GOVERNMENT ARTS COLLEGE (AUTONOMOUS)

Re-Accredited (II Cycle) with 'A' Grade by NAAC

KUMBAKONAM – 612 002

DEPARTMENT OF STATISTICS

SYLLABUS (2023-2024) Onwards

SEMESTER- WISE DISTRIBUTION OF PAPERS

INTRODUCTION

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, Distribution Theory, Estimation Theory, Design of experiments, Operation Research, Testing Hypothesis, Sampling techniques, Sampling techniques ,Time series and index numbers, Vital 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 boththeoretical 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 modeling and solving real life problems.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KUMBAKONAM.

Course Structure under CBCS for Science (2023-24 Onwards)

B.Sc STATISTICS

Semester	code	Part	Course	Credits	Inst. Hours/wee	Internal	External	Total
I	23U1TLC1	I	Tamil - I	3	6	25	75	100
	23U1ELC1	II	English - I	3	6	25	75	100
	23U1S1	III	Core course –I (CC):Descriptive Statistics	5	5	25	75	100
	23U1SP1		Core Practical : Major Practical – I	3	3	40	60	100
	23U1SM1		Allied Course – I : Mathematics -I	4	4	25	75	100
			Allied Course - II Mathematics -II	-	2	-	-	-
	23U1VE	IV	Value Education	2	2	25	75	100
	23U1SFC		Foundation course-Basic Statistics	2	2	25	75	100
Total				**22**	**30**	**Total**		
II	23U2TLC2	I	Tamil - II	3	6	25	75	100
	23U2ELC2	II	English - II	3	6	25	75	100
	23U2S2	III	Core course –II (CC)-Probability Theory	5	5	25	75	100
	23U2SP2		Core Practical : Major Practical – II	3	3	40	60	100
	23U2SM2		Allied Course - II: Mathematics -II	4	4	25	75	100
	23U2SM3		Allied Course - III: Mathematics -III	2	2	25	75	100
	23U2ES	IV	Environmental Studies	2	2	25	75	100
	23U2SNMSEC1		Overview Of English Language Communication Assessment & Certification From Cambridge	2				
	23U5S5		Skill Enhancement Course SEC - I :Elementary Statistics /Naan Mudhalvan (Re-Appearance Students only)		2	25	75	100
Total				**24**	**30**			
III	23U3TLC3	I	Tamil - III	3	6	25	75	100
	23U3ELC3	II	English - III	3	6	25	75	100
	23U3S3	III	Core course –III (CC)-Discrete probability distribution	5	5	25	75	100

	23U3SCA1	III	Core Practical –III: Major Practical - III	3	3	40	60	100
	23U3SP3		Allied Course-I :Programming in 'c'	4	4	25	75	100
			Allied Practical - II Programming in 'c'& C++-Practical	-	2	-	-	-
	23U3SSEC2	IV	Skill Enhancement Course SEC – II Socio economic development of India in Indian political perspective	2	2	25	75	100
	23U3SSEC3		skill enhancement course iii – actuarial statistics(re-appearance students only)	2	2	25	75	100
	23U3SNMSEC2		Naan Mudhalvan					
			Health and wellness	1	–	–	–	–
Total				**23**	**30**			
IV	23U4TLC4	I	Tamil - IV	3	6	25	75	100
	23U4ELC4	II	English - IV	3	6	25	75	100
	23U4S4	III	Core course –IV Continuous probability distributions	5	5	25	75	100
	23U4SP4		Core Practical Major Practical - IV	3	3	40	60	100
	23U4SCA2		Allied Course - IV Programming in C++	4	4	25	75	100
	23U4SCAP1		Allied Practical - II Programming in 'c'& C++-Practical	2	2	40	60	100
	23U4SSEC4	IV	Skill Enhancement Course SEC - IVSoft Skills Development	2	2	25	75	100
	23U4SSEC5		skill enhancement course v – Indian official statistics(Re-Appearance Students only)	**2**	2	25	75	100
	23U4SNMSEC3		Naan Mudhalvan					
Total				**24**	**30**			
V	23U5S5	III	Core course –V: Estimation Theory	5	5	25	75	100
	23U5S6		Core course –V I: Design of experiments	4	5	25	75	100
	23U5S7		Core course –VII :Operation Research	4	4	25	75	100
	23U5SP5		Core Practical-V : Statistics Practical - V	3	6	40	60	100
	23U5SMBE1		Major based elective course-I :Sampling techniques	3	4	25	75	100
	23U5SMBE2		Major based elective course-II: Numerical methods	3	4	25	75	100
	23U5SSEC6	IV	SKILL ENHANCEMENT COURSE VI – OPTIMIZATION TECHNIQUES (Re-Appearance Students only)	2	2	25	75	100

	23U5SNMSEC4		Naan Mudhalvan					
	23U5SFV		Intership/ Industrial Visit/ Field Visit	2				
Total				**26**	**30**			
VI	23U6S8	III	Core course –VIII :Testing Hypothesis	5	6	25	75	100
	23U6S9		Core course –IX :Statistical Quality control	4	5	25	75	100
	23U6SP6		Core Practical VI: Statistics Practical - VI	3	5	40	60	100
	23U6SMBE3		Major based elective course-III :Time series and index numbers	3	5	25	75	100
	23U6SMBE4		Major based elective course-IV :Vital statistics	3	5	25	75	100
	23U6SSEC7	IV	Skill Enhancement Course SEC – VII: Biostatistics/	2	2	25	75	100
	23U6SNMSEC5		Naan Mudhalvan					
	23U6GS	V	Gender studies	1	2	25	75	100
			Extension Activity	1				
Total				**22**	**30**			
Net Total credits				**141**	**180**			

COURSE PATTERN SUMMARY

Part	Subject	Total papers	credits
I	Tamil	4	12
II	English	4	12
III	Core course	9	42
	Core practical	6	18
	Allied course	4	16
	Allied course –practical	2	4
	Major based elective course	4	12
IV	Foundation course	1	2
	Value education	1	2
	Envirormental studies	1	2
	Skill Enhanced course SEC/Nan mudalvan	7	14
	Field visit		2
	Health and willness		1
V	Gender studies	1	1
	Extension activity		1
Net Total			141

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Board Meeting: 13-04-2024 Time: 11.00 AM

DEPARTMENT OF STATISTICS
MINUTES OF THE BOARD OF STUDIES

The board of studies meeting was held on 13-04-2024 in the department. The proposed new syllabi were presented before the board. The following changes were made by the board members.

MAJOR SYLLABUS

- The syllabus is designed as per the instruction and guidelines of TANSCHE and College Education Academic Council.
- Majority of the changes have not been made in the Statistics syllabus offered by TANSCHE.
- The syllabus is designed in consultation with university and statistical curriculum experts.
- Basic statistics In I-semester is split into two parts and the first part is included in basic statistics and the second part is included in regression analysis to the foundation course
- Design of experiments which was a core course in VI-semester is changed as a core course in V –semester.
- statistical quality control which was a core course in V-semester is changed as a core course in VI –semester
- Sampling techniques and numerical methods which was a major based elective in VI-semester is changed as major based elective in V- semester.
- Numerical methods and Time Series and Index Numbers which was a major based elective in VI-semester is changed as major based elective in V-semester.
- Every Semester included in Statistics Practical –I, Statistics Practical – II. Statistics Practical – III. Statistics Practical – IV. Statistics Practical – V & Statistics Practical – VI.

