

**KUNTHAVAI NAACCHIYAAR GOVT ARTS COLLEGE (W)
AUTONOMOUS, THANJAVUR- 7**

An Autonomous College Affiliated To Bharathidasan University

Re – Accredited by Nacc with 'B' Grade

Thanjavur – 613 007. Tamil Nadu , India.



CBCS & OBE
Scheme of Instruction and Syllabus for
M.Sc., STATISTICS

(I to IV Semester)

Effective from 2022 - 2023 and onwards

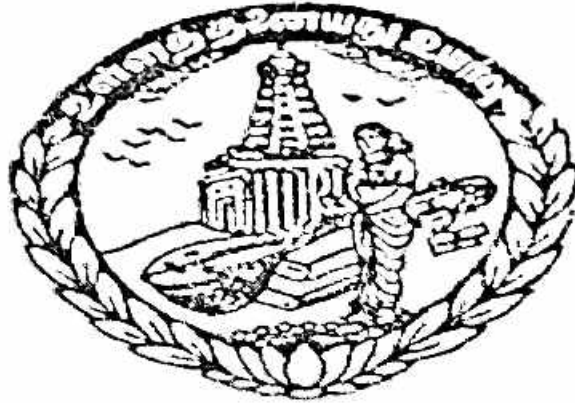
PG DEPARTMENT OF STATISTICS

**KUNTHAVAI NAACCHIYAAR GOVT ARTS COLLEGE (W)
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PG DEPARTMENT OF STATISTICS

IV. PROGRAMME STRUCTURE

									
Semester	Course	Subject Code	Title of the Paper	Inst. Hrs.	Credit	Exam. Hrs.	Marks		Total
							Int.	Ext.	
I	CC 1	22KP1S01	Distribution Theory	6	5	3	25	75	100
	CC 2	22KP1S02	Real Analysis and Matrix Theory	6	5	3	25	75	100
	CC 3	22KP1S03	Measure and probability Theory	6	5	3	25	75	100
	CC 4 (P)	22KP1S04P	Practical - I (programming in R)	6	4	3	40	60	100
	MBE 1	22KP1SELS1:1	Applied Regression Analysis	6	4	3	25	75	100
		22KP1SELS1:2	Inventory Model						
Total				30	23				500
II	CC 5	22KP2S05	Statistical Quality Control and Reliability	7	5	3	25	75	100
	CC 6	22KP2S06	Linear Model & Deign of Experiments	7	5	3	25	75	100
	CC 7	22KP2S07	Stochastic Processes	7	5	3	25	75	100
	CC 8 (P)	22KP2S08P	Practical -II(Matrix, SQCand Deign)	6	4	3	40	60	100
	NME-1	22KP2SEL01:1	Methods of Statistics - I	6	3	3	25	75	100
		22KP2SEL01:2	Vital Statistics						
	ECC1	22KP2ECCS1 :1	Advanced Quantitative Aptitude- I	-	3	3	-	-	100
		22KP2ECCS1 :2	MOOC (Value Added Course)						
ECC2	22KP2ECCS2	Data Analysis Using Statistical Packages (add on Course)		4					
Total				30	22				500
III	CC 9	22KP3S09	Statistical Estimation Theory	7	5	3	25	75	100
	CC 10	22KP3S10	Advanced Numerical Analysis	7	5	3	25	75	100
	CC11 (P)	22KP3S11P	Practical -III (Estimation and Numerical)	7	5	3	40	60	100
	MBE2	22KP3SELS2:1	Optimization Techniques	6	4	3	25	75	100
		22KP3SELS2:2	Computer Programming with C ++						
	NME --II	22KP3SEL02:1	Methods of Statistics - II	6	3	3	25	75	100
		22KP3SEL02:2	Survival Analysis						
ECC3	22KP3ECCS3: 1	Advanced Quantitative Aptitude - II	-	3	3	-	-	100	
	22KP3ECCS3: 2	MOOC (Value Added Course)							
Total				30	22				500
IV	CC 12	22KP4S12	Sampling Theory	6	5	3	25	75	100
	CC 13	22KP4S13	Testing of Statistical Hypothesis	6	5	3	25	75	100
	CC14 (P)	22KP4S14P	Practical -IV (Sampling and Testing of Statistical Hypothesis)	6	4	3	40	60	100
	MBE3	22KP4SELS3:1	Demography	6	4	3	25	75	100
		22KP4SELS3:2	Multivariate Statistical Analysis						
	Project Work	22KP4S15PW	PROJECT WORK	6	5			100	100
Total				30	23				500
Grand Total				120	90				2000

ECC - Extra Credit Course 1,2,3 : Total credits 10

V. ELECTIVES

M.Sc., STATISTICS - List of Elective Courses 2022-2023

Semester I	Major Based Elective I	Code
MBE1:1	Applied Regression Analysis	22KP1SELS1:1
MBE1:2	Inventory Model	22KP1SELS1:2
Semester III	Major Based Elective II	
MBE2:1	Optimizatin techniques	22KP3SELS2:1
MBE2:2	Computer programming with c++	22KP3SELS2:2
Semester IV	Major Based Elective III	
MBE3:1	Demography	22KP4SELS3:1
MBE3:2	Multivariate Statistical Analysis	22KP4SELS3:2

Add on Course: Semester II : Data Analysis Using Statistical Packages.

M.Sc Statistics – List of Non – Major Elective Courses 2022 – 2023

Semester II	Non -Major Based Elective I	Subject Code
NME 1	Methods of Statistics - I	22KP2SEL01:1
	Vital Statistics	22KP2SEL01:2
Semester III	Non- Major Based Elective II	Subject Code
NME 2	Methods of Statistics - I	22KP3SEL02:1
	Survival Analysis	22KP3SEL02:2

VI. Details on the number of courses, Instruction Hours and Credits

Course	Course Title	No.of courses	Inst. Hours	Credits
Part III	Core Course 14(Theory) & 1(Project)	15	97	71
Part III	Major Based Elective	03	19	15
Part IV	NME	02	04	04
	Total	20	120	90
	ECC 1,2,3	03	-	10

VII. SEMESTER – WISE COURSE STRUCTURE

Semester	Course	Total Courses	Inst.Hours/week	Credits
I	CC, MBE	5	30	23
II	CC, NME,ECC	7	30	22
III	CC, MBE,NME,ECC	6	30	22
IV	CC, MBE	5	30	23

SEM-I	CC1	DISTRIBUTION THEORY	22KP1S01	Inst.Hrs.6	Credits : 5
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Course Objectives:

1. To learn basic and advanced techniques in distributions and their properties, characteristics.
2. To present the general theory of statistical distributions as well as the standard distributions found in statistical practice.
3. Understanding through real-world statistical applications.

