, correlation significance, and F-test for comparison of variances under given assumptions.		
Module 1	Large sample tests:	[15L]
Learning Objective		
1. Understand and define key statistical terms related to hypothesis testing. 2. Learn the systematic procedure of conducting a test of hypothesis. 3. Study and apply significance tests for proportions, means and standard deviations in population-based decision-making for large sample test. 4. Solve practical problems related to hypothesis testing for attributes and variables for large sample test.		
Learning Outcomes:		
At the end of this module the learner will be able to		
1. define and explain core terms such as hypothesis, type I & II errors, p-value, test statistic, standard error, and significance levels. 2. describe and apply the step-by-step procedure for testing statistical hypotheses, including identifying null and alternative hypotheses, determining critical values, and interpreting results. 3. conduct and interpret significance tests for: Single proportions and difference of proportions (attributes), Single mean, difference of means, and difference of standard deviations (variables). 4. solve numerical problems and case studies involving both attribute and variable tests using correct statistical formulas and logic.		



1.1	• Terminology: ○ Define terms: Parameter, Statistic, Sampling distribution of a statistic, Standard error, Hypothesis, Statistical hypothesis, Simple and composite hypothesis, Null and alternative hypothesis, Test of a statistical hypothesis, Type I and Type II errors, Power of a test, Level of significance, Rejection region, Critical value, Test statistic, Two-tailed and One-tailed test, Degrees of freedom, Concept of p value • Procedure for testing of hypothesis	[6L]
1.2	• Significance tests for attributes: (i) Test of significance for single proportion (ii) Test of significance for the difference of proportions • Problems of above topics	[4L]
1.3	• Significance tests for variables: (i) Test of significance for single mean (ii) Test of significance for the difference of means (iii) Test of significance for the difference of standard deviations • Problems of above topics	[5L]
Module 2	Small sample tests	[15L]
Learning Objective 1. Understand the theory, assumptions, and applications of the Chi-square test, including goodness of fit, independence of attributes with Yate's correction and variance testing for small sample. 2. Learn the concept, assumptions, and practical applications of the t-test for single mean, difference of means (independent and dependent samples), and significance of correlation coefficient. 3. Understand the F-test statistic, its assumptions, and its use in testing the equality of two population variances and develop problem-solving skills by applying these tests to real-world statistical data and interpreting the results.		
Learning Outcomes: At the end of this module the learner will be able to 1. explain the assumptions and applications of the Chi-square test, and perform tests for goodness of fit, independence of attributes, and population variance using the Chi-square variate and Yate's correction. 2. apply the t-test to test hypotheses involving a single mean, difference of means for independent and dependent samples, and assess the significance of correlation coefficients. 3. conduct the F-test to compare two population variances and interpret the outcomes correctly and solve numerical problems involving Chi-square, t-test, and F-test, demonstrating critical analysis of results.		



2.1	• Chi square test: ○ Chi square variate, Assumptions of Chi square test ○ Applications: ▪ To test the goodness of fit ▪ To test the independence of attributes ▪ To test a specified value of the variance of the population ○ Yate's Correction ○ Problems of above topics	[6L]
2.2	• t- Test: ○ t- statistic, Assumptions of t - test ○ Applications: ▪ Test for single mean ▪ Test for difference of means: For independent samples and for dependent sample ▪ Test the significance of an observed sample correlation coefficient ○ Problems of above topics	[6L]
2.3	• F- Test: ○ F- statistic, Assumptions of F - test ○ Application: Test for equality of two population variances ○ Problems of above topics	[3L]

References:

1. S. C. Gupta, V. K. Kapoor: Fundamentals of Mathematical Statistics -12/e, Sultan Chand & Sons.
2. Gupta S.P: Statistical Methods -34/e, S. Chand & Sons., New Delhi.
3. Goon A.M., Gupta M. K. and Dasgupta: Fundamentals of Statistics, Vol. I & 11, 8/e. The world press, Kolkata.
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5. Roxy Peck, Chris Olsen, Jay L. Devore: Introduction to Statistics and Data Analysis – 5/e Cengage Learning.



Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Define and explain statistical terms and concepts such as parameter, statistic, hypothesis, types of errors, p-value, test statistic, and significance levels used in hypothesis testing.	X					X
Apply the procedure of hypothesis testing to formulate null and alternative hypotheses, determine critical regions, and make statistical decisions.		X		X		
Conduct and interpret significance tests for attributes and variables, including tests for proportions, means, and standard deviations for large sample test.		X	X		X	
Perform and interpret chi-square tests for goodness of fit, independence of attributes, and population variance, including using Yate's correction when applicable.		X		X		
Apply t-tests for means, paired and unpaired data, correlation significance, and F-test for comparison of variances under given assumptions.		X	X		X	

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	60%	20%	-	-	-	100%
II	20%	60%	20%	-	-	-	100%



SEMESTER V

COURSE NAME: Statistics Minor Lab Course V

COURSE CODE: STME-S5PR5-2CRC26

Course Learning Outcomes

After the successful completion of the Course, the learner will be able to:

1. apply the Chi-square (χ^2) test for analyzing categorical data and testing independence of attributes.
2. apply t -tests for analyzing sample means, differences between means, and correlation significance.
3. apply the F-test to compare population variances.

PRACTICAL V

STME-S5PR5-2CRC26

[60 Hr]

- 1 Examples of χ^2 test for independence of attributes of 2×2 contingency table.
- 2 Examples of χ^2 test for independence of attributes.
- 3 Examples of χ^2 test for Population variance.
- 4 Examples of t test for single mean
- 5 Examples of t test for difference of means.
- 6 Examples of t test for independent samples and for dependent sample
- 7 Examples of t test the significance of an observed sample correlation coefficient.
- 8 Examples of F test for difference of variances.

Minimum number of experiments: 7