SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS)

SALEM – 16 Reaccredited with 'B++' Grade by NAAC (Affiliated to Periyar University)



DEPARTMENT OF STATISTICS

OUTCOME BASED SYLLABUS B.Sc. Statistics

(From the academic year 2023 – 24 onwards)

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), SALEM – 16. DEPARTMENT OF STATISTICS B.Sc. STATISTICS PROGRAMME STRUCTURE UNDER CBCS (From the academic year 2023-24 onwards) Total Credits: 140 + Extra Credits (Maximum 28)

I - SEMESTER

Part	Course	Course Title	Code	Hours	Credit			
				per				
				week				
Ι	Language	Tamil/Hindi/Sanskrit	23ULTC1/	6	3			
			23ULHC1/					
			23ULSC1					
II	English	General English - I	23ULEC1	6	3			
III	Core Course – I	Descriptive Statistics	23USTCC1	5	5			
	Core Course – II	Probability Theory	23USTCC2	5	5			
	Elective – I	Algebra and Differential	23USTMGE	4	3			
	Generic Course	Calculus	CI					
IV	Skill Enhancement	Basics of Statistics	23USTSEC1	2	2			
	Course (NME 1)							
	Skill Enhancement	Introductory Statistics	23USTSEFC	2	2			
	(Foundation Course)							
				30	23			
V	• Articulation and	Idea Fixation Skills						
(Extra	• Physical Fitness	Practice – 35 hours per semes	ster					
Skills)	 Advanced Diploma Course in Statistical Methods Level – I: Certificate Course 100 hours per Year 							

II - SEMESTER

Part	Course	Course Title	Code	Hours	Credit		
				per			
				week			
Ι	Language	Tamil/Hindi/Sanskrit	23ULTC2/	6	3		
			23ULHC2/				
			23ULSC2				
II	English	General English – II	23ULEC2	6	3		
III	Core Course – III	Matrix and Linear	23USTCC3	5	4		
		Algebra					
	Core Course – IV	Distribution Theory	23USTCC4	4	4		
	Generic Course	Integral Calculus and	23USTMGEC2	3	3		
	Allied – II	Laplace Transforms					
		Theory of Equations and	23USTMGECQ	2	2		
		Laplace Transforms using					
		Sagemath					
		Practical					
IV	Skill Enhancement	Statistics in Ancient India	23USTSEC2	2	2		
	Course (NME I1)						
	Skill Enhancement	Basic Statistics: Practical	23USTSECQ3	2	2		
	(SEC III)	(Problems from CORE					
		COURSE I, II, III and IV)					
				30	23		
	Articulation and Idea Fixation Skills						
• Physical Fitness Practice – 35 hours per semester							
	• Adva	unced Diploma Course in Sta	tistical Methods				
Level – I: Certificate Course 100 hours per week							

Part	Course	Course Title	Code	Hours	Credit		
				per			
				week			
Ι	Language	Tamil	23ULTC3	6	3		
		Hindi	23ULHC3				
		Sanskrit	23ULSC3				
II	English	General English – III	23ULEC3	6	3		
III	Core Course – V	Estimation Theory	23USTCC5	5	5		
	Core Course – VI	Sampling Techniques	23USTCC6	5	5		
	Discipline Specific	Numerical Methods	23USTDSEC1	4	3		
	Course						
	Allied – III						
IV	Skill Enhancement	Data Analysis using MS	23USTSECQ4	2	1		
	Course IV	EXCEL					
	Skill Enhancement	Estimation and Sampling	23USTSECQ5	2	2		
	V	Techniques: Practical					
		(Problems from CORE					
		COURSE V and VI)					
				30	22		
• A	Articulation and Idea Fixa	ation Skills					
• I	Physical Fitness Practice – 35 hours per semester						
• A	Advanced Diploma Cours	e in Statistical Methods					
• I	Level – II: Diploma Cours	se 100 hours per week					

Part	Course	Course Title	Code	Hours	Credit
				per	
				week	
Ι	Language	Tamil	23ULTC3	6	3
		Hindi	23ULHC3		
		Sanskrit -IV	23ULSC3		
II	English	English – IV	23ULEC3	6	3
III	Core Course – VII	Testing of Statistical	23USTCC7	5	5
		Hypothesis			
	Core Course – VIII	Actuarial Statistics	23USTCC8	5	5
	Discipline Specific	Economic & official	23USTDSEC2	3	3
	Course	Statistics			
	Allied – IV				
IV	Skill Enhancement	Testing of Hypothesis &	23USTSECQ6	2	2
	Course VI	Actuarial Statistics using MS			
		Excel			
	Skill Enhancement	Biostatistics	23USTSEC7	2	2
	Course VII				
		Environmental Studies	23UEVSC	1	2
				30	22
• A	Articulation and Idea Fixa	ation Skills	1	<u> </u>	<u>I</u>
• F	Physical Fitness Practice -	- 35 hours per semester			
• 4	dvanced Dinloma Cours	e in Statistical Methods			
- 1	a functu Dipitinu Cours	e in Statistical Methods			

• Level – II: Diploma Course 100 hours per week

B.Sc. Statistics : Programme Outcome, Programme Specific Outcome and Course Outcome

Statistics is the study of Data and extracting knowledge in the data using various methods and techniques, analyze and interpret data, taking data driven predictions and decisions. It also helps data collection through sampling techniques, that is to collect data focusing on problem solving, and presenting it with wider scope of application in science, social sciences, medical science, life sciences, country's official statistics etc. Statistical methods are used as research methodology in all most all domains. The key core areas of study in Statistics include Descriptive Statistics, Probability Theory, Sampling techniques, Matrix and Linear Algebra, Distribution Theory, Estimation Theory, Testing of Statistical hypotheses, Stochastic process, Regression analysis, Design of Experiments, Demography and Official Statistics. The Bachelor's Degree B.Sc. Statistics is awarded to the students on the basis of knowledge, understanding, skills, attitudes, values and academic achievements expected to be acquired by learners at the end of the Programme. Learning outcomes of Statistics are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for gaining knowledge of Statistics.

Bachelor's degree in Statistics is the culmination of in-depth knowledge in both theoretical and practical methods and techniques of Statistics. This also leads to study of related areas like Computer science, Industrial Statistics, Mathematical Statistics, Business Statistics and many more. Thus, this programme helps learners in building a solid foundation for higher studies in Statistics. The skills and knowledge gained have intrinsic aesthetics leading to proficiency in analytical reasoning. This can be utilized in Statistical modelling and solving real life problems.

Students completing this programme will be able to present Statistics clearly and precisely, make abstract ideas precise by formulating them in the language of Statistics, describe Statistical ideas from multiple perspectives and explain fundamental concepts of Statistics to those non-Statistics users.

Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs, entrepreneurship, business and research areas and jobs in various other public and private enterprises.

Programme outcomes (PO) of B.Sc degree programme in Statistics

- > Scientific aptitude will be developed in Students
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the science & humanities stream.
- Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship
- Students will possess basic subject knowledge required for higher studies, professional and applied courses
- Students will be aware of and able to develop solution-oriented approach towards various Social and Environmental issues.
- Ability to acquire in-depth knowledge of several branches of Statistics and aligned areas. This Programme helps learners in building a solid foundation for higher studies in Statistics
- The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modelling and solving real life problems.
- Utilize Statistics to solve theoretical and applied problems by critical understanding, analysis and synthesis.
- > To recognize patterns and to identify essential and relevant aspects of problems.
- Ability to share ideas and insights while seeking and benefitting from knowledge and insight of others.
- Develop students into responsible citizens in a rapidly changing interdependent society.

Programme Specific Outcomes (PSO) of B.Sc Degree programme in Statistics

- 1. Think in a critical manner
- 2. Familiarize the students with suitable tools of statistical analysis to handle issues and problems in Statistics and related sciences.
- 3. Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.
- 4. Understand, formulate, develop arguments logically and use quantitative models to address issues arising in social science, business and other contexts.
- 5. Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Statistics.
- 6. Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in Statistics and its allied areas on multiple disciplines linked with Statistics.
- 7. Equip with Statistical modelling ability, problem solving skills, creative talent and power of communication necessary for various forms of employment
- 8. Develop a range of generic skills helpful in employment, internships& societal activities.
- 9. Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of Mathematical sciences

Programme Title	: B.Sc. Statistics	5	
Course Category	: Core Course –	Ι	
Course Title	: DESCRIPTIV	E STATISTICS	
Course Code	: 23USTCC1		
Hours/Week	: 5 hrs	Semester	Ι
Credit	:5	Batch	: 2023-2026

Objectives of the Course

- 1. It explains the important concepts of statistics and statistical data.
- 2. It provides to formulate the visualization of frequency distribution.
- 3. Also they measure the averages, dispersions, lack of symmetry, moments, relationship among variables.
- 4. Estimate and predict the unknown and future values.
- 5. Study of non-linear and consistency of the data.