Course Outcomes:

CO	STATEMENT
1	Understand the most common discrete and continuous probability distributions and their real life applications.
2	Apply compound, Truncated, mixture and non-central probability distributions to solve problems.
3	Analysis marginal and conditional distributions from joint distributions.
4	Acumen to apply standard discrete probability distribution to different situations.
5	Get familiar with transformation of univariate and multivariate densities. Understanding of distribution helps to understand the nature of data and to perform appropriate analysis.

UNIT - I : DISCRETE DISTRIBUTIONS

Discrete distribution - Binomial, Poisson and Geometric distributions - Derivation of the distributions and their constants properties and problems.

UNIT - II : CONTINUOUS DISTRIBUTIONS

Continuous Distributions - Normal, Laplace, Exponential, Gamma ,Beta, Weibull and Cauchy distributions - Derivation of the distributions and their constants, properties and problems.

UNIT - III : BIVARIATE NORMAL DISTRIBUTIONS

Bivariate Normal distribution - Derivation of its Moment Generating Function, marginal and conditional distributions.

UNIT - IV : SAMPLING DISTRIBUTIONS

Students's -t, Chi-square and Snecdecor's F Distribution - Derivations of the distributions, properties and relationship between 't', F and Chi-square distributions.

UNIT - V : ORDER STATISTICS

Order Statistics: Distribution of smallest, largest, and r th order Statistics - Distribution of Range and median - Joint distribution of two order statistics and joint distribution of several order statistics.

UNIT -VI : APPLICATIONS

To learn basic and advanced techniques in distributions and their properties, characteristics. To present the general theory of statistical distributions as well as the standard distributions found in statistical practice. Understanding through real-world statistical application.

CO-PO MAPPING FOR DISTRIBUTION THEORY

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1	3			
CO2			2		
CO3	1		1		
CO4					1
CO5		2	2		

Text Book :

1. Gupta, S.C. & Kapoor, V.K. (1977) Fundamentals of Mathematical Statistics, SultanChand & Sons.

Reference Book:

1. Rohatgi. V.K., An Introduction to Probability theory and Mathematical Statistics. Wiley Eastern.
2. John and Kotz, Discrete distribution, John Wiley Publications New York.
3. John and Kotz, Continuous distribution, John Wiley Publications New York.

Dr. J. S. J. 2/13/20
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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM-I	CC2	REAL ANALYSIS AND MATRIX THEORY	22KP1S02	Inst.Hrs.6	Credits : 5
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Course Objectives:

1. The aim of the course is to introduce fundamental concept of real analysis such as sequence, series of real numbers and their convergence, continuity, differentiability of real valued functions.
2. To learn the basic ideas of abstract algebra and techniques with proof in pure mathematics and further, it can be use in many other courses.

Course Outcomes:

COs	STATEMENT
1	Understand abstract ideas and rigorous methods in mathematical analysis to solve practical problems.
2	Describe fundamental properties of the real numbers that lead to the formal development of real analysis.
3	Comprehend rigorous arguments developing the theory underpinning real analysis.
4	Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration. Construct rigorous mathematical proofs of basic results in real analysis.
5	Practiced the conditions for intergrability of a real valued function.

UNIT - I : FUNCTION AND SEQUENCES

Functions - Real valued function, Equivalence, countability, least upper bounds Sequence of real numbers - Definition, limit of a sequence, convergent sequence, divergent sequence, bounded sequence, monotone sequence, limit superior and limit inferior, Series of real numbers - convergence and divergence, series with non-negative terms, alternating series, conditional convergence and absolute convergence.

UNIT - II : CALCULUS

Calculus - Sets of Measure zero, Definition of the Riemann integral, existence of the Riemann integral, Derivatives, Rolle's Theorem, the law of the mean, Fundamental theorems of calculus, improper integrals.

UNIT - III : MATRIX

Rank of a matrix - elementary transformation of a matrix, Equivalent Matrices, Elementary matrices, Echelon matrix - Hermite Canonical form, Sylvester's law, Frobenius inequality, certain results on the rank of an Idempotent matrix.

UNIT - IV : EIGEN VALUES AND EIGEN VECTORS

Eigen values and Eigen Vectors - properties, Cayley - Hamilton theorem, application of Cayley-Hamilton theorem - simple problems.

UNIT - V : GENERALISED INVERSE OF MATRIX

Generalized inverse of a matrix: Definition, different classes of generalized inverse, Properties of G-inverse - classes properties - properties of Moore and Penrose - application of generalized inverse in the solution of system of linear equations. Quadratic forms - Definition, classification of the quadratic form, positive semi-definite quadratic form and Canonical reduction.

UNIT - VI : APPLICATIONS

To learn the basic ideas of abstract algebra and techniques with proof in pure mathematics and further, it can be use in many other courses.

CO-PO MAPPING FOR REAL ANALYSIS AND MATRIX THEORY

COs	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	2				1
CO2		3	3		
CO3		3			1
CO4				2	
CO5				1	1

Text Book :

1. Goldberg. R. (1963), Method of Real Analysis, Oxford & IBH publishers, New Delhi
2. Biswas.S(1996), A Text book of Matrix Algebra, New Age International Publishers, New Delhi.

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM I	CC3	MEASURE AND PROBABILITY THEORY	22KP1S03	Inst.Hrs.6	Credits : 4
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Course Objectives:

1. To impart knowledge in the measure and probability theory.
2. To develop skills and to acquire knowledge on basic concepts of Lebesgue Measure, the Lebesgue Integral, Measurable Functions, L^p - spaces, Minkowski inequalities, holder inequalities, Convergence and completeness.
3. To illustrate probabilistic pre-requisites are required for building statistical models.

