Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

Autonomous

Course Structure for M.Sc. I STATISTICS

Semester	Paper Code	Title of Paper	No. of Credits
I	STAT-4101	Mathematical Analysis	4
	STAT-4102	Linear Algebra	4
	STAT-4103	Probability Distributions	4
	STAT-4104	Sampling Theory	4
	STAT-4105	Practical-I	4
	STAT-4106	Practical-II	4

SYLLABUS(CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020

Class : M. Sc. (Semester- I)
Paper Code: STAT-4101
Paper : I Title of Paper : Mathematical Analysis
Credit : 4 credits No. of lectures: 60

A) Learning Objectives: Students should:

1 Use calculus to analyze and evaluate properties of real valued functions.

2 Have a deeper understanding of mathematical theory.

B) Learning Outcome:

CO1 Understand the fundamentals ideas and applications of calculus.

CO2 Employ technology to investigate mathematical concepts and applications.

CO3 Understand the concepts required for further studies in Probability Theory and Asymptotic Inference.

CO4 Use technology appropriately to investigate and solve mathematical and statistical problems.

CO5 Be familiar with several subfields of mathematics (e.g, numerical analysis, topology, operations research).

CO6 Apply mathematical concepts and principles to perform numerical and symbolic computations.

CO7 concept of convergence of sequence of real numbers, pointwise and uniform convergence of sequence of functions.

TOPICS/CONTENTS:

Unit-1

Set of real numbers, supremum and infimum of sets of real numbers, real field, Euclidean spaces, Finite, Countable and uncountable sets, metric spaces, interior points and limit points of a set,

open set, closed set. (These concepts will be introduced through metric spaces and R^n will be considered as a special case) Compactness, Heine-Borel theorem.

(15L)

Unit-2

Sequence of real numbers, convergence and divergence of sequence, subsequences of a sequence, Cauchy sequences, Bolzano-Weierstrass theorem, completeness of R, limit inferior, limit superior of the sequences, some special sequences. **(15L)**

Unit-3

Series of real numbers, convergence of series, tests for convergence of series (ratio test, root test), alternative series, conditional and absolute convergence, power series and radius of convergence, examples and problems on these concepts. **(15L)**

Unit-4

Concept and examples on Derivative of real function, mean value theorem, L' Hospital rule, Taylor's theorem, Inverse function theorem (without proof), implicit function theorem (without proof), definitions and existence of Riemann integral, refinement of partitions, condition of integrability, Riemann sums, fundamental theorem of calculus, definition and existence of Riemann-Stieltjes integral, a condition of integrability **(15L)**

References:

1. Apostol T.M. (1975). Mathematical Analysis: A modern approach to advanced calculus. Addison-Wesley
2. Rudin, W. (1985). Principles of Mathematical Analysis, McGraw-Hill
3. Goldberg R.R.(1964): Methods of Real Analysis-Blaisell Publishing company, New York, U.S.A.
4. Bartle R.G. & Sherbert D.R. (2000): Introduction to Real Analysis-John Wiley & Sons Inc.
5. Bartle R. G. (1976). Elements of Real Analysis, John Wiley
6. Mapa S. K. (2018) Inroduction to Real Analysis, Sarat Book Distributors, Kolkata
7. Ghorpade, S. R. and Limaye, B. V. (2006). A Course in Calculus and Real Analysis, Springer
8. Ajit Kumar (2019), A Basic Course in Real Analysis, A Chapman & Hall Book

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-							2
CO2		2							
CO3									
CO4			1						
CO5					2				
CO6						2			
CO7							2		

Justification:

PO1 - Disciplinary Knowledge

CO1 (Weightage: 3): Understanding the fundamentals of calculus directly aligns with disciplinary knowledge as it is a foundational concept in mathematics.

PO2 - Critical Thinking and Problem Solving

CO2 (Weightage: 2): Employing technology to investigate mathematical concepts requires critical thinking and problem-solving skills in utilizing these tools effectively.

PO3 - Social Competence

CO4 (Weightage: 1): Using technology appropriately to investigate and solve mathematical problems partially relates to social competence as it involves effective communication of mathematical solutions.