Unit – I (Hours: 12)

Statistics: Introduction - Definition – Functions - Applications - Limitations. Organising a Statistical Survey: Planning the survey - Executing the survey-Collection of Data: Primary and secondary data - Methods of collecting primary data - Sources of secondary data. Sampling: Census and Sample methods. Classification-Types - Formation of frequency distribution-Tabulation - parts of a Table - Types. Diagrammatic representation – Types. Graphical representation - Graphs of frequency distributions. Merits and Limitations of diagrams and graphs.

Unit-II (Hours: 12)

Measures of Central tendency: Introduction-Definitions-Types - Mean-Median-Mode-Geometric mean-Harmonic Mean-Weighted mean - Merits and Demerits-Measures of Dispersion: Introduction – Definition – Types – Range - Quartile deviation - Mean deviation - Standard deviation - Co-efficient of variation – Lorenz curve - Merits and Demerits.

Unit-III (Hours: 12)

Skewness: Introduction-Definition-Types-Karl Pearson's – Bowley's - Kelly's methods – Their merits and demerits. Kurtosis: Introduction-Definition-Types-Its merits and demerits. Moments: Introduction - Definition-Types - Raw, Central moments and their relations.

Unit-IV (Hours: 12)

Correlation analysis: Introduction - Definition - Types – Ungrouped and Grouped data – Probable error – properties - Rank correlation – Partial and Multiple correlations - Regression analysis: Introduction - Definition – Regression Equations -Multiple regression - Principle of least squares for first degree, Second degree, Exponential and Power curves.

Unit-V(Hours: 12)

Theory of Attributes: Introduction – Definition-Classes and Class frequencies-Consistency of data-Independence of attributes-Association of attributes-Yule's coefficient and -Coefficient of Colligation.

Recommended Text	 Gupta, S.P. (2017): Statistical Methods, Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition. Gupta S.C and Kapoor, V.K. (2002). Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd., New Delhi
Reference Books	 Goon A.M. Gupta. A.K. and Das Gupta, B (1987). Fundamental of Statistics, vol.2 World Press Pvt. Ltd., Kolkatta G.U.Yule and M.G. Kendall (1956). An introduction to the theory of Statistics, Charles Griffin. M.R. Spiegel (1961). Theory and problems of Statistics, Schaum's outline series
	 4. Anderson, T.W. and Sclove SL. (1978). An introduction to statistical analysis of data, Houghton Miffin&co. 5. Pillai, R.S., and Bagavathi (2003): Statistics, S. Chand and Company Ltd., New Delhi.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject <u>https://en.wikipedia.org/wiki/Statistics</u> <u>https://en.wikipedia.org/wiki/Descriptive_statistics</u> <u>https://socialresearchmethods.net/kb/statdesc.php</u> <u>http://onlinestatbook.com/2/introduction/descriptive.html</u>
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Course Outcomes (CO):

Students will be able to

CO-1: Describe the scope, functions, applications and limitations of Statistics.

CO-2: Also to explain the statistical survey, collection of data, sampling and presentation of data. **CO-3:** Discuss the importance and uses of central values and dispersions for the various types of data.

CO-4: Also to measure the various measures of averages and scatteredness of the mass of data in a series.

CO-5: Explain about the lack of symmetry, rth moments and peakedness of the frequency distributions.

CO-6: Ability to apply in data

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	S	S	М	Μ	М	S	М	S	М
CO2	S	S	S	S	М	S	М	S	М
CO3	S	S	S	М	S	S	М	S	S
CO4	Μ	S	S	S	S	S	S	S	М
CO5	S	S	S	S	М	S	S	S	М
CO6	S	S	S	S	М	S	S	S	М

Mapping of Cos with PSOs

Programme Title	: B.Sc. Statistics	5	
Course Category	: Core Course -	II	
Course Title	: PROBABILIT	TY THEORY	
Course Code	: 23USTCC2		
Hours/Week	: 4 hrs	Semester	Ι
Credit	: 5	Batch	: 2023-2026

Objectives of the Course

- 1. It provides the study of random variable, distribution function, mathematical expectation,
- 2. Generating function and law of large numbers.
- 3.Two-dimentional variables and its distributions

Unit-I(Hours: 12)

Theory of Probability: Introduction-Basic terminology- Definition - Axiomatic approach – Types of Events - Conditional Probability - Addition and Multiplication theorems of Probability for 'two' and 'n' events (Statement and Proof) - Boole's inequality (Statement and Proof)- Bayes' theorem of Probability (Statement and Proof with numerical illustration -very simple problems)

Unit-II(Hours: 12)

Random variables and Distribution functions: Introduction - Discrete random variable: Probability mass function-Discrete distribution function, Properties. Continuous random variable : Probability density function and properties, measures of central tendency, dispersion, Skewness and kurtosis for continuous Probability distribution.

Unit-III(Hours: 12)

Two dimensional random variables - Joint probability mass function- Marginal probability function, Conditional probability function. Two dimensional distribution functions-Marginal distribution functions - Joint density function-Marginal density function - Conditional distribution function - Conditional probability density function. Transformation of One - Dimensional and Two Dimensional random variable (concept only).

Unit-IV(Hours: 12)

Mathematical Expectations: Introduction- Expected value of a random variable (Discrete and Continuous)-Expected value of function of a random variable - Properties of Expectation-Properties of variance- Covariance. Inequalities involving expectation: Cauchy Schwartz and Markov inequalities.

Unit-V(Hours: 12)

Generating functions: M.G.F-Properties-Uniqueness theorem - C.G.F-Properties- P.G.F-Properties. Characteristic Function: Properties–Inversion theorems (Statement only)- Uniqueness theorem (Statement only). Chebychev's Inequality (Statement and Proof). Law of Large Numbers (L.L.N): Convergence in probability - Properties: Weak L.L.N - properties-Bernoulli's L.L.N (Statement and Proof) - Khinchin's theorems (Statement only).

Recommended Texts	1.Gupta S.C. and Kapoor V.K (2015): Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
Reference Books	 1. Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics. 2. Hogg. R.V. and Craig. A.T. (1978) : Introduction to Mathematical Statistics, McGraw Hill Publishing Co. Inc. New York
	3.Mood A.M. Graybill, F.A. and Bose. D.C. (1974): Introduction to the theory of Statistics, McGraw Hill Publishing Co. Inc. New York. 4.Sanjay Arora and Bansilal (1989): New Mathematical Statistics, Satyaprakashan, New Delhi.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject www.khanacademy.org/math/statistics-probability/random- variables-stats-library https://ocw.mit.edu/courses/mathematics/18-440-probability-and- random-variables-spring-2014/
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Course Outcomes (CO):

Students will be able to

CO1: Understand concepts of probability and Identify the different approaches of probability theory

CO2: Define the random variable and its respective probability values and to compare a discrete and continuous random variable.

CO3: Calculate the expected value of a random variable variance, covariance, moments and find the conditional expectation and variance of bi-variate random variable.

CO4: Estimate the measures of central values, Dispersions, Skewness and Kurtosis through th generating function

CO5: Understand bivariate random variables and its distributions

CO6:Application of probability theory in real life

Mapping of Cos with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	S	S	М	Μ	Μ	S	Μ	S	Μ
CO2	S	S	S	S	Μ	S	Μ	S	М
CO3	S	S	S	Μ	S	S	Μ	S	S
CO4	S	S	S	Μ	S	S	S	S	М
CO5	S	S	S	S	Μ	S	S	S	М
CO6	S	S	S	S	М	S	S	S	М

Programme Title	: B.Sc. Statistics	5	
Course Category	: Generic Cours	e	
Course Title	: ALGEBRA A	ND DIFFERENTIAL C	CALCULUS
Course Code	: 23USTEC1		
Hours/Week	: 4 hrs	Semester	Ι
Credit	: 3	Batch	: 2023-2026

Objectives of the Course:

- **1.** To create deep interest in learning Mathematics which develop broad and balance knowledge and understanding definitions, concepts, principles and theorems.
- 2. It helps the students to enhance the ability of learners to apply the knowledge and skill acquired by them to solve specific theoretical and applied problems in Mathematics.
- **3.** It also encourages the students to develop a range of generic skill helpful in employment, internships in social activities.