Course Outcomes:

CO	STATEMENT
1	Knowledge and understanding: understanding basic concepts of measure and integration theory.
2	Application: measure theory is a part of the basic curriculum since it is crucial for understanding the theoretical basis of probability and statistics.
3	To learn how to analysis the measure and measurable functions, definition of random variable, distribution function and concepts of convergence of distribution.
4	Transferable skills: Ability to use abstract methods to solve problems. Ability to use a wide range of references and critical thinking.
5	Solve the problems based on WLLN, SLLN and CLT. Understanding of the characteristics functions and related results.

UNIT-I : EVENTS AND ALGEBRA OF SETS

Events; algebra of sets, Fields:-fields; Borel fields, Intersection and union of fields monotone fields and necessary properties- minimal monotone class.

UNIT-II : FUNCTIONS AND CONCEPTS OF RANDOM VARIABLES

Function, inverse function, measurable function, borel function, induced- field, indicator functions, elementary function, concept of random variable, Borel function of a vector random variable, Limits of random variables, continuity property of probability space, Caratheodory extension theorem (Statement only), induced probability space, probability as a measure.

UNIT-III : DISTRIBUTION FUNCTION

Distribution function, Properties, Jordan decomposition theorem, distribution function of a random vector, Marginal and conditional distributions, correspondence theorem (Statement

only) empirical distribution function, Expectation properties- Cramer Rao-inequality, Holder's inequality, Cauchy Schwartz's inequality, Minkowski inequality, Jensen's inequality, Basic inequality.

UNIT-IV : CONVERGENCE OF RANDOM VARIABLES

Convergence of random variables. Types of convergence: Monotone Convergence theorem, Dominated Convergence theorem, Characteristic function, properties, some inequalities on Characteristic functions, inversion theorem and simple problems.

UNIT-V : LAW OF LARGE NUMBERS

Limit theorems, Law of large numbers, weak law of large numbers, Bernoulli, Poisson and Khinchine's law of large numbers; Strong law of large numbers, Levy-Cramer theorem, Central limit theorem, De-Moivre-Laplace, Liapounov's, Lindingberg-Levy theorems. Statement of Lindberg-Feller theorem.

UNIT-VI : APPLICATIONS

To impart knowledge in the measure and probability theory. To develop skills and to acquire knowledge on basic concepts of Lebesgue Measure, The Lebesgue Integral, Measurable Functions, L^p - spaces, Minkowski inequalities, Holder inequalities, Convergence and completeness. To illustrate probabilistic pre-requisites are required for building statistical models.

CO-PO MAPPING FOR MEASURE AND PROBABILITY THEORY

COs	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	2	1			3
CO2	1	1	3		
CO3		2			3
CO4	1				
CO5		3			

Text Books Reference:

1. B.R.Bhat(1999)-Modern probability theory - New Age International(P) limited Publishers.
2. Mark Fisz-Probability theory and mathematical statistics.

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM I	CC 4(P)	PRACTICAL - I (Programming in R)	22KP1S04P	Ins.Hrs.6	Credits: 4
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Course Objectives:

To train students in R Software

Course Outcome:

CO	STATEMENT
1	Understand basics of R environment.
2	Able to work with R packages and their installation
3	Demonstrate exploratory data analysis (EDA) for a given data set.
4	Implement and assess relevance and effectiveness of machine learning algorithms for a given dataset.
5	To provide the programming skills using job oriented concept in R program.

LIST OF TOPICS:

DIAGRAMMATIC AND GRAPHICAL REPRESENTATION:

1. Simple Bar Diagram
2. Multiple Bar Diagram
3. Line Diagram
4. Pie Diagram
5. Histogram and Frequency Curve
6. Box Plot
7. Scatter Diagram

Frequency Distribution table

MEASURES OF CENTRAL TENDENCY:

1. Arithmetic Mean
2. Median
3. Mode
4. Geometric Mean
5. Harmonic Mean

MEASURES OF DISPERSION:

1. Range
2. Quartile Deviation
3. Mean Deviation
4. Standard Deviation

MEASURES OF SKEWNESS AND KURTOSIS

CORRELATION AND REGRESSION:

1. Karl Pearson Coefficient of Correlation
2. Spearman's Rank Correlation
3. Simple Linear Regression
4. Multiple Regression

TESTING OF HYPOTHESIS:

1. One Sample t test
2. Independent t test
3. Paired t test
4. Analysis of Variance - One way Classification
5. Analysis of Variance - Two way Classification
6. Chi Square Test : Independence of Attributes
7. Chi Square Test: Goodness of Fit

CO-PO MAPPING FOR PRACTICAL - I (Programming in R)

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1				2
CO2		2		1	
CO3	1		2		
CO4	1			2	
CO5		1			1

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM I	MBE I:1	APPLIED REGRESSION ANALYSIS	22KPISELS1:1	Ins.IIrs.6	Credits: 35
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Course objectives:

1. To develops a deeper understanding of the linear and non-linear regression model and its limitations.
2. To learn how to develop regression model and apply for the specific perspective data appropriate manner.
3. To understand the practical applications of the various regression models and Time series.
4. In this course, students will learn the use of different useful tools used in regression analysis. They will learn about simple and multiple linear regression, non-linear regression and Generalise linear models (GLM) including logistic regression.

Course Outcomes:

CO	Statements
1	Understand multiple linear regression models with applications and concept of Multicollinearity and autocorrelation.
2	Apply Logistic and Non-linear regression models and its implementation in real life situation.
3	Compute multiple and partial correlation and checking residual diagnostic to validate model.
4	Apply simple linear regression model to real life examples.
5	Develop a deeper understanding of the linear regression model. Differentiate between linear and non-linear regression and how to apply them in real life situations.

UNIT - I : LINEAR REGRESSION MODEL

Simple Linear Regression Model – Least Squares Estimation of the Parameters and Properties Hypothesis Testing on the Slope and Intercept Estimation by Maximum Likelihood – Interval Estimation in Simple Linear Regression Co- efficient.

UNIT – II: MULTIPLE REGRESSION MODEL

Multiple Regression Models – Estimation of the Model Parameters and Properties – Confidence Interval in Multiple Regression – Hypothesis Testing in Multiple Linear Regression.