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DEPARTMENT OF STATISTICS
SYLLABUS FOR THE STUDENTS ADMITTED FROM2023-2024
B.Sc STATISTICS PROGRAM

Title of the subject	**: Descriptive Statistics**	**credits**	**: 5**
Subject code	**: 23U1S1**	**Marks**	**: 75**
Semester	**: I**		

Course Objectives:

- To explain how to analyze the given data. At the end of the course a Student should be able to solve simple real-life problems.
- To explains the important concepts of statistics and statistical data.
- To provides to formulate the visualization of frequency distribution.
- To Also they measure the averages, dispersions, lack of symmetry, moments, and relationship among variables.

Unit -I

Statistics: Definition – Functions and scope of Statistics – Primary data and Secondary data Collections. Classification: Definition and types. Tabulation – Parts of table and Types of tables.

Unit- II

Diagrammatic representations – Bar diagrams and Pie diagram. Graphical representations – Histogram, Frequency curve, frequency polygon and O give-(definitions, Simple problems).

Unit- III

Measures of Central Tendencies – Arithmetic Mean, Median, Mode, Geometric mean and Harmonic mean – Definition, merits and demerits.
(Simple problems)

Unit -IV

Measures of Dispersion-Range, Quartile deviation, mean deviation, Standard Deviation, Coefficient of Variation - Definitions, merits and demerits. (Simple problems).

Unit-V

Skewness: Definition – Bowley's and Karl Pearson's Coefficient of Skewness (Simple problems). Moments and Kurtosis-Definition and types. (Simple problems)

Books for study

Statistics (Theory and practice) -R.S.N. Pillai and V. Bagavathi, Chand& company LTD, New Delhi.

Unit – I	Chapter:2(Page No:13-18), Chapter : 4(Page No:31-37), Chapter : 6 (Page No:73-79)
Unit –II	Chapter :7 (Page No:84-96) ,Chapter:8 (Page No:101-110)
Unit – III	Chapter :9 (Page No :124-186)
Unit – IV	Chapter :10 (Page No:229-278)

Unit – V Chapter :11 (Page No:316-351)

Books for Reference

1. S.C.Gupta and V.K.Kapoor – Fundamentals of Mathematical Statistics, Sultan Chand & sons, New Delhi. (11th Edition June 2002. Reprint 2017)
2. S.P.Gupta – Statistical Methods. Sultan Chand&sons, New Delhi. (44th Revised Edition 2014, Reprint 2017)

Website and e-Learning Source:

- e-books, tutorials on MOOC/SWAYAM courses on the subject
- https://en.wikipedia.org/wiki/Statistics
- https://en.wikipedia.org/wiki/Descriptive_statistics
- https://socialresearchmethods.net/kb/statdesc.php
- http://onlinestatbook.com/2/introduction/descriptive.html

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

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

CLO-2: Also to explain the statistical survey, collection of data, sampling and presentation of data.

CLO-3: Discuss the importance and uses of central values and dispersions for the various types of data.

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

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

CLO-6: Ability to apply in data

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

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

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DEPARTMENT OF STATISTICS
SYLLABUS FOR THE STUDENTS ADMITTED FROM 2023-2024
B.Sc STATISTICS PROGRAM

Title of the subject	**: Foundation Course-Basic Statistics**	**credits**	**: 2**
Subject code	**: 23U1FSC**	**marks**	**: 75**
Semester	**: I**		

Objectives:

To explain how to analyze the given data. At the end of the course a Student should be able to solve simple real-life problems.

Unit-I

Introduction: Origin, growth, Etymology of statistics, meaning, definition, statistics as data, Statistics as methods, nature, object, science or arts, statistical thinking, - theoretical question only.

Unit-II

Importance, statistics in states, economics, business, astronomy, education, accounting, research and planning - theoretical question only.

Unit III

Correlation – Definition and Types of Correlation - Properties, Methods – Scatter diagram, Karl Pearson's coefficient of Correlation and Spearman's Rank Correlation Coefficient. (Simple problems only)

Unit IV

Regression lines and Regression coefficients- Properties. - (Simple problems only)

Unit V

Association of Attributes – Class frequencies – Order of frequencies –(2X2) Contingency table – Finding missing frequencies – Yule's coefficient of Association and Coefficient of Colligation.

Course Outcomes:

Student learns to identify the relationship between two variables using scatter plot. Interpret a sample correlation

Books for study :

1. Pillai, R.S., and Bagavathi (2003): Statistics, S. Chand and Company Ltd., New Delhi.
2. Statistics (Theory and practice) -R.S.N. Pillai and V. Bagavathi, Chand& company LTD, New Delhi.
   Unit – III - Chapter 12(Page No 362-392)
   Unit – IV - Chapter 13 (Page No 430-448)

3. Statistical Methods – S.P.Gupta, Sultan Chand & Sons, New Delhi
Unit –V - Chapter 12 (Page No 496-533)

Course Learning Outcome (for Mapping with POs and PSOs)

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

CLO-2: Also to explain the statistical survey, collection of data, sampling and presentation ofdata.

CLO-3: Discuss the importance and uses of central values and dispersions for the various types ofdata.

CLO-4: Also to measure the various measures of averages and scatteredness of the mass of datain a series.

CLO-5: Explain about the lack of symmetry, r^{th} moments and peakedness of the frequencydistributions.

CLO-6: Ability to apply in data

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

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

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SYLLABUS FOR THE STUDENTS ADMITTED FROM 2023-2024
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Title of the subject	**: Major Practical-I**	**credits**	**: 3**
Subject code	**: 23U1SP1**	**marks**	**: 60**
Semester	**: I**		

Unit- I

Construction of Univariate and Bivariate Frequency Distributions. Diagrammatic representations – Bar and Pie diagrams. Graphical Representations – Histogram, Frequency curve, Frequency Polygon and Ogive curves.

Unit- II

Measures of Central Tendency – Arithmetic Mean, Median, Mode, Geometric mean and Harmonic mean.

Unit- III

Measures of Dispersion – Quartile Deviation, Mean Deviation, Standard deviation and Co-efficient of variation.

Unit- IV

Moments, Measures of Skewness– Bowley's and Karl Pearson's method- Kurtosis.

Unit –V

Correlation analysis – Karl Pearson's coefficient of Correlation and Spearman's Rank Correlation Coefficient. Regression lines. Association of Attributes

Reference Books:

1. J.N. Kapur and H.C. Saxena (1999). Mathematical Statistics – S. Chand and Company Ltd., New Delhi
2. S.C.Gupta and V.K.Kapoor, (2004), Fundamentals Mathematical Statistics, Sultan Chand & Sons, New Delhi.

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Title of the subject : Probability Theory **credits: 5**
Subject code : 23U2S2 **marks: 75**
Semester : II

Objective:

The techniques in Inferential Statistics by and large depend on Probability concepts. Hence the study of Probability theory in this Semester serves as a pre-requisite for all the subsequent Semesters (Major for B.Sc., Degree Course)

Unit-I

Concept of Random experiment – Trial – Sample point – Sample space Event, Mutually Exclusive – Definition of probability, and Axiomatic approach , Theorems on Probability – Addition theorem of probability – Conditional probability – Multiplication theorem – Baye's theorem - (simple problems.)

Unit-II

Concept of Random variables – Discrete and continuous random variables, probability mass function- Probability density function. Distribution function – Properties (simple problems)

Unit-III

Bivariate distribution – Distribution function of bivariate random variable and its properties – joint probability function and joint probability density function - marginal and conditional distributions – Independence of random variable. (Simple problems).