Unit - I (Hours:12)

Matrices

Rank of a matrix, Elementary transformations, Equivalent matrices, Finding the rank of a matrix using elementary transformations (Upto third order) Characteristic equation of a matrix, characteristic vectors of a matrix, Cayley – Hamilton theorem (statement only), Verification of Cayley –Hamilton theorem. (Examples 3-16 to be excluded) Chapter – 5 (Page No: 5.25 – 5.37, 5.50-5.54,5.61-5.75)

Unit - II (Hours:12)

Theory of Equations

Relation between the roots and coefficients of an equation, Imaginary and irrational roots, Symmetric functions of the roots of an equation in terms of its coefficients (up to cubic equations) and Reciprocal equation.

Chapter 6 (Page No: 6.2 – 6.37)

Unit - III(Hours:12)

Theory of Equations

Transformation of equation (Definition only), Multiplication of roots by m(Definition only), Diminishing the roots of an equation, Removal of a term, Descartes' rule of sign, Descartes rule of signs for negative roots of an equation, Horner's method, Newton's method of evaluating a real root correct to given decimal places.

Chapter 6 (Page No: 6.38 - 6.67)

Unit - IV(Hours:12)

Rational fractions

Rational fractions – Proper and improper rational fractions, Partial fractions forms of Partial fractions.

Chapter 1 (Page No: 1.1 – 1.14)

Unit - V(Hours:12)

Differential calculus

Successive differentiation: Leibnitz's theorem, nth derivatives of standard functions – simple problems. Partial differentiation – Maxima and minima for two variable functions homogeneous function- Euler's theorem on homogeneous function.

Chapter 8 and 9 (Page No: 8.1 – 8.42, 9.1 – 9.62)

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill			
RecommendedText Reference Books	 P.R. Vittal - Allied Mathematics, Margham Publications, Chennai-17 (i) Durai Pandian P and Udaya Baskaran S (2014) : Allied Mathematics, Vol – I & II, S.Chand & Company Pvt.Ltd. (ii) T.K.Manicavachagam Pillai, T.Natarajan& K.S. Ganapathy - Algebra Volume-I, S.Viswanathan Publishers, Pvt. Ltd, 2004. 			
Web resources	 http://www.universityofcalicut.info/SDE/VI%20Sem.%20B.Sc %20Maths%20- 0Additional%20Course%20in%20lie%20of%20Project%20- Theory%20of%20equations%20&%20fuzzy%20set.pdf <u>https://sol.du.ac.in/pluginfile.php/41111/mod_resource/content/ 1/B.A.%20st%20m%204_1-7pdf</u> 			

Course Outcomes:

Students will be able to

CO1: Learn the concepts of matrices, Rank of the matrix characteristic roots.

CO2: Solve the problems about polynomials with real coefficients, imaginary and irrational roots.

- **CO3:** Analyse various methods to find roots of polynomial equation and inspect Horner's method and Newton's method to find approximate real roots
- **CO4:** Distinguish between proper and improper fractions. Express an algebraic fraction as a sum of its partial fractions.
- **CO5:** Obtain the nth derivative in successive differentiation. Apply Euler's theorem on Homogeneous function.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	S	S	М	Μ	Μ	S	М	S	Μ
CO2	S	S	S	S	Μ	S	М	S	Μ
CO3	S	S	S	Μ	S	S	М	S	S
CO4	S	S	S	Μ	S	S	S	S	Μ
CO5	S	S	М	М	М	S	S	S	М

Mapping of COs with PSOs

Programme Title	: B.A/B.SC/B.C	0 m	
Course Category	: Skill Enhance	ment Course (NME – I))
Course Title	:: BASICS OF S	STATISTICS	
Course Code	: 23USTSEC1		
Hours/Week	: 2 hrs	Semester	Ι
Credit	: 2	Batch	: 2023-2026

Objectives of the Course:

- 1. To introduce the basic concepts of Statistics
- 2. To make them to apply real time data
- 3. To learn statistical techniques for data analysis

Note: Derivations are not included Questions – Only on the topics mentioned.

Unit – I Introduction to Statistics, Functions and Applications of Statistics. Volume 1 – Chapter 1 (Page No. 1-18)

Unit – II

No of hours: 6 hrs Types of data, Collection of data, Presentation of data, Tabulation and Classification of data Volume 1 – Chapter 3 (Page No. 39-44), Volume 1 – Chapter 5 (Page No. 91-95)

Unit – III

Diagrammatic and Graphical Representation of data, Types of Diagrams Volume 1 – Chapter 6 (Page No. 130-154)

Unit – IV

Measures of Central tendency - Definition and its characteristics - Mean, Median, Mode-(Individual and Discrete series only) Simple problems. Volume 1 – Chapter 7 (Page No. 180-213)

Unit – V

Correlation – Definition, its types and uses co-efficient of correlation for ungrouped data only – Rank correlation co-efficient (No repeated ranks) – Simple problems Volume 1 - Chapter 10 (Page No. 378-381), Volume 1 - Chapter 10 (Page No. 386-388, 406-**407**)

BOOKS FOR STUDY

S.P. Gupta : Statistical Methods 37th Edition, Sultan Chand & Sons Publications.

BOOKS FOR REFERENCE

1.B.L.Agarwal : Programmed Statistics. 2.R.S.N. Pillai and Bagavatti: Statistics. 3.P.R. Vital: Business Statistics.

No of hours: 6 hrs

No of hours: 6 hrs

No of hours: 6 hrs

No of hours: 6 hrs

Course Outcomes (CO)

Students will be able to

- 1. **apply** various statistical techniques related data
- 2. **identify** the data and present it precisely
- 3. organize and summarize the data using descriptive statistics
- 4. **predict** the relevant relationship between various variables

Mapping of COs with PSOs:

					PSO				
CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	S	Μ	L		L	L	Μ	L	Μ
CO2	L	L	Μ		L	Μ		Μ	
CO3	М			М	S	М	L	М	L
CO4	L		Μ	S		Μ	S	Μ	S

L – Low; M – Medium; S - Strong

Programme Title	: B.SC Statistic	8	
Course Category	: Foundation C	ourse	
Course Title	: INTRODUCT	ORY STATISTICS	
Course Code	: 23USTSEFC		
Hours/Week	: 2 hrs	Semester	Ι
Credit	: 2	Batch	: 2023-2026

Course Objective:

- To introduce the basic concepts of Statistics 1.
- To make them to apply real time data 2.
- To learn statistical techniques for data analysis 3.

Note: Derivations are not included Questions – Only on the topics mentioned.

Unit – I

Introduction to Statistics, Growth of Statistics, Functions and Applications of Statistics, Limitations of Statistics.

Unit – II

No of hours: 6 hrs Types of data, Methods of Collecting data, Presentation of data, Meaning and objectives of Classification, Tabulation of data

Unit – III

Diagrammatic and Graphical Representation of data, Types of Diagrams

Unit – IV

Measures of Central tendency - Definition and its characteristics - Mean, Median, Mode-(Individual and Discrete series only) Simple problems.

Unit – V

Correlation – Definition, its types and uses co-efficient of correlation for ungrouped data only – Rank correlation co-efficient (No repeated ranks) – Simple problems

BOOKS FOR STUDY

1.S.P. Gupta : Statistical Methods 37th Edition, Sultan Chand & Sons Publications

BOOKS FOR REFERENCE

- 1. NCERT class XI and XII text books.
- 2. Any State board Statistics text books of class XI and XII

No of hours: 6 hrs

No of hours: 6 hrs

No of hours: 6 hrs

No of hours: 6 hrs

Course Outcomes (CO) :

Students will be able to

- 1. **apply** various statistical techniques related data
- 2. **identify** the data and present it precisely
- 3. organize and summarize the data using descriptive statistics
- 4. predict the relevant relationship between various variables

Mapping of COs with PSOs:

					PSO				
CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	S	М	L		L	L	Μ	L	Μ
CO2	L	L	Μ		L	М		Μ	
CO3	М			Μ	S	М	L	Μ	L
CO4	L		Μ	S		Μ	S	Μ	S

L – Low; M – Medium; S – Strong

Programme Title	: B.Sc. Statistics	Course	
Category	: Core Course –	III	
Course Title	: Matrix and I	Linear Algebra	
Course Code	: 23USTCC3	-	
Hours/Week	: 5 hrs	Semester	: II
Credit	:4	Batch	: 2023-2026

Objectives of the Course

- 1. To study the basic operations of transpose and inverse of matrices
- 2. To know the structure of orthogonal and unitary matrices
- 3. To learn the invariance properties of ranks
- 4. To know and to apply the concepts of vector space and matrix polynomials.