UNIT – III: REGRESSION ESTIMATION

Generalized and Weighted Least Squares –Robust Regression Estimation – Relationship between Analysis of Variances Generalized Linear Models – Non Linear Regression Model.

UNIT - IV : MULTICOLLINEARITY

Multicollinearity Sources of Multicollinearity - Effects of Multicollinearity - Methods for Dealing with Multicollinearity.

UNIT - V : MODEL ADEQUENCY CHECKING

Model Adequency Checking - Introduction Residual analysis; Definition Residual; Residual plots; Partial Regression and Partial regression plots.

UNIT - VI: APPLICATIONS

Regression analysis is the most common statistical modeling approach used in data analysis and it is the basis for advanced statistical modeling.

CO-PO MAPPING FOR REGRESSION ANALYSIS AND TIME SERIES

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1	2			2
CO2		1	2		
CO3	1		2		
CO4	1			2	
CO5	2			1	

Text Book:

Douglas C. Montgomery and Elizabeth A. Peck - Introduction to Linear Regression Analysis - John Wiley & Sons, New York.

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEMI	MBE1:2	INVENTORY MODELS	22KP1SELS1:2	Inst.Hrs.6	Credits :5
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Course Objectives:

1. To ensure a continuous supply of materials and stock so that production should not suffer at time of customers demand.
2. To avoid both over stocking and under - stocking of inventories.

Course Outcomes:

CO	STATEMENT
1	Understand the methods used by organisation to obtain the right quantities of stock or inventory.
2	The stochastic models possess some inherent randomness.
3	The output of the model is fully determined by the parameter values and initial conditions.
4	The same set of parameter values and initial conditions will lead to an ensemble of different outputs.
5	Case study requires student's comprehension of inventory management and emphasizes supply chain management applications.

UNIT-I: INVENTORY MODELS

Inventory models - definition - general inventory model - Role of demand in the development of Inventory models.

UNIT-II: STATIC ECONOMIC ORDER QUANTITY

Static economic order quantity -EOQ problems - with one price breaks - simple problems.

UNIT-III: MULTI ITEMS DETERMINISTIC MODELS

Multi items deterministic problems - limitations of inventories - limitations of storage area.

UNIT-IV: DYNAMIC EOQ MODELS

Dynamic EOQ models - set of EOQ model - General dynamic programming algorithm - Programming algorithm with constant or decreasing marginal cost - silver meal heuristic.

UNIT-V : PURCHASE INVENTORY MODEL

Purchase Inventory model with n price break multi item deterministic model - No set of EOQ model.

UNIT-VI : APPLICATIONS

To ensure a continuous supply of materials and stock so that production should not suffer at time of customers demand

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM II	CC5	STATISTICAL QUALITY CONTROL AND RELIABILITY	22KP2S05	Ins.Hrs. 7	Credits: 5
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Course Objectives:

1. To develops a deeper understanding of the linear and non-linear regression model and its limitations.
2. To learn how to develop regression model and apply for the specific perspective data appropriate manner.
3. To understand the practical applications of the various regression models and Time series.
4. Regression analysis is the most common statistical modeling approach used in data analysis and it is the basis for advanced statistical modeling.
5. In this course, students will learn the use of different useful tools used in regression analysis. They will learn about simple and multiple linear regression, non-linear regression and Generalize linear models (GLM) including logistic regression.

Course Outcomes:

CO	STATEMENTS
1	Understand basic of production process monitoring and apply concept of control charts on it.
2	Apply the acceptance and continuous sampling plans in production process.
3	Compute capability indices.
4	Know and apply the concept of weighted control charts, six sigma, ISO: 2000 series standards and designs.
5	Effectively interpret the results from the control charts

UNIT I: THE CONCEPT OF STATISTICAL QUALITY

Quality: Quality of Design - Quality of Conformance - Quality Assurance - Quality System - Quality management - Quality Policy - Quality Objectives - Quality Control - Quality Audit - Statistical Process Control(SPC): Chance and assignable causes of quality variation - Statistical basis of the control chart - Quality improvement tools - Implementing SPC - Control charts \bar{x} , R, p, np, c, and u (fixed and variable sampling sizes).

UNIT II: DIFFERENT TYPES OF TYPES CONTROL CHARTS

The Cumulative Sum control chart - Modified and Acceptance control charts - Group control charts - ARL procedures - Process Capability analysis - Introduction - DCA using Histogram, control chart and design of experiments - process capability ratios - estimating the natural tolerance limits of process.

UNIT III: ACCEPTANCE SAMPLING PLANS AND CURVE

Acceptance sampling: sampling inspection versus cent percent inspection - OC curve design of single, double, multi sequential sampling plans - attributes - Explanation of AOQL, ATI, ASN - use of sampling tables IS2500 part 1.

UNIT IV: THE CONCEPT OF RELIABILITY

Concepts of reliability, maintainability and availability - reliability of series and parallel systems and others simple configurations, survival models (exponential), weibull, Lognormal, Rayleigh and bath-tub, different types of redundancy and use of redundancies in reliability improvement.

UNIT V: THE EVALUATION OF SOFTWARE PROCESS AND DEVELOPMENT

Evaluation of software products - Quality Assurance in software development - software process maturity - five levels as per CMM - key process area - software quality assurance plan - Quality reviews and audits - reporting.

UNIT VI: APPLICATIONS

To develop scientific view to analyze the industrial data about specific perspective. To learn the statistical quality control techniques used in industries such as control charts, acceptance sampling plans etc.

CO-PO MAPPING FOR STATISTICAL QUALITY CONTROL

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1		2		
CO2		1			1
CO3	2				
CO4		1		2	
CO5		2			

Text Books:

Montgomery, D.C (1985) Introduction to Statistical Control, John Wiley and Sons.

Reference of Books:

Sinha, S.K (1979), Reliability and life-testing, Wiley Eastern, New Delhi.

S. K. Sinha
2/1/2020
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SEM II	CC6	LINEAR MODEL AND DESIGN OF EXPERIMENTS	22KP2S06	Ins.Hrs. 7	Credits: 5
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Course Objectives:

1. To learn the basic principles in the design of simple experiments.
2. To learn different tests for comparing pairs of treatment means, ANCOVA, factorial experiments, fractional factorial experiments, confounding, BIBD, PBIBD with solving real life examples.
3. To learn the applications of different designs in agriculture.
4. The course includes a review of the modest probability and statistics background necessary for conducting and analyzing scientific experimentation.