Unit-IV

Mathematical expectation – discrete and continuous random variables – Properties – variance – properties – covariance (simple problems).

Unit-V

Moment generating function – properties – cumulants – characteristic functions – properties. Inversion theorem and Chebychev's inequality theorem. (Statement only).

Book for study:

N.Subramaniam – Random Processes
Unit –I – Chapter-1(page no: 1-29)
S.C.Gupta and V.K.Kapoor, (2004), Fundamentals Mathematical Statistics, Sultan Chand & Sons, New Delhi.
Unit –II- Chapter -5(page no :5.2-5.11)
Unit –III- Chapter -5(page no :5.32-5.49)
Unit –IV- Chapter -6(page no:6.2-6.11)
Unit –V- Chapter -7(page no:7.2 -7.11,7.24)

Reference Books:

1. J.N. Kapur and H.C. Saxena (1999). Mathematical Statistics – S. Chand and Company Ltd., New Delhi.
2. Marek. Fisz, (1961). Probability Theory and Mathematical Statistics, John Wiley and Sons.
3. Hogg. R. V. and Allen T. Craig (1998). Introduction to Mathematical Statistics.

Website ande-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/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1: Understand concepts of probability and identify the different approaches of probabilitytheory

CLO-2: Define the random variable and its respective probability values and to compare a discreteand continuous random variable.

CLO-3: Calculate the expected value of a random variable variance, covariance, and moments andfind the conditional expectation and variance of bi-variate random variable.

CLO-4: Calculate the mean and variance through some law of large numbers.

CLO-5: Understand bivariate random variables and its distributions

CLO-6: Aplication of probability theory in real life

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

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

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Title of the subject	**: Major Practical-II**	**credits: 3**
Subject code	**: 23U2SP2**	**marks: 60**
Semester	**: II**	

Unit- I

Probability, Addition theorem of probability – Conditional probability– Multiplication theorem – Baye's theorem.

Unit- II

Random variables – Discrete and continuous random variables, probability mass function- Probability density function. Distribution function.

Unit- III

Bivariate distribution – Distribution function of bivariate random variable – joint probability function and joint probability density function - marginal and conditional distributions – Independence of random variable.

Unit- IV

Mathematical expectation – discrete and continuous random variables – variance – covariance

Unit –V

Moment generating function – cumulants– characteristic functions. Inversion theorem and Chebychev,s inequality theorem.

Reference Books:

1. J.N. Kapur and H.C. Saxena (1999). Mathematical Statistics – S. Chand and Company Ltd., New Delhi
2. S.C.Gupta and V.K.Kapoor, (2004), Fundamentals Mathematical Statistics, Sultan Chand & Sons, New Delhi.

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Title of the subject	**: Elementary course (SEC-1)**	**credits: 2**
Subject code	**: 23U2SSEC1**	**marks: 75**
Semester	**: II**	

Course Objective:

1. To enable the students to understand the basic concepts of settheory.
2. Appreciate the basics of functions and relations.
3. Understand the types of functions and relations.
4. To acquire knowledge the Sequence and series of Arithmetic and Geometric. Find useful applications in commercial problems amongothers.

Unit – I

Set Theory – Subset, Types of Sets, Relations, Functions – Simpleproblems

Unit – II

Sequence and Series of Arithmetic and Geometric Progressions – Introduction to Sequence, Series, Arithmetic Progression , GeometricProgression – Simple Problems.

Unit – III

Basic Concepts of Permutations & Combination – Fundamental Principles of Counting, Factorial, Permutations, Circular Permutations, Permutation with Restrictions, Combinations – SimpleProblems.

Unit – IV

Logical Reasoning – Number Series, Coding and decoding and oddman out.

Unit – V

Statistics – Importance of statistics, concept of statistical populationand a sample – quantitative and qualitative data. Collection of primary and secondary data, Measurement scales – nominal, ordinal
interval and ratio.

Reference Books

1. V.K. Kapoor and S.C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Charles C.Pinter : A Book of Set Theory –Dover Publications, Inc, Mineola, New York.
3. Dr. R.S. Aggarwal : A Modern Approach to Logical Reasoning, Sultan & Chand – 2018

Website and e-Learning Source

- https://www.icai.org/post.html?post_id=17790

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 : Describe the rule that definition, relations and functions of set theory.

CLO-2 : To develop the skill of computation with real sequences and series.

CLO-3 : Students should be able to determine the number of outcomes in a problem.

CLO-4 : Students should be able to apply the fundamental principle of counting to find out thetotal number of outcomes in problem.

CLO-5 : Understand of data and its relevance in business and develop an understanding ofquantitative techniques.

CLO-6 : Ability to apply in data.

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

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

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Title of the subject	**: Discrete probability distributions**	**credit : 5**
Subject code	**: 23U3S3**	**marks : 75**
Semester	**: III**	

Course Objective:

- To expose the various important discrete probability models and
- To real life Situations where these distributions provide appropriate models
- To learn discrete distributions
- To understand Distributions generated from mathematical functions

Unit – I

Binomial distribution – Definition, Concept and Derivation of Moments, Moment Generating Function, Additive property, Characteristic function and Recurrence relation for moments. Fitting of Binomial distribution – Simple problems.

Unit – II

Poisson distribution – Definition, Concept, Derivation of Moments, Moment Generating Function, Recurrence relation for moments and Poisson distribution as a limiting case of Binomial Distribution, Fitting of Poisson Distribution – Simple problems.

Unit – III

Negative Binomial Distribution – Definition, Derivation of constants and Poisson distribution as a limiting case of the Negative Binomial Distribution.

Unit – IV

Geometric Distribution – Definition, Moments, Derivation of Moment Generating Function and Lack of memory property. Power series distribution (Concept only).

Unit – V

Hyper Geometric Distribution – Definition, Derivation of Mean and Variance approximation to Binomial distribution and Recurrence relation. Multinomial distribution (Concept only).

Book for Study:

Gupta,S.C & Kapoor, V.K (2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Unit – I - Chapter -8(page no :8.4-8.22)
Unit – II - Chapter -8(page no :8.28-8.47)
Unit – III - Chapter -8(page no :8.48-8.54,8.63)
Unit – IV - Chapter -8(page no:8.54-8.57,8.63)
Unit – V - Chapter -8(page no:8.57 -8.60)

Reference Books

1.V.K. Rohatgi, (1985), An introduction to probability theory and mathematical statistics, Wiley Eastern Ltd., New Delhi

2.Johnson, N.L. and Kotz, S: "Discrete Distributions", John Wiley and sons, 1969.

Website ande-Learning Source

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

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 indistribution 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	M	M	M	S	M	S	M
CLO2	S	S	S	S	M	S	M	S	M
CLO3	S	S	S	M	S	M	M	S	M
CLO4	S	S	S	M	S	S	S	M	M
CLO5	S	M	M	M	M	S	S	S	M
CLO6	S	M	M	S	M	S	S	S	M

CLO-PSO Mapping (Course Articulation Matrix)

S-Strong, M-Medium, W-Weak

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

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DEPARTMENT OF STATISTICS
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Title of the subject	**: Major Practical-II**	**credits**	**: 3**
Subject code	**: 23U3SP3**	**marks**	**: 60**
Semester: III			

Unit – I

Binomial distribution –Fitting of Binomial distribution.

Unit – II

Poisson distribution – Fitting of Poisson distribution.