Unit I Matrices-Transpose-Conjugate transpose- Reversal law for the transpose and conjugate transpose. Adjoint of a matrix, Inverse of a matrix, Singular and Non -Singular matrices,

Unit II Reversal law for the inverse of product of two matrices. Commutativity of inverse and transpose of matrix, Commutativity of inverse and conjugate transpose of matrix, Orthogonal and Unitary Matrices, Product of unitary matrices, Partitioning of matrices.

Unit III Rank of a matrix, Echelon form, Rank of transpose, Elementary transformations, Elementary matrices, Invariance of rank through elementary transformations, Reduction to Normal form, Equivalent matrices.

Unit-IV Vector space – Linear Dependence - Basis of a vector space – Sub-space - Properties of Linearly Independent and Dependent systems, Row and Column spaces, Equality of Row and Column ranks, Rank of Sum and Product of matrices

Unit-V Matrix polynomials, Characteristic roots and vectors, Relation between characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity, Nature of characteristic roots in case of special matrices, Cayley-Hamilton theorem.

Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional
Course	Competency, Professional Communication and Transferrable Skill
Recommended Text	 Vasishtha.A.R (1972) : Matrices, KrishnaprakashanMandir, Meerut.
Reference Books	1. Shanthinarayan, (2012): A Text Book of Matrices, S Chand& Co New Delhi

2. M.L.Khanna (2009), Matrices, Jai PrakashNath& Co

Website and e-Learning Source e-books, tutorials on MOOC/SWAYAM courses on the subject https://samples.jbpub.com/9781556229114/chapter7.pdf

https://www.vedantu.com/maths/matrix-rank

https://textbooks.math.gatech.edu/ila/characteristic-

<u>polynomial.html</u>

https://www.aitude.com/explain-echelon-form-of-a-matrix/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Do basic operations of matrices

CLO-2 Understand various transactions of matrices and its applications

CLO-3 Understand various properties of matrices

CLO-4 Able to understand vector space and its applications

CLO-5 Able understand eigen vector and its applications

CLO-6 Able understand vector and matrix applications

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CLO1	S	S	М	М	М	S	М	S	М
CLO2	S	S	S	S	М	S	М	S	М
CLO3	S	S	S	М	S	М	М	S	S
CLO4	S	S	S	М	S	S	S	S	М
CLO5	S	S	М	М	М	S	S	S	М
CLO6	S	S	М	S	М	S	S	М	М

CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Programme Title	: B.Sc. Statistics Course		
Category	: Core Course – IV		
Course Title	: Distribution Theory		
Course Code	: 23USTCC4		
Hours/Week	: 4 hrs	Semester	: II
Credit	:4	Batch	: 2023-2026

Objectives of the Course

- 1. To learn discrete distributions
- 2. To learn continuous distributions
- 3. to understand Distributions generated from mathematical functions
- 4. learn normal distribution and its properties
- 5. understand about sampling distributions

Unit I

Binomial distribution – moments, recurrence relation, mean deviation, mode, moment generating function, characteristic function, cumulants. Fitting of Binomial Distribution. Poisson distribution – moments, mode, recurrence relation, moment generating function, characteristic function, cumulants. Fitting of Poisson distribution. Negative binomial distribution – m.g.f., cumulants. Fitting of Negative binomial distribution.

Unit II Geometric distribution – lack of memory, moments, m.g.f.- Hypergeometric distribution – mean, variance, approximation to Binomial, recurrence relation – Multinomial distribution – m.g.f., mean and variance.

Unit III Normal Distribution – chief characteristics of the normal distribution and normal probability curve, mean, median, mode, m.g.f. characteristic function, moments, points of inflexion, mean deviation, Area property – Rectangular distribution – moments, m.g.f., characteristic function, mean deviation about mean.

Unit-IV Exponential distribution – m.g.f., characteristic function, memory less property – Gamma distribution – m.g.f., cumulants and central moments, reproductive property – Beta distribution – First kind and second kind – constants.

Unit-V Functions of Normal random variables leading to t, Chi-square and F-distributions (derivations, properties and interrelationships).

Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional
Course	Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Gupta, S.C. Kapoor, V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi
	2. Goon, A.M. Gupta M.K. and Das Gupta B (1977) An Outline of Statistical Theory, Vol I, 6/e, World Press, Calcutta.
	3. Hogg, R.V. and Graig, A.T. (1978) : Introduction to Mathematical Statistics, A/e, Mc.Graw Hill Publishing Co.Inc., New York.
Reference Books	1. Mood, A.D. Graybill, F.A. and Boes, D.C (1974): Introduction to the Theory of Statistics, 3/e, Mc.Graw Hill, New York.
Website and	e-books, tutorials on MOOC/SWAYAM courses on the subject
e-Learning Source	

Course Learning Outcome (for Mapping with POs and PSOs)

- Students will be able to
- CLO-1 identify discrete distributions appeared in real life situations
- CLO-2 understand some continuous distributions and its applications

CLO-3 connection between some of the real values mathematical functions and its application in distribution theory

- CLO-4 understand normal distribution and its properties
- CLO-5 understand sampling distributions and its applications in real life

CLO-6 identify probability models in real data and estimate population parameters

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CLO1	S	S	М	М	М	S	М	S	М
CLO2	S	S	S	S	М	S	М	S	М
CLO3	S	S	S	М	S	М	М	S	М
CLO4	S	S	S	М	S	S	S	М	М
CLO5	S	М	М	М	М	S	S	S	М
CLO6	S	М	М	S	М	S	S	S	М

CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

СО /РО	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Title of the Course Paper Number Category ELECTIVE	INTEGRAL CALC (I B.Sc STATISTIC EC II (GENERIC) Year Semester	CULUS A CS) I II	ND LAPLAC Credits	E TR 3	ANSFORM Course Code	23USTMGEC2
Instructional Hours per week	Lecture 3	Tutoria -	l Lab P	ractic -	e Total	3
Pre-requisite	12 th Standard Math	nematics				
Objectives of the Course	 1.To acquire the kn 2. To understand th 3. To analysis the c transform 	nowledge ne metho different	e in integral ca d of doing pro methods of so	alculu oblem olving	s, Fourier serie s using the abo differential ec	es and Laplace transform ove concepts. quations using the Laplace

Course Outcomes:

Students will be able to

CO1:learn and understand the methods of double integrals.

CO2:learn and understand the methods of triple integrals.

CO3:apply the concept of integration to evaluate Fourier series.

CO4:evaluate the solutions of differential equations using Laplace transform

CO5:evaluate the solutions of differential equations using inverse Laplace transform

Course Outline

Unit – I (Hours : 9) Integral Calculus

Multiple Integrals Evaluation of double integrals, Double integral in polar co- ordinates.

Chapter 20(sections20.1-20.17)

Unit – II (Hours : 9)

Triple integrals, Change of order of integration. applications of double and triple integrals to area volume and centroid.

Chapter 20(sections20.18 - 20.44)

Unit – III (Hours : 9)

Fourier Series

Definition, Finding Fourier series for a given periodic function with period 2π , Fourier series for odd and even functions.

Chapter 21 (sections 21.1-21.40)

Unit – IV(Hours : 9)

Laplace Transform

Definition, Laplace transform of elementary functions, Linearity property, Shifting property, Change of Scale property, Laplace transform of derivatives.

Chapter 27 (sections 27.1-27.20)

Unit – V(Hours : 9)

Inverse Laplace transform, Solving differential equations using Laplace transform. (Simultaneous equations are to be excluded).