PO4 - Research-related Skills and Scientific Temper

CO3 (Weightage: 3): Understanding concepts required for further studies in Probability Theory and Asymptotic Inference strongly relates to research-related skills and scientific temper.

PO5 - Trans-disciplinary Knowledge

CO5 (Weightage: 2): Being familiar with several subfields of mathematics (e.g., numerical analysis, topology, operations research) moderately relates to trans-disciplinary knowledge as it involves knowledge integration from various mathematical domains.

PO6 - Personal and Professional Competence

CO6 (Weightage: 2): Applying mathematical concepts to perform numerical and symbolic computations moderately relates to personal and professional competence by showcasing mathematical skills in practical applications.

PO7 - Effective Citizenship and Ethics

CO7 (Weightage: 2): Understanding the concept of convergence of sequences and functions moderately relates to effective citizenship and ethics as it involves precision and adherence to mathematical principles.

PO8 - Environment and Sustainability

(No direct alignment observed): None of the COs strongly align with Environment and Sustainability.

PO9 - Self-directed and Life-long Learning

CO1 (Weightage: 2): Understanding the fundamentals of calculus significantly contributes to self-directed and lifelong learning by establishing a strong foundation for further mathematical studies.

SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020

Class : M. Sc. (Semester- I)
Paper Code: STAT-4102
Paper : II Title of Paper : Linear Algebra
Credit : 4 credits No. of lectures: 60

A)Course Objectives:

1 Use the basic concepts of vector and matrix algebra
2 Understand real vector spaces and subspaces and apply their properties.
3 Solve systems of linear equations using various methods
4 Understand basic mathematical concepts required in advanced statistical and machine learning techniques.

B) Course Outcome:

CO1 Comprehensive knowledge of matrix operations, including addition, subtraction, multiplication, and properties of matrices.
CO2 Proficiency in matrix algebra, including determinant computation, inverse matrices, and their applications.
CO3 Understanding the concept of linear transformations and their representations using matrices.
CO4 Ability to analyze and describe transformations geometrically, algebraically, and computationally.
CO5 learn about eigen values and eigenvectors and their applications in various fields.
CO6 explore inner product spaces, orthogonality and orthogonal projections.
CO7 apply the concept of decomposition of a matrix.

TOPICS/CONTENTS:

Unit-1

Vector space, subspace, linear dependence and independence, basis and dimension of a vector space, orthogonal and orthonormal vectors, null space, Gram-Schmidt Orthogonalization process, orthonormal basis, orthogonal projection of vector, linear transformation, algebra of matrices, row and column spaces of a matrix, elementary operations and elementary matrices, rank of a matrix. **(15 L)**

Unit-2

Inverse of a matrix null space and nullity, partitioned matrices, permutation matrix, reducible / irreducible matrix, primitive / imprimitive matrix, idempotent matrix, Kronecker product, Generalised inverse, Moore-Penrose generalized inverse, solution of a system of homogenous and non-homogeneous linear equation, theorem related to existence of solution and examples **(15 L)**

Unit-3

Characterstic roots of a matrix algebraic and geometric multiplicities of a characteristic root, right and left characteristic, vector, orthogonal property of characteristic vector Cayley-Hamilton theorem and its applications. **(15 L)**

Unit-4

Spectral decomposition of a real symmetric matrix singular value decomposition nth power of a matrix, Choleskey decomposition of real quadratic form, reduction and classification of simultaneous reduction of two quadratic forms, maxima and minima of ratio of quadratic form. **(15 L)**

References:

1 . Graybill, F.A(1961) An Introduction to Linear Statistical Models Vol 1,McGraw-Hill Bokk Company Inc.
2 . Hadely G.(1962) Linear Algebra,Narosa Publishing House.
3 . Harville D. (1997) Matrix Algebra From Statistics Perspective,Springer.
4 . Rao A.R. and Bhimasankaram P.(2000),Linear Algebra,Second edition,Hindustan Book Agency.
5 . Rao C.R. (2001) Linear Statistical Inference and Its Application,Second Edition,Wiley.
6 . Schott J. (2016) Matrix Analysis for Statistics,Third edition Wiley.
7 . Searl S.B.(2006) Matrix Algebra Useful for Statistics,Wiley.
8 . R. B. Bapat Linear Algebra and Linear Models.