Unit – III

Negative Binomial distribution – Poisson distribution as a limiting case of the Negative Binomial distribution.

Unit – IV

Geometric distribution, Power series distribution.

Unit – V

Hyper Geometric distribution, Multinomial distribution.

Book for Study:

Gupta,S.C & Kapoor, V.K (2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

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B.Sc STATISTICS PROGRAM

Title of the subject	**: Actuarial Statistics (SEC-III)**	**credits**	**: 2**
Subject code	**: 23U3SSEC3**	**marks**	**: 75**
Semester	**: III**		

Course Objective

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 andmodels.
3. It gives the understanding of the application knowledge of the life insurance 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, Family income benefits.

Unit- III

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

Unit-IV

Contingent Functions: Contingent probabilities, assurances. Decrement tables. Pension funds: Capitalsums 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

Book for Study:

1. Hooker,P.F., Longley, L.H.-Cook (1957) : Life and other contingencies, Cambridge.
2. Alistair Neill(1977) : Life contingencies, Heinemann professional publishing.

Book for Reference

1. Gu Study material of IAI/IFoA of Actuarial Societies
2. Hosack,I.B., Pollard, J.H. and Zehnwirth, B.(1999) : introductory statistics with applications in generalinsurance, Cambridge University.

pta and Kapoor (2001) Fundamentals of Applied Statistics

Website ande-Learning Source

- e-books, tutorials on MOOC/SWAYAM courses on the 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 lifefunctions 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 yearof death-level benefit insurance.
CLO6: To understand real life problems related to insurance

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

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

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Title of the subject	**: Continuous Probability Distributions**	**credits**	**: 5**
Subject code	**: 23U4S4**	**marks**	**: 75**
Semester	**: IV**		

Course Objective:

To expose the various important continuous probability models and real Life situations where these distributions provide appropriate models

Unit – I

Normal Distribution – Introduction, Limiting form of Binomial Distribution. Characteristics of Normal Distribution, and its curve. Derivation of Mode, Median, Moments and Moment Generating Function .

Unit – II

Derivation of Cumulant Generating Function, Mean Deviation about Mean, and Points of Inflection of Normal curve. Importance of Normal Distribution – Fitting of normal distribution – Simple Problems.

Unit – III

Beta Distribution of First and Second Kind – Derivation of Moments, $\beta 1$, $\beta 2$ and Harmonic Mean. Gamma Distribution – Definition and Derivation of Moment Generating Function, Cumulant Generating function, Moments and Additive property of Gamma Distribution.

Unit – IV

Rectangular Distribution-Introduction and derivation of Moments, Moment Generating Function and Mean Deviation about Mean**.** Exponential Distribution – Definition, Derivation of Moment Generating Function and Lack of Memory property. Concept of Weibul Distribution.

Unit – V

Sampling Distribution - Concept of 't', 'χ^2' and 'F' Distributions – Derivation of these distributions, Constants and Moment Generating Function – Relationship between 't', '$\chi 2$' and 'F' Distribution.

Book for Study:

Gupta,S.C & Kapoor, V.K (2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Unit – I - Chapter -9(page no :9.3-9.8)
Unit – II - Chapter -9(page no :9.8-9.23)
Unit – III - Chapter -9(page no :9.38-9.43)
Unit – IV - Chapter -9(page no:9.29,9.30,9.50,9.51,9.55,9.59)

Unit – V - Chapter -15(page no:15.2-15.5),Chapter -16(page no:16.2-16.6,16.29-16.31,16.40,16.41)

Reference Books

Johnson, N.L. and Kotz, S : "Continuous univariate Distributions", Vol.I & Vol.II, John Wiley and Sons, 1970.

Website ande-Learning Source

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

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 indistribution 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	M	M	M	S	M	S	M
CLO2	S	S	S	S	M	S	M	S	M
CLO3	S	S	S	M	S	M	M	S	M
CLO4	S	S	S	M	S	S	S	M	M
CLO5	S	M	M	M	M	S	S	S	M
CLO6	S	M	M	S	M	S	S	S	M

CLO-PSO Mapping (Course Articulation Matrix)

S-Strong, M-Medium, W-Weak

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

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Title of the subject	**: Major Practical-IV**	**credits: 3**
Subject code	**: 23U4SP4**	**marks: 60**
Semester	**: IV**	

Unit – I

Fitting of Normal distribution -Area and Ordinate methods.

Unit – II

Cumulate Generating Function and Points of Inflection of Normal curve. Importance of Normal Distribution – Fitting of normal distribution

Unit – III

Beta Distribution of First and Second Kind .Gamma Distribution.

Unit – IV

Rectangular Distribution, Exponential Distribution, Weibul Distribution.

Unit – V

Sampling Distribution - 't', 'χ^2' and 'F' Distributions – Relationship between 't', '$\chi 2$' and 'F' Distribution.

Book for Study:

Gupta,S.C & Kapoor, V.K (2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Reference Books

Johnson, N.L. and Kotz, S : "Continuous univariate Distributions", Vol.I & Vol.II, John Wiley and Sons, 1970.

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Title of the subject	**: Indian official statistics (SEC-V)**	**credits**	**: 2**
Subject code	**: 23U4SSEC5**	**marks**	**:75**
Semester	**: IV**		

Unit – I

Statistical organization – Population Statistics – Agricultural Statistics – Indices of Agricultural production – Miscellaneous Agricultural Statistics.

Unit – II

Industrial statistics – ASI – Indices of Industrial Production and profits.

Unit – III

Price statistics – Price index numbers – Labour Bureau; Index number of Retail prices – Indices of security prices.

Unit – IV

Wage statistics – trade statistics – Financial statistics – National income statistics.

Unit – V

National sample surveys – Activities and publications of CSO and the Department of Statistics, Government of Tamil Nadu. National Income compilation.

Book for Study:

1. Gupta SP : Statistical Methods (Sultan Chand & Sons)
2. Saluja MR : Indian Official Statistical System (Publication of Indian Econometric Society)
3. Central Statistical Organisation, Guide to Official Statistics 1979 Ed Department of Statistics, Ministry of Planning, India

Reference Books

1. Spyros Makridakis, Steven C. Wheelwright and Rob J
2. Hyndman (2003) :ForecastingMethods and Applications ,3rd Edition ,John Wiley and Sons Inc. .

Irving W. Burr (1974): Applied Statistical Methods, AcademicPress.

Website ande-Learning Source

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

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	M	S	M	S	S	S	S
CLO2	S	S	S	S	M	S	S	S	S
CLO3	S	S	S	S	S	M	S	S	S
CLO4	S	S	S	M	S	S	S	S	M
CLO5	S	S	S	M	M	S	S	S	M
CLO6	S	S	M	S	M	S	S	S	M

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

CO /PO	PSO1	PSO1	PSO1	PSO1	PSO1
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 C

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B.Sc STATISTICS PROGRAM

Title of the subject	**: Estimation Theory**	**credits**	**: 5**
Subject code	**: 23U5S5**	**marks**	**: 75**
Semester	**: V**		

Course Objective:

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

Unit – I

Introduction to estimation theory – definition of parameter space, estimate and estimator. Characteristics of estimator – unbiasedness – definition and simple problems. Consistency – definition, problem based on Normal and Poisson distribution. Invariance property of consistency, sufficient condition for consistency.

Unit – II

Efficient estimators – definition of efficiency, most efficient estimator, minimum variance unbiased estimator. (simple problems).