Course Outcomes

CO	STATEMENT
1	Describe how to design experiments, carry them out, and analyze the data they yield
2	Examine how a factorial design allows cost reduction, increases efficiency of experimentation, and reveals the essential nature of a process; and discuss its advantages to those who conduct the experiments as well as those to whom the results are reported.
3	Construct fractional factorial experiments and apply confounding in real life problems.
4	Evaluate the analysis of BIBD, PBIBD, Latin square, Youden square and cross over design and their applications in agriculture, business and industries.
5	To apply various designs for agricultural data/agricultural field

UNIT I : LINEAR MODELS

Linear Models: Definition - Functionally Related Models - Mean Related Model - Regression Model - Experimental Design Model - Components of Variance Model - Point Estimation - Estimation of β and σ^2 under normal theory - Gauss Mark off theorem.

UNIT II : RBD AND LSD

RBD - Missing observations in RBD - Analysis of RBD with one and two missing values - Analysis of LSD with one and two missing values - Orthogonal Latin Squares - Graeco LSD.

UNIT III : FACTORIAL EXPERIMENT

Factorial Experiment: Main effects, Interaction effects, Orthogonal, Contrasts- Designs for 2ⁿ, 3ⁿ experiments. Total and Partial confounding in 2³ experiments - Analysis of Split Plot Design.

UNIT IV : INCOMPLETE BLOCK DESIGN

Incomplete Block Design - Balanced Incomplete Block Design - Relationship between the parameters. Constructions of BIBD - Recovery of Inter Block Information - Resolvable Designs.

UNIT V : ANALYSIS OF PBIBD

Analysis of PBIBD - Two Associate classes and Response surface design.

UNIT VI : APPLICATIONS

To learn the basic principles in the design of simple experiments. To learn different tests for comparing pairs of treatment means, ANCOVA, factorial experiments, fractional factorial experiments, confounding, BIBD, PBIBD with solving real life examples.

CO-PO MAPPING FOR LINEAR MODEL AND DESIGN OF EXPERIMENT

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1	1	-	2	-
CO2	-	-	1	2	-
CO3	1	2	-	-	-
CO4	-	-	-	1	2
CO5	-	1	2	2	-

(High correlation -3, Moderate correlation-2, No correlation-(-)).

TEXT BOOKS:

1. Montgomery() ,Design & Analysis of Experiments,
2. Das, M.N. and Giri, N.C,(1997), Design and analysis of experiments, Wiley Eastern Ltd., New Delhi.

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM II	CC7	STOCHASTIC PROCESSES	22KP2S07	Ins.Hrs. 7	Credits: 5
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Course Objectives:

1. To learn and to understand stochastic processes predictive approach.
2. To develop an ability to analyze and apply some basic stochastic processes for solving real life situations.
3. This paper deals with theoretical and applications of stochastic processes. The concept of Markov chain, stationery probability distribution, birth process, Poisson process, Renewal processes - renewal function are covered in detail.

Course Outcome

CO	STATEMENT
1	Understand the stochastic processes, Markov chains, Transition probability matrix and various types of states.
2	Explain Random walk, Gambler ruins problem and apply Poisson process in real life situations.
3	Skills. The student is able to formulate simple stochastic process models in the time domain and provide qualitative and quantitative analyses of such models. Formulate and solve problems which involve setting up stochastic models.
4	Understand renewal theory and branching processes with applications. Also Stochastic process to developing in time according to Markov chains, Poisson process, the vital process and queues.
5	Solve differential equations for distributions and expectations in time continuous processes and determine corresponding limit distributions.

Unit - I

Stochastic Processes: Definition and examples: Classification of Stochastic Processes.

Markov Chains - Definition and examples: one and two dimensional random walk; Transition probabilities; Classification of States and chains.

Unit - II

Basic limit theorems of Markov Chains, determination of higher transition probabilities.

Stability of a Markov system- limiting behavior : finite irreducible chain, computation of the stationary probabilities - simple problems.

Unit - III

Continuous time Markov Chains - Poisson Process - its derivation and properties. Pure

birth processes : Yule furry process. Birth and death processes.

Unit - IV

Renewal processes - renewal function, renewal equation, stopping time : Wald's equation, renewal theorems. Branching process - generating function relation, mean and variance of generations.

Unit - V

Queuing processes - general description of M/M/I models with finite and infinite Capacities, Waiting time and busy period for both steady state and transient state behavior. Birth and Death processes in queuing theory. Multi-channel model of M/M/S. Non-Markovian Queues model (concept only).

Unit - V I APPLICATIONS

To learn the basic principles in the stochastic processes.

CO-PO MAPPING FOR STOCHASTIC PROCESSES

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1	1	-	2	-
CO2	-	-	1	2	-
CO3	1	2	-	-	-
CO4	-	-	-	1	2
CO5	-	1	2	2	-

(High correlation -3, Moderate correlation-2, No correlation-(-)).

Book for study :

Medhi. J. (2010), Stochastic Processes, New age international (p) limited publishers, NewDelhi.

Books for Reference:

1. Karlin, S. and Taylor. H.W (1975), A First Course in Stochastic Processes, Academic Press, 2nd Edn.
2. Karlin S. and Taylor. H.W (1979), A Second course in Stochastic Processes, Academic Press.
3. Basu A.K(2007), Introduction to Stochastic Processes, Narosa Publishing.
4. Srinivasan, S.K. (1976), Introduction to Stochastic processes and their Applications, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
5. Applications, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM II	CC8(P)	PRACTICAL -II (SQC,DEIGN,MATRIX)	22KP2S08P	Ins.Hrs.7	Credits:5
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Course Objectives:

To carried out and practiced in field of the industrial area and population studies.

Course Outcomes:

CO	STATEMENT
1	Apply different designs in real life situations.
2	Hands on experience in implementation of concepts in Statistical Inference, Multivariate Analysis and Linear Model and Design of Experiments.
3	Understand and use the terminology of experimental designs.
4	Enables to solve suitable problems of LPP and implement practical cases of decision making under different environments.
5	Hands on experience in implementation of concepts in Statistical Inference, Linear Regression analysis and Operations Research.