Chapter 27 (sections 27.23-27.57)

(Section 5:Examples1-10 only,Exercise 4:1-26only)

Skills acquired from the course

Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	P.R.Vittal, Allied Mathematics, Margham Publications, Chennai-1
Reference Books	S. Narayanan and T. K. ManicavachagamPillay, Calculus-Volume III, S. Viswanathan (PrintersandPublishers). Pvt., Ltd, 2011.
Web resources	https://nptel.ac.in

Title of the Course Paper Number Category	THEORY O MATH- PRA EC – PRACT ELECTIVE	F EQUATION ACTICAL (I E FICAL Year:	ANSFORM Course	USING SAGE 23USTMGECQ				
					Code:			
		Semester:	II					
Instructional	Lecture	Tutorial		Lab Practice	Total			
Hours per week	-	-		2	2			
Pre-requisite	Basic knowle	Basic knowledge in data and representations						
Objectives of the	The main obj	The main objectives of this course are:						
Course	1. To work using Sag	with interpolat ge Math.	tion and a	approximation m	ethods in fir	nding roots		
	2. To utilize	e Sage Math to	perform	symbolic and nu	imerical inte	egration, and		

2. To utilize Sage Math to perform symbolic and numerical integration. and Laplace Transforms

Course Outcomes:

Students will be able to

- **CO1:** learn the notions of approximation of solutions, Laplace transforms, inverse Laplace transform and basic operations, commands within Sage Math
- **CO2:** understand the fundamental principles of ordinary differential equations and numerical integrations using Sage Math to solve them accurately
- **CO3:** apply the Laplace, Inverse Laplace Transforms to solve linear differential equations in SageMath.
- **CO4:**analyze the application of SageMath in solving differential equations in simplifying and solving complex problems.
- **CO5:**evaluate multiple integrals, and non-linear equations with accuracy using SageMath while demonstrating critical thinking skills

Course Outline

Unit I: Theory of Equations

Problems on Finding the roots of the equations using the SageMath. (Page No: 140-141)

Unit II: Non-Linear Equations

Numerical Solution: Location of solutions of Algebraic equations and Iterative Approximation Methods using SageMath

(Page No: 263-278)

Unit III: Multiple integral

Available Integration Functions, Multiple Integrals using SageMath

(Page No: 305-317)

Unit IV: Laplace Equations

Solving problems on Laplce transforms using SageMath (Page No: 225)

Unit V: Inverse Laplace Transforms

Solving problems on Inverse Laplace transformations using SageMath (Page No: 226)

Skills acquired	Computational Mathematics with SageMath
from the course	
Web resources	https://archive.nptel.ac.in/courses/111/106/111106149/

: Basic Statistics (Practical – I)
: 23USTSEC3
: 2 hrs
: II
: 2

Course Objective:

The course aims to provide data handling experience using MS- Excel

Basic Statistics (Practical – I) (Problems from CORE COURSE I, II, III and IV)

- 1. Measures of Central Tendencies
- 2. Measures of Dispersion
- 3. Correlation and Regression Analysis
- 4. Association of Attributes.
- 5. Addition Theorem and Booleans Inequalities.
- 6. Conditional Probability and Multiplication Theorem.
- 7. Bayes Theorem
- 8. Matrix Operations
- 9. Rank of a Matrix
- 10. Characteristic roots.
- 11. Fitting of Distribution (Discrete and Continuous Distribution).

Recommended Text:

- 1. Gupta, S.C. Kapoor, V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
- 2. Vasishtha.A.R (1972) : Matrices, Krishna prakashan Mandir, Meerut.

Course Title	: NME – II: Statistics in Ancient India.
Course Code	: 23USTSEC2
Hours/Week	: 2 hrs
Semester	: II
Credit	: 2

Course Objective:

The course aims to provide insight about statistics used in ancient India.

Unit – I: Introduction

Statistics: Definition – Importance and its uses – Probability: Definition and basic terminologies – Addition and Multiplication Theorem

Unit – II: Vedic Mathematics

Introduction - Basic Vedic Mathematical formulae- Sutras for Addition, Subtraction, Multiplication and sub- Multiples – Nikhilam method Yavadunam for finding square and cubic roots.

Unit – III: Statistics in ancient India Introduction – Probability concepts in Ancient India – Application of Probability in Dice, Vaccines and insurance in Ancient India.

Unit – IV: Statistics in Games Introduction – Permutation and Combinatorics - Game of Dice in India – Hymn on Dice in Rigveda – Gambling in Mahabharata.

Unit – V: Evolution of Statistics. Statistics in ancient Period – Moghul Period – Early and Later British Period – Statistics after Independence

Recommended Text:

 Tirthaji B.K. (1965) Vedic Mathematics, Motilal Banarsidass
 Raju, C. K, Probability in Ancient India, in Handbook of Philosophy of Statistics (2011) , Pg. No. 1175-1196.,
 Vallverdu, Jordi. (2016). Ancient Statistics History in a Nutshell. 10.1007/978-3-662-48638-2_2.

Programme Title	: B.Sc Statistics		
Course Category	: Core		
Course Title	:Estimation Theory		
Course Code	:23USTCC5		
Hours/Week	: 5 hrs	Semester	: III
Credit	:5	Batch	: 2023- 2026

Objectives of the Course:

- 1. To Emphasize on the Concept of Point Estimation and IntervalEstimation.
- 2.
- To learn properties of a good estimator To understand various methods of estimation 3.

Unit I

Point estimation - Estimator - Consistency and Unbiasedness - Efficiency and asymptotic efficiency -Estimators based on sufficientstatistics – Neyman Factorization theorem (statement only) – Simple Illustrations

Unit II

Minimum variance unbiased estimators - Cramer - Rao Inequality - Rao Blackwell theorem - Simple illustrations

Unit III

Methods of Estimation - Methods of Maximum likelihood and moments - Properties of estimators obtained by these methods – Simple illustrations

Unit-IV

Method of Minimum Chi-Square-Method of Minimum Variance-Methods of moments -Methods of Least squares- Intervalestimation.

Unit-V

Notion of Bayes estimation – concept of prior, posterior and conjugate priors. Simple problems involving quadratic error loss function – Notion of Minimax estimation – Simple illustrations

Skills acquired from thiscourse:

Knowledge, Problem Solving, Analytical ability, ProfessionalCompetency, Professional Communication and Transferrable Skill

Recommended Text:

- 1. GuptaS.C. and Kapoor V.K. (2007): Fundamentals of Mathematical Statistics, Sultan Chand Sons, New Delhi.
- P.R. Vittal(2002) : Mathematical Statistics, Margham Publications, Chennai. 2.
- 3. Ashok K. Bansal (2007): Bayesian Parametric Inference, Narosa Publishing House.
- 4. Mood, A.M. Graybill, F.A. and Boes D.C. (1974): Introduction to Theory of Statistics, McGraw -Hill.

Books For Reference:

- 1. Rohatgi, V. (1976): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
- 2. Goon A.M. Gupta M.K. and Das B. (1980): An Outline of Statistical Theory, Vol II, World Press, Calcutta
- 3. Sanjay Arora and Bansi Lal (1989): New Mathematical Statistics, Satya Prakasam, New Delhi.
- 4. Hodges, J.L. and Lehman, E.L (1964): Basic Concepts of Probability and Statistics, Holden Day.
- 5. Dr. A. Santhakumaran (2004): Probability Models and their Parametric Estimation

Web resources:

e-books, tutorials on MOOC/SWAYAM courses on the subject

Course Learning Outcome (for Mapping with POs and PSOs)

CLO-1 estimate population parameters

CLO-2 identify good estimators and its properties

CLO-3 derive interval estimators of a parameter

CLO-4 estimate parameters using various estimation methods and identify the best among the estimators

CLO-5 handle data and can estimate population parameters

CLO-6 realize the application of different types of estimators

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CLO1	S	S	М	М	М	S	S	S	М
CLO2	S	S	S	S	М	S	S	S	М
CLO3	S	S	S	М	S	М	S	S	М
CLO4	S	S	S	М	S	S	S	S	М
CLO5	S	S	М	М	М	S	S	S	М
CLO6	S	М	М	S	М	S	S	S	М

CO-PO Mapping (Course Articulation Matrix)

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of	3.0	3.0	3.0	3.0	3.0
Course Contribution to Pos					

Level of Correlation between PSO's and CO's S-Strong, M-Medium, W-Weak

Programme Title	: B.Sc Statistics		
Course Category	:Core		
Course Title	: Sampling Techniques		
Course Code	: 23USTCC6		
Hours/Week	: 5 hrs	Semester	: III
Credit	:5	Batch	: 2023- 2026

Objectives of the Course:

- 1. To know the basic operations of sampling
- 2. To study the theory and applications of SRS
- 3. To learn practical uses of Stratification
- 4. To apply Systematic and PPS Sampling in real time problems.