Unit – III

Sufficiency – definition, Rao Blackwell theorem, Crammer-Rao inequality, statement of Neymann factorization theorem, (simple problems).

Unit – IV

Methods of estimation: Method of Maximum likelihood estimation – definition of likelihood function and M.L.E., properties of M.L.E(simple problems). Hazoor Bazar's theorem.

Unit – V

Methods of minimum variance, Methods of moments and Methods of least squares(simple problems).Interval estimation – definition of confidence limits, confidence co-efficient, confidence interval and Confidence intervals for large samples (simple problems).

Book for Study:

Gupta,S.C & Kapoor, V.K (2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Unit – I - Chapter -17(page no :17.2-17.7)
Unit – II - Chapter -17(page no :17.8-17.14)
Unit – III - Chapter -17(page no :17.14-17.23)

Unit – IV - Chapter -17(page no: 17.30-17.40)
Unit – V - Chapter -17.(page no: 17.43-17.46,17.46-17.52)

Book for Reference:

1. Rohatgi.V.L, "An introduction to probability theory and Mathematical Statistics", Wiley Eastern limited
2. Radhakrishna Rao C., "Linear Statistical Inference and its Applications", Wiley Eastern limited.
3. Lehmann.E.L, Testing of Statistical Hypothesis, John Wiley.
4. Gibbons.J.D, Non – Parametric Statistical Inference, Duxbury.

Website ande-Learning Source

- 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 theestimators
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	M	M	M	S	S	S	M
CLO2	S	S	S	S	M	S	S	S	M
CLO3	S	S	S	M	S	M	S	S	M
CLO4	S	S	S	M	S	S	S	S	M
CLO5	S	S	M	M	M	S	S	S	M
CLO6	S	M	M	S	M	S	S	S	M

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

CO /PO	PSO1	PSO1	PSO1	PSO1	PSO1
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

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Title of the subject	**: Design of experiments**	**credits : 4**
Subject code	**: 23U5S6**	**marks: 75**
Semester	**: V**	

Course Objective:

- ✓ To get theoretical knowledge in Statistical Design of Experimentsand analysis of variance
- ✓ To build strong theoretical foundation in Orthogonal Latin squares, fractional experiments.
- ✓ To develop analytical thinking in problem solving skills

Unit - I

Analysis of Variance: Definition and assumptions. Cochran's theorems (statement only) ANOVA - One way and Two way classifications (with one observation per cell).

Unit - II

Design of Experiment: Need, terminology. Experimental design, Randomization, Replication and Local control; Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) - Estimation of missing values in RBD and LSD (one and two).

Unit - III

Factorial experiment - main effects and interactions; definitions of contrast and orthogonal contrast; Analysis of 2^2 and 2^3 experiments.

Unit - IV

Confounding in factorial design –Total Confounding and Partial confounding in 2^3 experiments.

Unit – V

Analysis of co-variance for a one way layout with one concomitant variable and RBD with one concomitant variable.

Book for Study:

S.C. Gupta and V.K. Kapoor (2013), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

Unit – I - Chapter -5(Page no :5.2-5.41)
Unit – II - Chapter -6(Page no :6.1-6.45)
Unit – III - Chapter -6(Page no :6.9-6.95)
Unit – IV - Chapter -6(Page no: 6.100-6.104)

Unit – V - Chapter -6.(Page no: 6.54-)

Books for Reference:

1. Douglas C.Montgomery (2010), Design and Analysis of experiment, Wiley International Edition, India.
2. Cochran.W.G. & G.M.Cox(1957), Experimental designs, Wiley International edition, India.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 : To understand analysis of variance and experimental designs

CLO-2 : To have strong theoretical knowledge in Orthogonal latin squares, Hyper GraecoLatin squares

CLO-3 : Know factorialand fractional factorial experiments, PIBD, inter and intra blocks,split plot, analysis covariance

CLO-4 : To understand clinical trial concepts and Response surface methodology

CLO-5 : To do numerical problems and able to get critical thinking to solve problems

CLO-6 : To choose suitable experiment and do it for real life problems

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

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

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Title of the subject	**: Operations Research**	**credits**	**: 4**
Subject code	**: 23U5S7**	**marks**	**: 75**
Semester	**: V**		

Objective

- ✓ To import basic knowledge of various optimization techniques.
- ✓ Resources are scarce in many situations. Any decision making process may have to take into account, a set of constraints. The optimization in such a situation is of vital importance.

Unit I

Origin and development of OR- Definition,scope of OR ,Phases in OR, model in OR , Linear Programming Problem(LPP) – General Form, Standard form and Canonical form, Basic Solution, Basic Feasible solution, Optimum solution. Linear Programming Problem: Introduction- Mathematical Formulation of LPP-Graphical Solution methods.

Unit II

Simple Method: Formation of LPP and its Solution by Simplex Method, Big-M Method and Two-Phase Simplex Method

Unit III

Transportation Problem – Meaning, Balanced and Unbalanced Transportation Problem. Initial Basic Feasible Solution – North-West Corner Rule, Least Cost Method and Vogel's Approximation Method

Unit – IV

Assignment Problem – Meaning, Balanced and Unbalanced Assignment Problem – Hungarian method to solve an Assignment Problem. Maximization case in Assignment Problem

Unit – V

Introduction to Network – Concepts of activity, node, network, critical path, different floats, Critical path method – Calculation of earliest time and latest time – PERT Calculations.

Course Outcomes:

- ➢ Know the different types of Operations Research models.
- ➢ Obtain the role of Linear Programming Problem in real life problem.
- ➢ Show the uses of travelling sales man problem in marketing industry.
- ➢ Know the role of Transportation problems in Transport company.

Book for Study:

S. Kalavathy-Operations Research 2nd edition

Unit –I - Chapter -1(Page no 1-5) Chapter -2,3(Page no 7-26)
Unit –II - Chapter -4(Page no 35-36)
Unit –III - Chapter -8(Page no 125-136)
Unit –IV - Chapter -9(Page no 165-183)
Unit –V - Chapter -13(Page no 273-288)

Book for Reference

1. Philips, D.T., Ravindran, A and Solberg, J.J.: "Operations Research Principle and 2.Practice", 2007.
2. Taha, H.A., "Operations Research – An Introduction", PHI, 2014.
3. Kanti Swarup, P.K. Gupta & Man Mohan: Operations research – Sultan Chand & Sons.

Website ande-Learning Source

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

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 understand optimization techniques and solving set of equations with constraints

CLO-2 solve problems of linear programming

CLO-3 understand transportation problems and its applications

CLO-4 solve problems using games theory

CLO-5 do replacement problems and solve it

CLO-6 do network analysis and get problem solving skills

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

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

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Title of the subject	**: Major practical -V**	**credits : 3**
Subject code	**: 23U5SP5**	**marks: 60**
Semester	**: V**	

Unit –I

Characteristics of estimator, Method of Maximum likelihood Estimation, minimum variance Interval estimation –Confidence intervals for large samples.

Unit- II

Analysis of CRD, RBD one and two observations per cell and LSD layouts, missing plot techniques in RBD and LSD (one or two missing observations) Latin Square Design.

Unit- III

Analysis of 2^2 and 2^3 factorial design with and without confounding – Analysis of covariance for an RBD with one concomitant variable.

Unit – IV

Graphical Solution methods ,Simplex Method: Formation of LPP and its Solution by Simplex Method, Big-M Method and Two-Phase Simplex Method

Unit – V

Transportation Problem –. Initial Basic Feasible Solution – North-West Corner Rule, Least Cost Method and Vogel's Approximation Method.