UNIT I : CONTROL CHARTS

Control Charts for \bar{X} charts, R- charts, np-charts, U-chart, Acceptance sampling plan- Attributes (OC,AOQ,ASN : single and double sampling), Sequential sampling plans- Moving average range charts, O.C. Curves for control charts.

UNIT II : SPECIAL CONTROL CHART

Group control chart, moving average and moving range control chart, single double sampling plan for attributes ,variable sampling plan.

UNIT III : ANALYSIS OF RBD AND LSD

Analysis of RBD with one two missing values, Analysis of LSD with one and two missing values

UNIT IV : RANK OF A MATRIX

Rank of a matrix – elementary transformation of a matrix, Equivalent Matrices, Elementary matrices, Echelon matrix – Hermite Canonical form, sylvester's law, Frobenius inequality, certain results on the rank of an Idempotent matrix.

UNIT V : EIGEN VALUES AND EIGEN VECTORS

Eigen values and Eigen Vectors – properties, Cayley – Hamilton theorem, application of Cayley-Hamilton theorem – simple problems.

UNIT VI : APPLICATIONS

Practiced into the help of decision making the statistical data based on the statistical inference, multivariate analysis and design of experiment techniques.This course is based on both Based on SQC, Design, Matrix and will provide practical knowledge o the students on various topics elaborated in these two courses so that they can apply the relevant concepts to real life problems.

CO-PO MAPPING FOR PRACTICAL - II (SQC,DEIGN,OR)

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	1	-
CO2	1	-	-	2	-
CO3	-	1	-	2	-
CO4	1	-	-	1	2
CO5	-	-	1	2	-

BOOKS FOR STUDY :

1. Douglas C.Montgomery- Introduction to statistical quality control, John Wiley 3rd edn. 1996.
2. Hamdy A.Taha, An Introduction to Operation Research, Prentice Hall of India, NewDelhi.

SEM II	NME 1	METHODS OF STATISTICS - I	22KP2SEL01:1	Inst.Hrs:2	Credit:2
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Course objectives

1. The course aims to introduce the basic concepts in statistics.
2. Learning the preliminary tools and concepts (diagrams and graphs)
3. To make the students aware of different type of data sets .

Course outcomes:

Cos	Statements
CO 1	Knowledge of Statistics scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc.
CO2	Describe the basic concepts in sample surveys and data.
CO3	Evaluate the diagrammatic representation
CO4	Draw the graph based on the data
CO5	Analyze data from surveys using various sampling plans .Use appropriate method of sampling.

Unit – I: CLASSIFICATION & TABULATION

Definition of Statistics – Characteristics, Uses in business and limitations of statistics.

Classification- Types – Tabulation – different parts of Table and Types.

Text Book 1 Chapter:6

Unit – II: COLLECTION OF DATA

Collection of data - Definition of primary and secondary data – methods of collecting primary data and secondary data. **Text Book 1 Chapter:4**

Unit – III: PRESENTATION OF DATA

Diagrams – Definition and uses – Types of diagrams – simple bar, sub-divided, multiple bar diagrams and pie diagram- Simple Problems. **Text Book 1 Chapter:7**

Unit – IV: GRAPHS

Graphs – Definition and uses, difference between diagrams and graphs. Types of graphs – Histogram, frequency polygon and frequency curve - Simple Problems. **Text Book 1 Chapter:8**

Unit – V: SAMPLING TECHNIQUES

Sampling – Definition of population, Sample, parameter, statistic. Difference between census and sampling – Merits and demerits of sampling. Methods of sampling – Simple Random Sampling – Stratified and Systematic sampling. **Text Book 1 Chapter:5**

Unit – VI: APPLICATIONS

To construct the frequency table. Analyze the central tendency dispersion of the data.
Describe the differences between variables. Generate the regression equations.

Text Book

1. Statistics – R.S.N. Pillai & V. Bagavathi
2. Statistical Methods – S.P. Gupta

CO-PO Mapping for Statistical Methods

Cos	Pos					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	-	-	-	-
CO2	-	1	1	-	-	1
CO3	-	-	-	1	-	-
CO4	-	-	-	1	-	-
CO5	1	-	-	-	-	1

High correlation –(3), Moderate correlation-(2), No correlation-(-)

Kunthavai Naacchiyaar Govt. Arts College (W) Autonomous, Thanjavur

SEM - II	NME-1	VITAL STATISTICS	22KP2SEL01:2	Hours: 2	Credits: 2
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Course Objective:

The course aims to study the applications of Statistics in the field of Health statistics.

Course outcomes:

Cos	Statements
CO1	Enumerate the source of vital statistics
CO2	Calculate basic measures to evaluate vital Statistics
CO3	Determine fertility and mortality rates.
CO4	Derive information from the life tables.
CO5	Extract information from the life tables.

Unit – I : DEMOGRAPHY DEFINITION

Demography – definition, sources of demographic data – Population Census – Demography surveys – Registration method: vital registration – Population register and other administrative records, registrar. **Text Book :2 Chapter :16**

Unit – II: MEASUREMENT OF MORTALITY

Measurement of mortality: Crude death rate – Specific death rate – Age specific death rate – Infant mortality rate – Standardized death rate – Direct method of standardization – Indirect method of standardization – Simple problems. **Text Book :2 Chapter :16**

Unit – III :MEASURE OF FERTILIDY

Measure of fertility: Crude birth rate – General fertility rate – Specific fertility rate – Age specific fertility rate – Total fertility rate – Simple problems.

Text Book :2 Chapter :16

Unit – IV: PROBLEMS IN DEMOGRAPHY

Gross reproduction rate – Net reproduction rate – Simple problems.

Text Book :2 Chapter :16

Unit – V: USES OF LIFE TABLES

Life tables – Uses of life tables – Curate expectation of life and complete expectation of life – Central mortality – Description of a life table – Construction of a life table – Simple problems .**Text Book :2 Chapter :16**

Unit – VI: APPLICATIONS

Calculate basic measures to evaluate vital Statistics

Text Books:

D. C. Sancheti&V.K.Kapoor: Statistics

S.P. Gupta: Statistical Methods.