Unit I

Basic concepts of sample surveys – Advantages of Sampling – Principal steps in Sample survey, Sampling unit – Sampling frame – Census – Probability Sampling, Alternatives to probability sampling, Mean Square Error.

Unit II

Simple random sampling, Methods of selection, Sampling with and without replacement – Properties of estimates, Finite population correction, Estimation of Standard error, Confidence limits.

Unit III

Stratified random sampling, principles of stratification, Notations – Estimation of population mean and its variance – Estimated variance and confidence limits, Allocation techniques -equal allocation proportional allocation, Neyman allocation and optimum allocation Estimation of gain due to stratification.

Unit-IV

Systematic sampling –Relation to cluster sampling, Estimation of population mean and its sampling variance – Comparison of systematicsampling with stratified random samples.

Unit-V

Varying Probability sampling, Selection of one unit with PPS, PPS Sampling with replacement, Estimator for population total and itsvariance.

Design

Recommended Text:

- 1. Cochran, W.G. (1978): Sampling Techniques, John Wiley Eastern
- 2. Murthy M.N. (1967): Sampling Theory and Methods, Statistical Publishing Society, Calcutta

Books For Reference:

- Singh. D. and Chaudry F.S. (1986): Theory and Analysis of Sample Surveys Wiley Eastern Ltd.
- 2. Sampath. S, (2001), Sampling Theory and Methods, CRC Press.

Web resources:

e-books, tutorials on MOOC/SWAYAM courses on the subject

http://ocw.jhsph.edu/courses/statmethodsforsamplesurveys/pdfs/lectur

e2.pdf

https://www.questionpro.com/blog/stratified-random-sampling/ https://www.scribbr.com/methodology/systematicsampling/ http://home.iitk.ac.in/~shalab/sampling/chapter7-sampling-varying- probability-sampling.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Know the difference between census and sampling.

CLO-2 Understand basic operations and advantages of sampling

CLO-3 Understand widely used sampling techniques

CLO-4 Know to estimate population information using sampling

CLO-5 Apply sampling techniques in real time problems

CLO-6 identify suitable sampling technique for a real life survey

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CLO1	S	S	М	М	М	S	S	S	М
CLO2	S	S	S	S	М	S	S	S	М
CLO3	S	S	S	М	S	М	S	S	М
CLO4	S	S	S	М	S	S	S	S	М
CLO5	S	S	М	М	М	S	S	S	М
CLO6	S	М	М	S	М	S	S	S	М

CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Programme Title	e : B.Sc Statistics		
CourseCategory	:Core		
Course Title	:Numerical Methods		
Course Code	: 23USTDSEC1		
Hours/Week	: 4 hrs	Semester	: III
Credit	:3	Batch	: 2023- 2026

Objectives of this Course :

To introduce the study of algorithms that used numerical approximation for the problems of Mathematical analysis.
 To solve mathematical problems numerically.

Unit I

The Solution of Numerical Algebraic and Transcendental Equations: Iteration method, Bisection Method, Regula Falsi Method, Newton –Raphson Method.

Unit II

Interpolation for Equal intervals:Newton_s Forward Interpolation Formula and Newton_s Backward Interpolation Formula, Evaluation of missing terms.

Unit III

Central Difference Interpolation Formula For Equal Intervals: Gauss Forward Interpolation Formula, Gauss Backward Interpolation Formula, Sterling's Formula. Interpolation with Unequal Intervals: Lagrange_s Interpolation Formula.

Unit-IV

Numerical Differentiation: Numerical Differentiation based on Newton_s Forward and Backward Interpolation Formula – Computation of Second order derivatives.

Unit-V

Numerical Integration: General Quadrature formula for equidistant ordinates, Trapezoidal Rule, Simpson_s 1/3rd Rule, Simpson_s 3/8th Rule and Weddle_s Rule.

Skills a quired from this Course:

Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text:

- 1. Kandasamy, P., Thilagavathy, K. (2003): Calculus of Finite Differences and Numerical Analysis, S.Chand Publications
- 2. Balasubramaniam and Venkatraman(1972): Numerical mathematics part I and II by Rochouse and Sons

Books for reference:

- 1. Kalavathy, S., and Thomson. (2004): Numerical Methods, Vijay Nico::le Publications.
- 2. Gupta, B.D. (2004): Numerical Analysis, Konark Publications.
- 3. Venkatachalapathy, S.G. (2004): Calculus of Finite Differences and Numerical Analysis, Margam Publications.
- 4. Gerald Wheatley, (1970): Applied Numerical Analysis, Pearson Education Publications.
- 5. Jain, M.K., Iyengar, S.R., Jain, R.K., (1994): Numerical Methods Problems and Solutions, New
- Age International Publishers.

Website :

e-books, tutorials on MOOC/SWAYAM courses on the subject www.nptel.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Solve numerically equations that cannot have direct solution

CLO-2 solve system of linear equations

CLO-3 understand the need of interpolation

CLO-4 handle numerical differentiation

CLO-5 do integration numerically

CLO-6 get a foundation on algorithms to solve a mathematical problem

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9		
CL01	S	S	Μ	М	М	S	S	S	М	CO-PO Mapping	
CLO2	S	S	S	S	М	S	S	S	М	(Course Articulati	ion
CLO3	S	S	S	М	S	М	S	S	М	Matrix) S-Strong,	M-
CLO4	S	S	S	М	S	S	S	S	М	Medium, W-Weak	Ĺ
CLO5	S	S	М	М	М	S	S	S	М		
CLO	S	М	М	S	М	S	S	S	М		
CO/PO				PSO1	PS	SO2	PSO	3	PSO4	PSO5	
CO1				3		3	3		3	3	
CO2				3		3	3		3	3	
CO3				3		3	3		3	3	
CO4				3		3	3		3	3	
CO5				3		3	3		3	3	
Weighta	age			15	1	15	15		15	15	
Weighte Course	ed perce Contrib	ntage of ution to]	Pos	3.0	3	3.0	3.0		3.0	3.0	

Level of Correlation between PSO's and CO's

Programme Title : B.Sc. Statistics

Course Categor	ry :Core				
Course Title	: Data	Analysis Usin	g MS – Excel		
Course Code	: 23US	TSECQ4			
Hours/Week	: 2	-	Semester	: III	
Credit	:1		Batch	: 2023-	2026

Objectives

- : 1. To enable the students to gain computer practical knowledge about the concepts of statistiCS
 - 2. To apply the measures of descriptive statistics and probability in real life situations using MS excel

3. To provide practical knowledge in random variables, probability distributions, expectation, moment generating function, matrices, Rank of matrices

Practical Exercises:

1.Computation of Measures of Central Tendency for discrete data using MS Excel (Mean, Median, Mode, Geometric Mean, Harmonic Mean)

- 2. Computation of Measures of Central Tendency for Continuous data using MS Excel (Mean, Median, Mode, Geometric Mean, Harmonic Mean)
- 3. Computation of Measures of dispersion for discrete data using MS Excel ()
- 4. Computation of Measures of dispersion for Continuous data using MS Excel ()
- 5. Graphical Presentation of data (Histogram, Frequency Polygon, Ogives) Using MS Excel.
- 6. Computation of Co-efficient of Skewness and Kurtosis Karl Pearson_s and Bowley_s data using MS Excel
- 7. Fitting of Binomial distribution Direct Method using MS Excel.
- 8. Fitting of Poisson distribution Direct Method using MS Excel.
- 9. Fitting of Exponential distribution Direct Method using MS Excel.
- 10. Problems based on univariate probability distributions.
- 11. Problems based on probability.
- 12. Calculating Inverse matrix in Excel.
- 13. Calculating Transpose matrix in Excel
- . 14. Calculating Rank matrix in Excel.

Programme Title	: B.Sc Statistics			
Course Category	: Core			
Course Title	: Practical: Estimation And Sampling			
Course Code	:23USTSECQ5			
Hours/Week	: 2 hrs	Semester	: III	
Credit	:2	Batch	: 2023-	2026

Objectives of this Course

- 1. To enable the students to gain practical knowledge of estimation of parameters and its interval.
- 2. To know the basic operations of sampling
- 3. To study the theory and applications of SRS
- 4. To learn practical uses of Stratification
- 5. To apply Systematic and PPS Sampling in real time problems.