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3								
CO2		3							
CO3				3					
CO4									
CO5					3				
CO6						3			
CO7							2		

Justification:

PO1 - Disciplinary Knowledge

CO1 (Weightage: 3): Comprehensive knowledge of matrix operations and their properties directly aligns with disciplinary knowledge, forming the basis of linear algebra.

PO2 - Critical Thinking and Problem Solving

CO2 (Weightage: 3): Proficiency in matrix algebra, including determinant computation and inverse matrices, requires critical thinking skills and problem-solving abilities.

PO3 - Social Competence

(No direct alignment observed): None of the COs strongly align with Social Competence.

PO4 - Research-related Skills and Scientific Temper

CO3 (Weightage: 3): Understanding the concept of linear transformations and their representations using matrices strongly relates to research-related skills and scientific temper.

PO5 - Trans-disciplinary Knowledge

CO5 (Weightage: 3): Learning about eigenvalues, eigenvectors, and their applications in various fields strongly relates to trans-disciplinary knowledge as these concepts find applications across different disciplines.

PO6 - Personal and Professional Competence

CO6 (Weightage: 3): Exploring inner product spaces, orthogonality, and orthogonal projections significantly relates to personal and professional competence, showcasing mathematical skills applicable in various contexts.

PO7 - Effective Citizenship and Ethics

CO7 (Weightage: 2): Applying the concept of matrix decomposition moderately relates to effective citizenship and ethics as it involves utilizing mathematical principles appropriately.

SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020

Class : M. Sc. (Semester- I)
Paper Code: STAT-4103
Paper : III Title of Paper : Probability Distributions
Credit : 4 credits No. of lectures: 60

A) Course Objectives:

1. Providing students with a formal treatment of probability theory.
2. Understand characteristics about discrete and continuous random variable and their probability distributions.
3. Prepare students for modeling real data using distributions
4. Develop understanding of distribution theory related for further advanced topics in statistical inference.

B) Course Outcome:

Students should be able to:

CO1 Develop problem-solving techniques needed to accurately calculate probabilities.

CO2 Apply problem-solving techniques to solving real-world events.

CO3 Apply selected probability distributions to solve problems.

CO4 prepare students for modeling real data using distributions

CO5 develop understanding of distribution theory related for further advanced topics in statistical inference.

CO6 develop problem-solving techniques to solving real-world events.

CO7 apply selected probability distributions to solve problems.

TOPICS/CONTENTS:

Unit 1:

Random experiments and it's sample space, probability axioms, random variables, probability distribution of random variables, discrete and continuous random variable, functions of random variables and its distribution, mixture of probability distribution, m.g.f, p.g.f of distribution function. **(15 L)**

Unit 2:

Multiple random variables, joint, marginal and conditional distribution, variance covariance matrix, independence of random variables, marginal and conditional densities using joint densities, conditional expectations and variance, convolution of random variable, compound distribution, multiple and partial correlation coefficient, exponential family of distribution, location and scale families, non-regular family. **(15 L)**

Unit 3:

Bivariate normal, bivariate Poisson, bivariate exponential, (Olkins method 3 types) Weibull (2 and 3 parameter), multinomial, Dirichlet, sampling distribution of statistics from univariate normal random samples. **(15 L)**

Unit 4:

Non-central χ^2, t, F distribution and their properties, distribution of linear and quadratic forms in iid and standard normal variable (technique based on m.g.f.), Independence of two linear forms, Independence of two quadratic forms and independence of linear and quadratic forms, Fisher's Cochrans theorem, order statistic, joint distribution of order statistic, distribution of r^{th} order statistic, joint distribution of (r^{th} and s^{th} order statistic and their function), distribution of range. **(15 L)**

References:

1 Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics, John wiley & Sons (Asia)