CO-PO Mapping for DEMOGRAPHIC METHODS

Cos	Pos					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	-	-	-
CO2	-	-	1	-	-	2
CO3	-	-	2	-	-	2
CO4	-	-	-	-	2	1
CO5	-	-	-	-	-	2

High correlation - (3), Moderate correlation- (2), No correlation-(-).

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM II	ECC1	ADVANCED QUANTITATIVE APTITUDE - I	22KP2ECCS1:1	Ins.Hrs.	Credits: 3
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UNIT : I

Profit and Loss - Partnership - Chain Rule - Ratio and Proportion .

UNIT : II

Boats and Streams

UNIT : III

Calendar, Clock, Odd man out and series.

UNIT : IV

Data Interpretation- Tabulation.

UNIT : V

Pie-Chart.

Books for Reference:

1. QUANTITATIVE APTITUDE - Dr.R.S.Aggarwal

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR-7

SEM III	CC 9	STATISTICAL ESTIMATION THEORY	22KP3S09	Ins.Hrs. 7	Credits: 5
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Course Objectives:

1. The course aims to introduce the concept of Bayesian inference, concept of loss functions, risk function.
2. prior and posterior distribution and their application in various real fields.

Course Outcomes:

CO	Statements
1	Understand the concepts of prior and posterior distributions
2	Be able to differentiate between classical and Bayesian inference.
3	Applications of various loss and risk functions.
4	Be able to apply the concept of Bayesian inference in different fields of applications.
5	Develop the Bayesian frame work for data analysis and its flexibility and be able to demonstrate.

UNIT – I : POINT ESTIMATION

Point Estimation – properties of estimators. Consistency and efficiency of an estimator. Sufficiency of a statistic. Simple problem.

UNIT – II : PROPERTIES OF ESTIMATION

Unbiasedness – properties, minimum variance unbiased estimators, Rao – Blackwell theorem. Sufficiency and completeness, Lehman – Scheffe’s Theorem, Cramer –Rao Inequality – Simple problems.

UNIT – III : METHODS OF ESTIMATION

Methods of Estimation: Maximum Likelihood Estimation method – Asymptotic properties of MLE. Simple problems.

UNIT – IV : INTERVAL ESTIMATION

Interval Estimation – confidence level and confidence co-efficient, Confidence interval for proportion, difference between proportions, single mean and difference proportions – simple problems.

UNIT – V : CONSTRUCTION OF CONFIDENCE INTERVALS

Construction of Confidence intervals for variance based on chi square, Student’s-t, and F distributions. Simple problems.

UNIT – VI : APPLICATIONS

The course aims to introduce the concept of Bayesian inference, concept of loss functions, risk function, prior and posterior distribution and their application in various real fields.

CO-PO MAPPING FOR ESTIMATION THEORY

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1	2			
CO2	2		1		
CO3	1			1	
CO4		1		2	
CO5		2			1

(High correlation -3, Moderate correlation-2), No correlation-(-).

Text Books:

1. Rohatgi.V.L."An introduction to probability theory and Mathematical Statistics", Wiley Eastern limited.
2. Gupta.S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons.

Book for Reference:

C. Radhakrishna Rao, "Linear Statistics Inference and its Applications", Wiley Eastern limited.

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SEM III	CC10	ADVANCED NUMERICAL ANALYSIS	22KP3S10	Ins.Hrs.7	Credits: 4
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Course Objectives:

The aim of this course is to teach the applications of various numerical techniques for a variety of problems occurring in daily life. At the end of the course, the students will be able to understand the concepts in Numerical Analysis of differential equations.

COURSE OUTCOMES (COs)

1. *Solve* an algebraic or transcendental equation using an appropriate numerical method.
2. *Demonstrate* various numerical techniques such as interpolation and cubic splines.
3. *Evaluate* a derivative at a value and calculate a definite integral using an appropriate numerical technique.
4. *Apply* different techniques to solve the ordinary differential equations
5. *Use* numerical techniques to solve heat and wave differential equations

UNIT-I ERROR ANALYSIS AND NUMERICAL SOLUTIONS OF ALGEBRAIC EQUATIONS

Definition and sources of errors, Propagation of errors, Sensitivity and conditioning, Stability and accuracy, Floating-point arithmetic and rounding errors. Bisection method. Fixed-point iteration, Newton's method, Secant method, Convergence and order of convergence

UNIT-II LINEAR SYSTEMS OF EQUATIONS

Gauss Elimination, Gauss-Jordan method, LU decomposition, Gauss Jacobi method, Gauss-Seidel iteration method.

UNIT-III INTERPOLATION

Polynomial Interpolation: Interpolating polynomial, Lagrange and Newton divided difference interpolation, Error in interpolation, Finite difference formulas, Hermite Interpolation. Spline and Approximation: Cubic Spline.

UNIT-IV NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation with finite differences, Newton's forward formula, Newton's backward formula - Numerical integration: Trapezoidal rule, Simpson's 1/3 - rule, Simpson's 3/8 rule, Error estimates for Trapezoidal rule and Simpson's rule, Gauss quadrature formulas.

UNIT-V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Solution by Taylor series, Picard Method of successive approximations, Euler's Method, Modified Euler Method, Runge-Kutta Methods. Finite difference method for boundary value problems.

Mapping of Course Outcomes with Program outcomes (POs)

1	COs/Pos	PO1	PO2	PO3	PO4	PO5
2	CO1	3	3	1	1	1
	CO2	3	3	1	2	2
	CO3	3	2	3	1	3
	CO4	3	2	2	1	1
	CO5	2	2	2	1	1
	CO6	3	3	3	2	3

TEXT BOOKS:

1. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Edition, New Age International, New Delhi, 2015.
2. R.L. Burden and J. D. Faires, Numerical Analysis, 9th Edition, Cengage Learning, 2011.
3. S. S. Sastry, Introductory Methods of Numerical Analysis, 4th Edition, PHI, 2015.

REFERENCE BOOKS:

1. C. F. Gerald and P. O. Wheatly, Applied Numerical Analysis, 7th Edition, Pearson LPE, 2009.
2. R. S. Gupta, Elements of Numerical Analysis, Cambridge University Press, 2nd Edition, 2015.
3. K. Atkinson, An Introduction to Numerical Analysis, John Wiley & Sons, 2nd Edition, 1989.