Assignment Problem –Hungarian method to solve an Assignment Problem. Maximization case in Assignment Problem. Networkproblem.

Reference Books

1. Gupta,S.C & Kapoor, V.K (2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi
2. Statistics (Theory and practice) -R.S.N. Pillai and V. Bagavathi, Chand& company LTD, New Delhi

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SYLLABUS FOR THE STUDENTS ADMITTED FROM 2023-2024
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Title of the subject	**: Sampling Technique (MBE-I)**	**credits**	**: 3**
Subject code	**: 23U5SMBE1**	**marks**	**: 75**
Semester	**: V**		

Objective:

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

Unit I

Basic concept of sample survey - Introduction, definitions, Census and sample surveys,, principles of sampling theory, principal steps in a sample survey. Probability and non-probability sampling, sampling unit, sampling frame, sampling and non-sampling errors.

Unit II

Sampling from finite population – simple random sampling – unbiased estimate of the mean and variance –Determination of sample size.

Unit III

Stratified Random Sampling–Properties of the Unbiased Estimate of the Mean and Variances–Optimum and Proportional Allocation–Relative Precision of a Stratified Sampling and Simple Random Sampling.

Unit IV

Systematic sampling – Estimation of mean and variance – Comparison of simple random sampling and Stratified random sampling with systematic sampling

Unit V

Ratio – estimators – Variance of the ratio estimate – comparison of the ratio estimates with the mean per unit – Bias of the ratio estimate – Regression estimators – linear regression estimate – Regression estimators with pre-assigned ratio estimator.

Book for Study:

1.Gupta,S.C. & Kapoor,V.K (2014), Fundamentals of Applied Statistics, 4th Edition, Sultan Chand & Sons, New Delhi.

Unit –I - Chapter -7(Page no 7.2-7.12)
Unit –II - Chapter -7(Page no 7.12-7.22)
Unit –III - Chapter -7(Page no 7.42-7.54)
Unit –IV - Chapter -7(Page no 7.76-7.86)

2.Cochran W.G. (1984), Sampling Techniques, Wiley Eastern Ltd.

Unit –V - Chapter -6(Page no 157.160)

Books for Reference:

1. Murthy M.N.(1976), Sampling theory and methods- statistical publishing society, Calcutta.
2. Des Raj (1976): Sampling Theory, Tata-Mcgraw Hill.
3. Kapoor V.K. and Gupta S.C. Fundamentals of Applied statistics.
4. Daroga Singh and Choudry F.S(1986), Theory and Analysis of Sample Survey Design, Wiley Eastern Ltd: New Delhi.

Website ande-Learning Source

- e-books, tutorials on MOOC/SWAYAM courses on the subject
- http://ocw.jhsph.edu/courses/statmethodsforsamplesurveys/pdfs/lectur

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	M	M	M	S	S	S	M
CLO2	S	S	S	S	M	S	S	S	M
CLO3	S	S	S	M	S	M	S	S	M
CLO4	S	S	S	M	S	S	S	S	M
CLO5	S	S	M	M	M	S	S	S	M
CLO6	S	M	M	S	M	S	S	S	M

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

CO /PO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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

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Title of the subject	**: Numerical Methods (MBE-II)**	**credits**	**: 3**
Subject code	**: 23U5SMBE2**	**marks**	**: 75**
Semester	**: V**		

Objectives:

- ✓ To tackle the practical situations demands the use of interpolation and Extrapolation.
- ✓ To solve Mathematical calculus problems, whenever the classical approach fails.
- ✓ To solve mathematical calculus problems through computers.

Unit-I

Finite differences – Forward and Backward difference operators 'E' and 'And' their basic properties – Interpolation with equal intervals – Newton's forward and backward difference formulae – simple problems.

Unit-II

Interpolation with unequal intervals – Divided differences and their properties – Newton's divided difference formula – Lagrange's formula - simple problems

Unit-III

Central difference interpolation formula – Gauss forward and backward differences formulae – Stirring's, Bessel's and Everett's central difference formulae.

Unit-IV

Numerical integration – Trapezoidal rule, Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule (Problems only).

Unit-V

Numerical solution of Ordinary Differential Equation – Taylor series method, Modified Euler's method and Second and Fourth order Runge-Kutta method (Problems only)

Course Outcomes:

- ➢ Understand the uses of interpolation in various fields
- ➢ Know the role of Picard's method for successive approximation. .
- ➢ Learn the usage of numerical differentiation and integration
- ➢ Learn the importance of Lagrange's problem in interpolation..

Book for Study:

1.P.Kandasamy, K. Thilagavathy, and K.Gunavathy (2003), Numerical Method

Unit –I - Chapter -5(Page no 170-198)
Unit –II - Chapter -8(Page no 257-275)
Unit –III - Chapter -7(Page no 231-254)

Unit –IV - Chapter -9(Page no 299-317)
Unit –V - Chapter -9(Page no 348-393)

Books for Refernce:

1. S.S. Sastry (2000), Introduction methods of Numerical Analysis, Prentice- Hall of India Pvt- India III Editions.
2. P.Kandasamy, K. Thilagavathy, and K.Gunavathy (2005), Numerical Methods.
3. E. Balagurusamy (2004), Numerical Methods, Tata McGraw Hill Publishing Company Limited, New Delhi.
4. A.Singaravel, 'Numerical method', Meenakshi publications, Chennai.

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**
CLO1	S	S	M	M	M	S	S	S	M
CLO2	S	S	S	S	M	S	S	S	M
CLO3	S	S	S	M	S	M	S	S	M
CLO4	S	S	S	M	S	S	S	S	M
CLO5	S	S	M	M	M	S	S	S	M
CLO6	S	M	M	S	M	S	S	S	M

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

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Title of the subject	**: Optimization Techniques (SEC-VI)**	**credits**	**: 2**
Subject code	**: 23U5SSEC6**	**marks**	**: 75**
Semester	**: V**		

Course Objectives

- ✓ To import basic knowledge of various optimization techniques.
- ✓ Resources are scarce in many situations. Any decision making process may have to take into account, a set of constraints. The optimization in such a situation is of vital importance.

Unit I

Duality in linear programming: Concept of duality – Fundamental Properties of Duality, Dual Problem when Primal Problem is in the Standard Form – Dual Problem When Primal Problem is in the Mixed Form.

Unit II

Inventory control: techniques of inventory control with selective control, ABC analysis, economic lot size problem, and

Unit III

Inventory control -the fundamental problem of EOQ, Problem of EOQ with shortage and without shortages. Multi-item Deterministic Problem.

Unit-IV

Theory of Games-Game theory Optimal solution of Two-person Zero-sum Games-Mixed strategies-Graphical solutions of (2x n) and (n x 2) Games Solution of m x n games by LPP.

Unit V

Queuing Theory - Basic elements of the queuing model. Role of the Poisson and Exponential distribution: Arrival process-Departure processes - Detailed study of (M/M/1) / (“/FIFO) models.

Course Outcomes:

- Understand the role of Game theory in LPP.
- Know the determination critical path.
- Compute the deterministic inventory models.
- Know the practical problems using sequencing problem.
- Obtain the role of sequencing problems in Software Company.