2 Hogg R. V. and Crag R. G. (1978): Introduction to Mathematical Statistics Ed.4.

3 Casella and Burger(2002) Statistical Inference (Duxbury advanced series II edition)

4 Johnson N.L. & Kotz S.(1996) Distributions in statistics Vol.I .VolI and Vol III John Wiley and sons Inc.)

5 Johnson N.L., Kotz S., Balkrishnan, N. Multivariate Distributions (John Wiley and sons)

6 Rohatagi V.K. & Saleh A.K.(2001) Introduction to probability theory and mathematical statistics. (John Wiley and sons)

7 Anirban DasGupta, Fundamentals of Probability: A First Course

8 Feller, Fundamentals of Probability: A First Course

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2								
CO2		2							
CO3									
CO4				2					
CO5					3				
CO6						2			
CO7							3		

Justification:

PO1 - Disciplinary Knowledge
CO1 (Weightage: 2): Developing problem-solving techniques for calculating probabilities directly contributes to disciplinary knowledge in probability theory and statistics.
PO2 - Critical Thinking and Problem Solving
CO2 (Weightage: 3): Applying problem-solving techniques to real-world events strongly aligns with critical thinking and problem-solving skills.
PO3 - Social Competence
(No direct alignment observed): None of the COs strongly align with Social Competence.
PO4 - Research-related Skills and Scientific Temper
CO4 (Weightage: 2): Preparing students for modeling real data using probability distributions moderately relates to research-related skills and scientific temper as it involves applying theoretical knowledge to practical scenarios.
PO5 - Trans-disciplinary Knowledge
CO5 (Weightage: 3): Developing an understanding of distribution theory for further advanced topics in statistical inference strongly relates to trans-disciplinary knowledge as it provides a foundational understanding applicable across various fields.
PO6 - Personal and Professional Competence
CO6 (Weightage: 2): Developing problem-solving techniques for solving real-world events moderately relates to personal and professional competence by applying statistical knowledge in practical situations.
PO7 - Effective Citizenship and Ethics
CO7 (Weightage: 3): Applying selected probability distributions to solve problems significantly relates to effective citizenship and ethics by using statistical tools responsibly and ethically.

SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020

Class : M. Sc. (Semester- I)
Paper Code: STAT-4104
Paper : IV Title of Paper: Sampling Theory
Credit : 4 credits No. of lectures: 60

Course Objectives:

1 To introduce the statistical aspects associated with the design and analysis of sample surveys, and to develop your understanding of the principles and methods used to design survey sampling schemes.
2 Distinguish between probability and non-probability sampling.
3 Understand the factors to consider when determining sample size.
4 Understand the steps in developing a sampling plan.
5 Handle the problem of non response or missing data.

Course Outcomes:

Students are expected to

CO1 Define principal concepts about sampling
CO2 Explains the advantages of sampling.
CO3 Lists the stages of sampling process
CO4 Categorizes and defines the sampling methods
CO5 Apply the Simple Random Sampling (SRS) method
CO6 To analyze and solve problems
CO7 Use statistical softwares.

TOPICS/CONTENTS:

Unit 1:

Objectives of sample survey, planning for sample survey, concept of sampling distribution of statistic, Simple random sampling with replacement, Simple random sampling without replacement, systematic sampling and related results on estimation of population total, mean and proportion, circular systematic sampling, stratified sampling: formation of strata and number of strata, allocation problems and estimation problems, deep stratification and method of collapsed strata**.** **[15L]**

Unit 2:

Inclusion probabilities, Probability Proportional to Size With Replacement (PPSWR) methods, cumulative total method and Lahiri's method for estimation problem, estimation of finite population mean and total, PPSWOR method, Horvitz-Thompson estimator, its variance and properties, Des Raj estimators for a general sample size and Murthy's estimator for a sample of size 2, midzuno sampling design. **[15L]**

Unit 3:

Use of supplementary information for estimation, ratio and regression estimators using separate strata and combined strata, unbiased and almost unbiased ratio type estimators of population mean post stratification, variance of estimator of population mean under it, cluster sampling with clusters of equal sizes and unequal sizes, estimator of population mean and its properties, two stage sampling with equal first stage units, expected value and variance of sample mean, double sampling. **[20L]**