Unit I

Estimation of parameters of statistical model – Multinomial distribution, exponential, binomial and Poisson distribution –Construction of Confidence intervals for mean and variance

Unit II

Method of maximum likelihood and method of moments

Unit III

Simple random Sampling Drawing Sample from the Population with and without Replacement – Estimation of Population Mean, Total Variance and its Standard Error.

Unit IV

Stratified random Sampling Estimation of Mean, Variance of the Population Means – Variance of the estimator of Mean under Proportional and Optimal allocations

Unit V

Systematic random sampling Estimation of Mean and Variance – Comparison of Simple Random Sampling, Stratified Random Sampling and Systematic Random Sampling

Programme Title	B.Sc Statistics	S	
CourseCategory	:Core		
Course Title	:Testing of Stat	tistical Hypothesis	
Course Code	: 23USTCC7		
Hours/Week	: 5 hrs	Semester	: IV
Credit	: 5	Batch	: 2023- 2026

Objectives of the Course:

The main objectives of this course are:

- 1. To make familiar with testing concepts
- 2. To understand the concept of Most Powerful test
- 3. To understand the Likelihood ratio tests and their uses
- 4. To apply tests for samples from unknown distributions

Unit I

Statistical Hypothesis – Null and Alternative Hypothesis – Simple and Composite hypothesis – Critical region – Type-I and Type-II error – Most Powerful test – Uniformly Most powerful test – Neyman Pearson Lemma – Simple problems.

Unit II

Likelihood ratio test – Tests of mean of a normal population – Equality of two means of normal populations – test for variance of a normal population – Equality of variances of two normal populations.

Unit III

Chi-square tests, Distribution of quadratic forms, Test of equality of several means, Analysis of Variance. Correlation and Regression testing.

Unit-IV

Exact tests based on t distribution – One sample tests - one sided and two sided tests – Variance known and Variance unknown – Two sample tests – One sided and two sided - Variance known and Variance unknown.

Unit-V

Nonparametric methods – Confidence interval for distribution quantiles – Tolerance limits for distributions. Sign test, Wilcoxon test.

Extended Professional
Component (is a part of
internal component only,Questions related to the above topics, from various competitive examinations
UPSC / TRB / NET / UGC - CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)Not to be included in the
External Examination
question paper)(To be discussed during the Tutorial hour)

Skills acquired fron thisCourse	 Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	 Robert V. Hogg and Allen T.Craig (1978), Introduction toMathematical Statistics, 4th edition, Macmillan Publishing Co., Inc. New York An Introduction to Probability and Statistics (2001) Rohatgi.V.K, and A.K.Md.EhsanesSaleh, John Wiley & Sons
Reference Books	 Gupta S.C. and Kapoor V.K. (1991) : Fundamentals ofMathematical Statistics, Sultan Chand & Sons. Goon A.M. Gupta M.K. and Das Gupta B (1980) : An outlineof Statistical Theory, Vol.II World Press Calcutta. Mood A.M. Graybill F.A. and Boes D.C.B (1980) : Introductionto the Theory of Statistics 3/e, McGraw Hill, New York. Gibbons, J.D. (1971) : Non-Parametric Statistical Inference, McGraw Hill.
Website and	e-books, tutorials on MOOC/SWAYAM courses on the subject
e-Learning Source	http://fisher.stats.uwo.ca/faculty/kulperger/SS3858/Handouts/np- lemma.pdf https://www.sciencedirect.com/topics/mathematics/uniformly-most- powerful-test https://www.probabilitycourse.com/chapter8/8_4_5_likelihood_ratio_tests.php https://www.statisticshowto.com/probability-and-statistics/statistics- definitions/parametric-and-non-parametric-data/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 frame hypotheses about population in real life research

CLO-2 identify suitable testing procedure for given hypotheses

CLO-3 compare two populations using samples taken from them

CLO-4 Compare populations in its means and variances separately

CLO-5 identify situations to apply parametric and nonparametric tests

CLO-6 interpret results of a hypothesis testing

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CLO1	S	S	М	S	М	S	S	S	S
CLO2	S	S	S	S	М	S	S	S	S
CLO3	S	S	S	М	S	М	S	S	М
CLO4	S	S	S	М	S	S	S	S	М
CLO5	S	S	S	М	М	S	S	S	М
CLO6	S	М	М	S	М	S	S	S	М

CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of	3.0	3.0	3.0	3.0	3.0
Course Contribution to Pos	- • •			- • •	- • •

Level of Correlation between PSO's and CO's

Programme Title	: B.Sc Statistics		
CourseCategory	:Core		
Course Title	: Actuarial Statistics		
Course Code	: 23USTCC8		
Hours/Week	: 5 hrs	Semester	: IV
Credit	:5	Batch	: 2023- 2026

Objectives of the Course:

The main objectives of this course are:

- 1. It develops a greater understanding of statistical principles and their application in actuarial statistics.
- 2. Describe the core areas of actuarial practice and relate to those areas actuarial principles, theories and models.
- 3. It gives the understanding of the application knowledge of the lifeinsurance environment.

Unit I

Simple and compound interest, present value and accumulated values of fixed rate, varying rate of interest

Unit II

Mortality : Gompertz - Makeham laws of mortality - life tables. Annuities: Endowments, Annuities, Accumulations, Assurances, Familyincome benefits.

Unit III

Policy Values: Surrender values and paid up policies, industrial assurances, Joint life and last survivorship, premiums.

Unit-IV

Contingent Functions: Contingent probabilities, assurances. Decrement tables. Pension funds: Capital sums on retirement and death, widow's pensions, benefits dependent on marriage.

Unit-V

Principles of insurance, pure endowment, whole life assurance, Net premium for assurance and annuity plans-level annual premium under temporary assurance.

Extended	Professional	Questions related to the above topics, from various competitive
Component	(is a part of internal	examinations UPSC / TRB / NET / UGC - CSIR / GATE /
component o	only,Not to be included	TNPSC /IAII/ IFoA there to be solved
in the Extern	nal Examination	(To be discussed during the Tutorial hour)
question pap	er)	
Skills acqu	iired from thisCourse	Knowledge, Problem Solving, Analytical ability,
		ProfessionalCompetency, Professional Communication
		and Transferrable Skill

Recommended Text 1.	Hooker, P.F., Longley, L.HCook (1957) : Life and othercontingencies, Cambridge.
2.	Alistair Neill(1977) : Life contingencies, Heinemann professional
	i. publishing.
3.	Gupta and Kapoor (2001) Fundamentals of Applied Statistics
Reference Books 1.	Study material of IAI/IFoA of Actuarial Societies
2.	Hosack,I.B., Pollard, J.H. and Zehnwirth, B.(1999) : introductorystatistics with applications in generalinsurance, Cambridge University.
Website and	e-books, tutorials on MOOC/SWAYAM courses on the
e-Learning Source	subject

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1 : To explain the utility theory and insurance terminologies.

CLO2: To articulate the insurance and annuity benefits through multiple life functions evaluation for special mortality laws.

CLO3: To describe the various types of premium and their numerical evaluations.

CLO4 : To explain implementation of the Life insurance policies.

CLO5: To describe Insurance payable at the moment of death and at the end of the year of death-level benefit insurance.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CLO1	S	S	М	S	М	S	S	S	S
CLO2	S	S	S	S	М	S	S	S	S
CLO3	S	S	S	Μ	S	М	S	S	М
CLO4	S	S	S	Μ	S	S	S	S	М
CLOS	S	S	S	Μ	М	S	S	S	М
CLO	S	М	Μ	S	М	S	S	S	М

CLO6: To understand real life problems related to insurance

CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Programme Title	: B.Sc Statistics						
CourseCategory	: Discipline Specific Elective						
Course Title	: Economic & Official Statistics						
Course Code	: 23USTDSEC2						
Hours/Week	: 3 hrs	Semester	: IV				
Credit	:3	Batch	: 2023- 2026				

Objectives of the Course:

The main objectives of this course are:

- 1. To understand Indian official statistical system and data collection
- 2. To know Indian economic and agricultural surveys
- 3. To know index numbers and consumer price index
- 4. To know time series analysis
- 5. To learn demand analysis and its concepts

Unit I

Indian Statistical System: Data Collection for Governance – NSSO and ts role in national data collection. NSSO reports and publications

Unit II

Economic Statistics: Information collection for Socio-Economic Survey – Agricultural, Industrial, Crime Statistics and Statistical methods applied to analyse large volumes of data

Unit III

Index numbers: Basic problems in construction of index numbers Methods- Simple and Weightec aggregate-Average of price relatives Chain base method. Criteria of goodness-Unit test Time Reversal Factor Reversal and Circular tests.