Book for Study:

S. Kalavathy-Operations Research 2nd edition

Unit –I - Chapter -11(Page no 231-243)

Unit –II - Chapter -14(Page no 327-332)
Unit –III - Chapter -17(Page no 441-452)
Unit –IV - Chapter -16(Page no 411-414)
Unit –V - Chapter -13(Page no 273-288)

Book for Reference

1. Philips, D.T., Ravindran, A and Solberg, J.J.: "Operations Research Principle
2. Practice", 2007. 2. Taha, H.A., "Operations Research – An Introduction", PHI, 2014.
3. Kanti Swarup, P.K. Gupta & Man Mohan: Operations research – Sultan Chand & Sons.

Question Pattern

The question paper setter is kindly informed to strictly follow the following question paper pattern

	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-v**
Section-A Question no	1&2	3&4	5&6	7&8	9&10
Section-B Question no	11(a&b)	12(a&b)	13(a&b)	14(a&b)	15(a&b)
Section-C Question no	16	17	18	19	20

Section A- 10*2=20 Marks --- all question must be answered
Section B- 5*5=25 Marks --- Either (a) or (b)
Section C- 3*10=30Marks --- Three out of five questions must be answered

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Title of the subject : Industrial Visit **credits : 2**
Subject code : 23U5SFV
Semester : V

Objective:

- To expose students to real-world applications of statistics in industries or institutions.
- To help them understand how data collection, analysis, interpretation, and statistical software/tools are used in practice.
- To provide insight into career opportunities and professional practices in the field of statistics and data science.

Typical Industries Visited:

- Manufacturing Units (for quality control, Six Sigma practices)
- Pharmaceutical Companies (clinical trials, biostatistics)
- Insurance or Banking Firms (risk analysis, actuarial statistics)
- IT Companies (data analytics, machine learning applications)
- Government Statistical Departments (Census Bureau, NSSO, CSO)
- Research Organizations / NGOs (surveys, impact evaluation)

Syllabus Inclusion:

Often found under a heading like:

- *"Project Work / Field Work / Practical Training / Industrial Visit"*
- Sometimes part of a paper like Applied Statistics, Practical Statistics, or Statistical Computing.

Expected Output / Report:

- Students are usually required to submit a detailed report including:
  - Introduction of the organization
  - Objective of the visit
  - Departments involved in data handling
  - Tools/software used (e.g., R, SPSS, Python, Excel)
  - Statistical methods applied in the organization
  - Observations and learnings
  - Photographs, charts, and team reflections

Skills Gained:

- Data handling in real environments
- Exposure to statistical software
- Understanding practical constraints in data collection
- Communication and teamwork
- Awareness of ethical aspects in data usage

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Title of the subject	**: Testing Hypothesis**	**credits**	**: 5**
Subject code	**: 23U6S8**	**marks**	**: 75**
Semester	**: VI**		

Course Objective:

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

Unit – I

Statistical hypothesis – simple and composite, Null and Alternative hypothesis, Critical region, Level of significance, type of errors and Power of test (simple problems). Steps involved in testing of hypothesis. Neymann Pearson Lemma

Unit – II

Large sample test – Test for single proportion, difference between proportions, single mean, difference between means and difference between standard deviation.- Simple Problem.

Unit – III

Small sample test – student's 't' test – test for single mean, difference between means, paired 't' test and observed sample correlation co-efficient.- Simple Problem.

Unit –IV

Snedecor's F test – test for equality of two population variance – Testing the significance of an observed multiple correlation co-efficient, observed sample correlation ratio and linearity of regression , Chi-square test (concepts only).- Simple Problem.

Unit – V

Non-parametric test - Independence of attributes and goodness of fit. One sample tests – Sign test(small sample) and Run test for randomness, two sample tests – Sign, median and Mann Whitney U- test – Simple Problems.

Book for Study:

Gupta,S.C & Kapoor, V.K (2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Unit –I - Chapter -14(page no 14.6-14.25) Chapter -18(page no 18.8)
Unit –II - Chapter -14(page no 14.25-14.36)
Unit –III - Chapter -16(page no 16.2-16.25)
Unit –IV - Chapter -16(page no 16.29-16.40), Chapter -15(page no 15.2)
Unit –V - Chapter -18(page no18.2-18.47),

Book for Reference:

1. Radhakrishna Rao C., "Linear Statistical Inference and its Applications", Wiley Eastern limited.
2. Lehmann.E.L, Testing of Statistical Hypothesis, John Wiley.

3. Gibbons.J.D , Non – Parametric Statistical Inference, Duxbury.
4. Rohatgi.V.L, "An introduction to probability theory and Mathematical Statistics", Wiley Eastern limited.

Website ande-Learning Source

- e-books, tutorials on MOOC/SWAYAM courses on the subject
- 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	M	S	M	S	S	S	S
CLO2	S	S	S	S	M	S	S	S	S
CLO3	S	S	S	M	S	M	S	S	M
CLO4	S	S	S	M	S	S	S	S	M
CLO5	S	S	S	M	M	S	S	S	M
CLO6	S	M	M	S	M	S	S	S	M

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

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Title of the subject	**: Statistical Quality Control**	**credits**	**: 4**
Subject code	**: 23U6S9**	**marks**	**: 75**
Semester	**: VI**		

Objective:

- ✓ To impart basic theoretical knowledge about terminologies, need of control charts for quality control, construct control limits of variables and attributes.
- ✓ To educate the learner to be able to construct control charts for defects, number of defects (c-chart); and control chart for number ofdefects per unit (u-chart).
- ✓ To educate acceptance sampling plan and discuss the procedure of its implementation, compute the probability of accepting or rejecting a lot.

Unit – I

Introduction to SQC – Chance and Assignable Causes of Variation – Benefits of SQC – Process and Product Control – Tools for SQC- Control chart for Variables – X-Bar and R- Chart .

Unit – II

Control Chart for Attributes – Control Chart for Fraction Defective (p-Chart)- Control Chart for Number of Defectives (d-chart, for fixed and variable sample size) – Control Chart for Number of Defects per unit (c- Chart) – Natural Tolerance Limit and Specification Limits.

Unit –III

Acceptance sampling by Attributes – Acceptance Quality Level (A.Q.L) – Lot Tolerance Proportion or Percent Defective (LTPD) – Process Average Fraction Defective (p) – Consumer's Risk(β) – Producer's Risk(α) – Rectifying Inspection Plan – Average Outgoing Quality Level (AOQL)-Simple Problem.

Unit – IV

Operating Characteristic Curve (OC-curve) – Average Sample Number (ASN) – Average Amount of Total Inspection (ATI) – Single Sampling Plan – Determination of 'n' and 'c', AOQL, OC-curve – Double Sampling Plan – ASN and ATI of Double Sampling Plan – Single sampling Vs Double Sampling plan. Simple Problem .

Unit –V

Sequential Sampling – Sequential Probability Ratio Test (SPRT) – ASN Functionn.OC Function.

Book for Study:

Gupta,S.C. & Kapoor,V.K (2014), Fundamentals of Applied Statistics, 4th Edition, Sultan Chand & Sons, New Delhi.

Unit –I - Chapter -1(Page no 1.2-1.22)
Unit –II - Chapter -1(Page no :1.30-1.45)

Unit –III - Chapter -1(Page no :1.45-1.50)
Unit –IV - Chapter -1(Page no: 1.50-1.60)
Unit –V - Chapter -1(Page no:1.60-1.69)

Book for Reference:

Mahajan, M., Statistical Quality Control, Dhanpat Rai & Co.