Unit 4:

Sampling and non-sampling errors, Response and non response errors, mathematical model for Response errors, Hansen Hurwitz technique Randomized response technique (RRT), Warner's model; related and unrelated questionnaire methods. **[10L]**

References:

1. Des Raj & Chandhok P.(1998), Sample survey theory (Narosa)
2. Murthy M.N.(1977) Sampling theory and methods (Statistical Publishing Society)
3. Sukhatme P.V. Sukhatme B.V. and C. Ashok Sampling theory of survey and applications (Indian society for Agricultural statistics)
4. W.G.Cochran, (1977) Sampling techniques (John Wiley and sons)

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3								
CO2		2							
CO3									
CO4				3					
CO5					2				
CO6						2			
CO7							2		

Justification:

PO1 - Disciplinary Knowledge

CO1 (Weightage: 3): Defining principal concepts about sampling directly contributes to disciplinary knowledge in the field of sampling methodologies and statistics.

PO2 - Critical Thinking and Problem Solving

CO2 (Weightage: 2): Explaining the advantages of sampling requires critical thinking to analyze various sampling methods' strengths and weaknesses.

PO3 - Social Competence

(No direct alignment observed): None of the COs strongly align with Social Competence.

PO4 - Research-related Skills and Scientific Temper

CO4 (Weightage: 3): Categorizing and defining sampling methods strongly relates to research-related skills and scientific temper by understanding various methodologies used in research.

PO5 - Trans-disciplinary Knowledge

CO5 (Weightage: 2): Applying the Simple Random Sampling (SRS) method moderately relates to trans-disciplinary knowledge, providing a foundational understanding of a widely used sampling technique.

PO6 - Personal and Professional Competence

CO6 (Weightage: 2): Analyzing and solving problems related to sampling techniques moderately contribute to personal and professional competence by applying statistical knowledge practically.

SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020

Class : M. Sc. (Semester- I)
Paper Code: STAT-4105
Paper : V Title of Paper: Practical-I
Credit : 4 credits No. of lectures: 60

Course Outcomes:

Students should be able to:

- **CO1** understand various discrete and continuous probability distributions along with their real-life applications.
- **CO2** understand the concepts of quadratic forms and solve problems.
- **CO3** explore applications of linear algebra in multivariate analysis, linear models etc.
- **CO4** review the core topics in probability and statistics through the study and practice of data analysis and graphical interpretation using statistical software.
- **CO5** solve systems of linear equations using various methods.
- **CO6** plots different probability distributions and draw a model sample from it.
- **CO7** construct the orthogonal matrix, diagonalization of a symmetric matrix etc.

Sr. No.	Title of Experiments
1.	Introduction to Statistical Software – I (Minitab, R)
2.	Introduction to Statistical Software – II (Matlab, SPSS)
3.	Matrices
4.	G-Inverse
5.	MPG-Inverse
6.	Eigen value, Eigen vectors, Spectral decomposition, Power of matrix- I
7.	Eigen value, Eigen vectors, Spectral decomposition, Power of matrix- II
8.	Solution of system of linear equations using Gauss elimination and Gauss Jordon
9.	Solution of system of linear equations using Gauss Seidal and Gauss Jacobi methods
10.	Application of Calley- Hamilton Theorem
11.	Classification and reduction of quadratic forms
12.	Plotting of density function, distribution functions and Computation of probability of events related to bivariate probability distribution computation of probability of non-central χ^2, t, F-distributions

13.	Model sampling from Gamma, Chi-square, Weibull, Lognormal probability distribution
14.	Model sampling from discrete, continuous and mixture distribution
15	Model sampling from bivariate probability distribution

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3								
CO2		2							
CO3									
CO4				3					
CO5					2				
CO6						2			
CO7							2		

Justification:

PO1 - Disciplinary Knowledge

CO1 (Weightage: 3): Defining principal concepts about sampling directly contributes to disciplinary knowledge in the field of sampling methodologies and statistics.