Unit-IV

Time Series: Measurement of Trend: Graphic, Semi-averages, Moving averages. Least Squares – Straight line, Second degree parabola, Exponential curve, Modified Exponential curve, Gompertz curve and Logistic curve. Measurement of Seasonal variation by Ratio-to-Moving average method.

Unit-V Demand Analysis: Introduction- Demand and Supply Price elasticity of demand and supply, partial and cross elasticities o demand.

Extended Professional Component Questions related to the above topics, from various competitive (is a part of internal component examinations UPSC IES-ISS/ TRB / NET / UGC – CSIR / GATE / only, Not to be included in the TNPSC /others to be solved External Examination

question paper)

Skills acquired from thisCourse	Knowledge,	Problem Solving,	Analytical ability,	Professional
	Competency,	Professional Com	nunication and Trai	nsferrable Skill

Recommended Text	 Gupta S.C. and Kapoor V.K. (2007) :Fundamentals of Applied Statistics, 4thedition,Sultan Chand &Sons Publishers, New Delhi. Gupta S.P. (2011) :Statistical Methods, Sultan Chand &Sons Publishers, NewDelhi.
	3. Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman (2003):Forecasting Methods and Applications, 3 rd Edition ,John Wiley and Sons Inc.
	4. Websites of Government of India – Ministry of Statistics
	& Programme Implementation
Reference Books	 Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman (2003) :ForecastingMethods and Applications ,3rd Edition ,John Wiley and Sons Inc
	 Irving W. Burr (1974): Applied Statistical Methods, Academic Press.
Website and	e-books, tutorials on MOOC/SWAYAM courses on the subject
e-Learning Source	

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 :understand Indian official statistics and offices related to it

CLO-2 understand Indian surveys for collecting official statistics

CLO-3 know uses of index numbers

CLO-4 know demand analysis and its need

CLO-5 to understand economic India by knowing agricultural and economic surveys

CLO-6 to know the time series and prediction

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CLO1	S	S	М	S	М	S	S	S	S
CLO2	S	S	S	S	М	S	S	S	S
CLO3	S	S	S	S	S	М	S	S	S
CLO4	S	S	S	М	S	S	S	S	М
CLOS	S	S	S	М	М	S	S	S	М
CLO	S	S	М	S	М	S	S	S	М

CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Programme Title	: B.Sc Statistics		
Course Category	: Skill Enhancement Cour	rse	
Course Title	: Biostatistics		
Course Code	: 23USTSEC7		
Hours/Week	: 2 hrs	Semester	: IV
Credit	:2	Batch	: 2023- 2026

Objectives of the Course

The main objectives of this course are to:

- 1. Initiate the awareness of Biostatistics and its need.
- 2. Make the students have a clear understanding of special kinds of various statistical tools used in biostatistics.
- **3.** Be knowledgeable about the potential applications of these tools

Unit I - Introduction to Bio statistics – Various types of studies – Ethics – Measures of disease frequency and disease burden. Clinical trials – Goals of Clinical trials – Phases of clinical trials – Classification of clinical trials

Unit II – Randomization : Fixed Allocation, Simple , Blocked, Stratified, Baseline Adaptive and Response Adaptive – Blinding: Single, Double and triple- Designs for clinical Trials : Parallel Groups Design, Cluster Randomization Designs, Crossover Designs.

Unit III –Multiple Regression – Assumptions – Uses – Estimation and interpretation of regression coefficients – Testing the regression coefficients – Coefficient of determination.

Unit IV –Logistic Regression : Introduction – Logistic regression model–Relative risk – Logit – odds Ratio – Properties of odds ratio – the relationship between the odds ratio and relative risk.

Unit V-Maximum likelihood estimates and interpretation of coefficients – Test for coefficients – Test for overall regression and goodness of fit using Maximum Likelihood technique – Deviance Statistics , Wald Test, LR Testand score test.

Extended Professional Component (is a part of internal component only,Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from	Knowledge, Problem Solving, Analytical ability, Professional
thisCourse	Competency, Professional Communication and Transferrable Skill

Recommended Books	1. Chow, S. C., and Liu, J. P. (2013). Design and Analysis of Clinical Trials: Concepts and Methodologies, Third Edition, Wiley – Interscience, John Wiley & Sons, NJ.				
	2. Friedman, l. M., Furberg, C. D., and DeMets, D. L. (2015), Fundamentals of Clinical Trials, Fifth edition, Springer – Verlag,NY				
	3. Van Belle, G., Fisher, L. D., Heagerty, P. J., and Lumley, T. (2004). Bio-Statistics – A				
	Methodology for the Health Science, Second Edition, Wiley, NY. 4. Daniel, W. W. and Chad L. Cross(2018). Bio-Statistics: A foundation for analysis in the				
	Health Sciences, Eleventh Edition, John Wiley & Sons, NY. 5. Kleinbaum, D. G., and Klein, M. (2012): Logistic regression: ASelf- Learning Text, Third Edition, Springer – Verlag, NY.				
Reference Books	1. Hosmer, Jr. D. W., Lemeshow, S., and Sturdivant, R. X. (2013). Applied Logistic Regression, Third Edition, John Wiley & Sons, Inc., NY				
	2. Rossi, R. J. (2010). Applied Biostatistics for Health Sciences, John Wiley & Sons, Inc., NY				
Website and e-Learning Source	1. Prof.Shamik Sen, Department of Bioscience and Bioengineering,IIT Bombay, –Introduction to Biostatistics , NPTEL. [https://99wayam.gov.in/nd1_noc20_bt28/preview]				
	2. Dr.Fenx Bast, Central University of Punjab, Bathinda, 2020, −Biostatistics and Mathematical Biology , (NPTEL).				
	[https://99wayam.gov.in/nd2_cec20_ma05/preview]				

Course Learning Outcome (for Mapping with Pos and PSOs)

Students will be able to

CLO-1 Understand the concepts and statistical tools used in Biostatistics

CLO-2 Effectively apply these tools on solving the biological problems occurring in real life

CLO-3 Analyze the given Bio-statistical data as per the objectives of the problem

CLO-4 Interpret the outcomes of the analyses meaningfully

CLO-5 Create research problems of his own and able to proceed with them

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CLO1	S	S	М	М	М	S	М	S	М
CLO2	S	S	S	S	М	S	М	S	М
CLO3	S	S	S	М	S	S	М	S	S
CLO4	S	S	S	М	S	S	S	S	М
CLOS	S	S	М	М	М	S	S	S	М

CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Programme Title	: B.Sc Statistics		
CourseCategory	: Skill Enhancement Course		
Course Title	: Testing of Hypothesis & Actuarial Statistics using MS-EXCEL		
Course Code	: 23USTSECQ7		
Hours/Week	: 3 hrs	Semester	: IV
Credit	:3	Batch	: 2023- 2026

Objectives:

The main objectives of this course are:

1. To enable the students to gain practical knowledge of test of significance in large and smallsamples.

2. To provide practical application of hypothesis testing based on single sample and two samples, using averages and proportions.

3. To provide practical application knowledge of the life insurance environment.

4. Understand the methods of computing assurance benefits and premiums of various insuranceplans and to apply the various methods in framing mortality tables.

Programming Exercises :

- 1. Large Sample tests for means, proportions
- 2. Large Sample tests for standard deviations and correlation coefficient.
- 3. Small sample tests for single mean.
- 4. Small sample tests for difference of means and correlation coefficient.
- 5. Paired t-test.
- 6. Chi square test for goodness of independence of attributes.
- 7. Non parametric test for single and related samples
- a. Sign Test, b. Wilcoxon signed rank test
- 8. Non parametric test for two independent samples
- a. Median test, b. Wilcoxon Mann Whitney U-test
- 9. Creating an Actuarial table to input interest rate.

10. Creating functions Increasing and Decreasing life insurances.

11. Increasing and decreasing annuities both due and immediate.

12. Calculates the values of risk free rate.