Website ande-Learning Source

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

Course Learning Outcome (for Mapping with POs and PSOs)

CLO-1 understand Industrial applications of Statistics

CLO-2 understand statistical process control and methods for it

CLO-3 understand attribute and variable control chart and interpret process based on it

CLO-4 understand the situations using special purpose control charts

CLO-5 know various product control techniques

CLO-6 To do numerical problems and able to get critical thinking to solve problemsTo explore real life problems

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

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

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Title of the subject	**: Major Practical-VI**	**credits**	**: 3**
Subject code	**: 23U6SP6**	**marks**	**: 60**
Semester	**: VI**		

Unit-I

Large sample test – Test for single proportion, difference between proportions, single mean, difference between means and difference between standard deviation.

Unit – II

Small sample test – student's 't' test – test for single mean, difference between means, paired 't' test .Snedecor's F test – test for equality of two population variance ,Chi-square test.

Unit – III

Non-parametric test - Independence of attributes and goodness of fit. One sample tests – Sign test and Run test for randomness, two sample tests – Sign, median and Mann Whitney U- test – Simple Problems.

Unit –IV

Construction of $\bar{X}$,R, P, c and np charts,

Unit- V

Operating Characteristic Curve (OC-curve) – Average Sample Number (ASN) – Average Amount of Total Inspection (ATI) – Single Sampling – Double Sampling Plan

Book for Reference:

1. 1.Gupta,S.C & Kapoor, V.K (2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. S.C. Gupta and V.K. Kapoor (2013), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

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Title of the subject : Time series and index numbers (MBE-III) credits: 3
Subject code : 23U6SMBE3 marks: 75
Semester : VI

Course Objective

- ✓ On successful completion of this course, students will be able to acquire the knowledge of time series data and its applications.
- ✓ Outline the growth curves and their fitting.
- ✓ To compute the different index numbers in real life problems.
- ✓ To calculate the seasonal indices by various methods.
- ✓ 5.To analyse the importance of a good index number

Unit- I

Time series –Concept and Sources of time series data – Components of time series – Additiveand Multiplicative models – Resolving the components of time series.

Unit- II

Trend –Methods of measuring trend – Semi average method – Method of moving average –Method of least squares.(simple problems)

Unit –III

Index Numbers – Definition – uses - Problems in the construction – Different types of Index Numbers – Simple and Weighted Index Numbers – Laspeyre's Index Numbers – Paaschey's Index Numbers – Fisher's Index Numbers –Marshall - Edgeworth Index Numbers.(simple problems).

Unit –IV

Index Numbers – Time reversal test – Factor Reversal Test –Circular Test – Chain base Index Number – Conversion of FBI into CBI and Vice versa - Wholesale price Index Numbers (Concept only**).**

Unit –V

Cost of living Index Numbers – Methods of construction – Aggregate method -Family budget method – Uses of cost of living Index Numbers- Splicing and Deflating – Base shifting (Concepts only).

Course Outcomes:

- ➢ Learn the economic statistics.
- ➢ Compute the different index numbers.
- ➢ Learn the uses of Laspeyre's and Passche's and Fisher's index numbers in real life problems.
- ➢ Learn the importance of good index number.

Book for Study:

Gupta,S.C. & Kapoor,V.K (2014), Fundamentals of Applied Statistics, 4th Edition, Sultan Chand & Sons, New Delhi.

Unit –I - Chapter -2(Page no 2.2-2.7)
Unit –II - Chapter -2(Page no 2.7-32)
Unit –III - Chapter -3(Page no 3.2-3.31)
Unit –IV - Chapter -3(Page no 9.28-9.33)
Unit –V - Chapter -3(Page no3.29-3.47)

Book for Reference:

1. A.M. Goon M.K. Gupta and B. Dass Gupta (1994), Fundamentals of Statistics V-II, The worlds press Ltd., Calcutta.
2. Croxton: Applied General Statistics.
3. S.C.Gupta, V.K.Kapoor, (2007): Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Understand the time series concept

CLO-2 estimate the trend values using various methods

CLO-3 concept and purposes of index numbers

CLO-4 understand the notation and formulae concerning the use.

CLO-5 understand time series data its components and its application in various fields

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

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

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Title of the subject	**: Vital statistics (MBE-IV)**	**credits**	**: 3**
Subject code	**: 23U6SMBE4**	**marks**	**: 75**
Semester	**: VI**		

Course Objective

- ✓ To Learn population and demographic registration
- ✓ To learn fertility and mortality measurements
- ✓ To understand Life table uses
- ✓ To learn migration effect

Unit I

Definition of vital statistics and demography – uses of vital statistics, Methods of collecting Vital Statistics.

Unit II

Measurement of Mortality – Specific death rate – Standardized death rate – Infant Mortality- Concepts and simple problems.

Unit III

Mortality Table or Life table - Stationary and Stable population – Central Mortality Rate, Force of Mortality.

Unit IV

Life Table – Assumptions, Descriptions, Construction and Uses of Life Table. -Simple Problem.

Unit V:

Measurement of Fertility – CBR (crude birth rate) – SFR (specific fertility rate) - ASFR (age specific fertility rate) – GFR (general fertility rate) – TFR (total fertility rate)- Simple Problem.

Book for Study:

Gupta,S.C. & Kapoor,V.K (2014), Fundamentals of Applied Statistics, 4th Edition, Sultan Chand & Sons, New Delhi.

Unit –I - Chapter -9 (Page no 9.2-9.4)
Unit –II - Chapter -9 (Page no 9.6-9.15)
Unit –III - Chapter -9 (Page no 9.15-9.27)
Unit –IV - Chapter -9 (Page no 9.28-9.37)
Unit –V - Chapter -9 (Page no 9.44-9.48)

Book for Reference:

1. Hansraj, Fundamentals of Demography, Surjeet Publications, New Delhi.
2. Peter R Cox, Demography, Fifth edition, Vikas Publishing House, New Delhi.

Website ande-Learning Source

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

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 to understand need of population study and its registration system
CLO-2 to understand fertility and mortality effect on population
CLO-3 to understand life table and its usage to real problems
CLO-4 to get effect of migration in population
CLO-5 to understand population growth and its effect
CLO-6 to understand the need of population study for a government

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

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

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KUMBAKONAM
DEPARTMENT OF STATISTICS
SYLLABUS FOR THE STUDENTS ADMITTED FROM 2023-2024
B.Sc STATISTICS PROGRAM

Title of the subject	**: Bio statistics (SEC-VII)**	**credits**	**: 2**
Subject code	**: 23U6SSEC7**	**marks**	**:75**
Semester	**: VI**		

Course Objective

- ✓ Initiate the awareness of Biostatistics and its need.
- ✓ Make the students have a clear understanding of special kinds ofvarious statistical tools used in biostatistics.
- ✓ 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 ofClinical 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 andtriple 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 – Testing model Adequacy.

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.

Book for Study:

1. Chow, S. C., and Liu, J. P. (2013). Design and Analysis of ClinicalTrials: 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.

Book for Reference

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://swayam.gov.in/nd1_noc20_bt28/preview]

2. Dr.Felix Bast, CentralUniversity of Punjab, Bathinda, 2020, "Biostatisticsand Mathematical Biology", (NPTEL). [https://swayam.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

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**	**PSO 9**
CLO 1	S	S	M	S	M	S	S	S	S
CLO 2	S	S	S	S	M	S	S	S	S
CLO 3	S	S	S	M	S	M	S	S	M
CLO 4	S	S	S	M	S	S	S	S	M
CLO 5	S	S	S	M	M	S	S	S	M
CLO 6	S	M	M	S	M	S	S	S	M

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