PO2 - Critical Thinking and Problem Solving

CO2 (Weightage: 2): Explaining the advantages of sampling requires critical thinking to analyze various sampling methods' strengths and weaknesses.

PO3 - Social Competence

(No direct alignment observed): None of the COs strongly align with Social Competence.

PO4 - Research-related Skills and Scientific Temper

CO4 (Weightage: 3): Categorizing and defining sampling methods strongly relates to research-related skills and scientific temper by understanding various methodologies used in research.

PO5 - Trans-disciplinary Knowledge

CO5 (Weightage: 2): Applying the Simple Random Sampling (SRS) method moderately relates to trans-disciplinary knowledge, providing a foundational understanding of a

widely used sampling technique.

PO6 - Personal and Professional Competence

CO6 (Weightage: 2): Analyzing and solving problems related to sampling techniques moderately contribute to personal and professional competence by applying statistical knowledge practically.

SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020

Class : M. Sc. (Semester- I)
Paper Code: STAT-4106
Paper : VI Title of Paper: Practical-II
Credit : 4 credits No. of lectures: 60

Course Outcomes:

CO1 Ability to choose appropriate methods for interpolation, optimization, integration, and statistical analysis based on the problem at hand.
CO2 Enhanced critical thinking and problem-solving skills in mathematics, statistics, and computational methods.
CO3 use statistical software for the analysis and interpretation of the outcomes.
CO4 estimate parameters under various sampling techniques.
CO5 find solutions of equations using various numerical computing methods.
CO6 understand different sampling survey methods and give examples of situations where these methods are useful.
CO7 learn R-reporting and developing own R code and use of different R packages.
CO8 Proficiency in applying mathematical and computational techniques for data analysis and problem-solving.

Sr. No.	Title of Experiments
1.	Estimation of parameters in simple random sampling using SRSWR and SRSWOR
2.	Estimation of parameters in Systematic sampling
3.	PPS sampling
4.	Ratio and Regression estimates
5.	Stratified sampling (using ratio and regression)
6.	Cluster sampling with equal and unequal cluster size
7.	Two stage sampling
8.	Double sampling
9.	Simultaneous Transcendental equations (Theory and Procedure)
10.	Simultaneous Transcendental equations (Problems using any Software)
11.	Bivariate Interpolation

12.	Unconstraint Optimization Techniques (Theory and Procedure)
13.	Unconstraint Optimization Techniques (Problems using any Software)
14.	Computation of integral by Riemann and Riemann-Stiltjes integral
15	Jackknife technique and Bootstrap technique

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3								
CO2		3							
CO3									
CO4				2					
CO5					2				
CO6						2			
CO7							3		

Justification:

PO1 - Disciplinary Knowledge

CO1 (Weightage: 3): Ability to choose appropriate methods for interpolation, optimization, integration, and statistical analysis based on the problem at hand directly aligns with disciplinary knowledge in applied mathematics, statistics, and computational methods.

PO2 - Critical Thinking and Problem Solving

CO2 (Weightage: 3): Enhanced critical thinking and problem-solving skills in mathematics, statistics, and computational methods strongly relate to the development of critical thinking and problem-solving abilities.

PO3 - Social Competence

PO4 - Research-related Skills and Scientific Temper

CO4 (Weightage: 2): Estimating parameters under various sampling techniques moderately relates to research-related skills, especially in statistics and sampling methodologies.

PO5 - Trans-disciplinary Knowledge

CO5 (Weightage: 2): Finding solutions of equations using various numerical computing methods moderately contributes to trans-disciplinary knowledge by integrating numerical methods across different disciplines.

PO6 - Personal and Professional Competence

CO6 (Weightage: 2): Understanding different sampling survey methods and providing examples of their usefulness moderately contributes to personal and professional competence, particularly in understanding real-world applications of sampling techniques.

PO7 - Effective Citizenship and Ethics

CO7 (Weightage: 3): Learning R-reporting, developing own R code, and using different R packages significantly relate to effective citizenship and ethics by emphasizing responsible and effective usage of statistical software.