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM III	CC11(P)	PRACTICAL - III (Estimation and Numerical)	22KP3S11P	Ins.Hrs.7	Credits:5
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Course Objectives:

Practiced into the sampling methods and distribution techniques based on relevant data. This course is based on both Based on CC IX and CC XI and will provide practical knowledge to the students on various topics elaborated in these two courses so that they can apply the relevant concepts to real life problems.

Course Outcomes:

CO	STATEMENT
1	Estimate the parameter of a distribution from sample and give conclusions.
2	Hands on experience in implementation of concepts in Measure and Probability theory.
3	Analyse and Solve the problems related to distribution function.
4	Apply regression analysis technique real life problems.
5	Practice and Implement various sampling methods, Ratio and Regression estimation in real life problems.

UNIT-I : POINT ESTIMATION

Point Estimation-MLE of Exponential Distribution, Normal distribution, Multinomial distribution, Method of chi square Estimation.

UNIT-II : INTERVAL ESTIMATION

Interval Estimation- Confidence interval for single proportion, difference between proportions, single mean and difference between proportions.

UNIT-III : CONSTRUCTION OF CONFIDENCE INTERVALS

Construction of confidence intervals for variance based on chi-square, student's t, f distributions

UNIT- IV : Numerical Differentiation:

Numerical differentiation with finite differences, Newton's forward formula, Newton's backward formula - Numerical integration.

UNIT- V : TRAPEZOIDAL RULE:

Trapezoidal rule, Simpson's 1/3 - rule, Simpson's 3/8 rule, Error estimates for Trapezoidal rule and Simpson's rule, Gauss quadrature formulas.

CO-PO MAPPING FOR PRACTICAL - III (ESTIMATION THEORY, SAMPLING)

COs	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1		2		
CO2	2	1			
CO3		2		1	
CO4	1		1		
CO5		1			1

(High correlation -3, Moderate correlation-2), No correlation-(-).

Text Books:

1. Rohatgi.V.L" An introduction to probability theory and Mathematical Statistics", Wiley Eastern limited.
2. Cochran, W.G. (1994) - Sampling Techniques, Wiley Easter Lt
3. Lehmann.E.L, Testing of Statistical Hypothesis, John Wiley.

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEMII	MBE2	OPTIMIZATION TECHNIQUES	22KP3SELS2:1	Ins.Hrs.7	Credits: 5
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Course Objectives:

1. To develop the optimization techniques that will be useful in the personal and professional life.
2. To learn the mathematical formulation of complex decision-making problems and arrives at optimal or near-optimal solutions using different techniques of operations research.
3. To impact knowledge in concepts and tools of operations research.
4. To understand mathematical models used in operations research.
5. To apply these techniques constructively to make effective business decisions.

Course Outcomes:

CO	STATEMENT
1	Understand basics and formulation of linear programming problems and appreciate their limitations; solve linear programming problems using graphical method.
2	Gain knowledge about sequencing problems, travelling salesman problem and various methods to solve sequencing problems.
3	Analyse and Solve artificial variable technique, duality theory, revised simplex method, sensitivity analysis, transportation and assignment problems.
4	Evaluate and apply simplex method to solve real life problems
5	Be able to build and solve Game theory, PERT/ CPM, simulation, investment analysis with real life applications.

UNIT I : LINEAR PROGRAMMING PROBLEM

Linear Programming Problem(LPP) - Graphical Method, Simplex Method ,Two-Phase Simplex, Duality in Linear Programming, Dual simplex method and revised Simplex method.

UNIT II : NON-LINEAR PROGRAMMING PROBLEM

Non-Linear Programming Problem(NLPP) - Formulating a Non-Linear Programming Problem, Kuhn- Tucker conditions with Non-Negative Constraints. Quadratic Programming - Wolfe's Modified Simplex Method and Beale's method.

UNIT III : INTEGER PROGRAMMING

Integer Programming - Gomory's fractional cut method for all integer, fractional cut method for mixed integer and Branch and Bound method.

UNIT IV : INVENTORY CONTROL

Inventory control - deterministic Inventory problems with no shortages and with shortages. Project Scheduling by PERT and CPM - Network, Critical path method and PERT.

UNIT V : DYNAMIC PROGRAMMING

Dynamic Programming-Recursive equation-Characteristics of Dynamic Programming-
Dynamic Programming Algorithm-Solution of Discrete D.P.P.-Some Applications-Solution of
L.P.P. by Dynamic Programming.

UNIT VI : APPLICATIONS

To develop the optimization techniques that will be useful in the personal and professional life. To learn the mathematical formulation of complex decision-making problems and arrives at optimal or near-optimal solutions using different techniques of operations research.

CO-PO MAPPING FOR ADVANCED OPERATION RESEARCH

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1	-		1	-
CO2	1	2	1	-	-
CO3	1	-	-	1	-
CO4	1	-	-	-	-
CO5	1	-	-	2-	-

(High correlation -3, Moderate correlation-2), No correlation(-).

TEXT BOOK:

Kanti Swarup, P.K. Gupta and Man Mohan, Operation Research, Sultan and Chand, New Delhi.

BOOKS FOR REFERENCE:

1. Hamdy A.Taha, An Introduction to Operation Research, Prentice Hall of India, New Delhi.
2. Ravindran.A, Don.T.Philips and James J.Solberg, Operation Research Principles and Practice, John Wiley & Sons.
3. Pannerselvam.R, Operation research, prentice Hall of India, New Delhi.
4. Prem Kumar Gupta, Hira.D.S, Operation Research, S.Chand & Company Ltd, New Delhi.

KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM-IV	MBE5:2	OFFICIAL STATISTICS	22KP2SELS5:2	Inst.Hrs.6	Credits : 4
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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM IV	MBE2	COMPUTER PROGRAMMING WITH C++	22KP39ELS2:2	Ins.Hrs.7	Credits: 5
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Course Objectives:

1. Write clear, elementary C++ programs.
2. Understand algorithmic thinking and apply it to programming.
3. Understand problem-solving techniques.

Course Outcomes:

CO	Statements
1	Understand and trace the execution of programs written in C ++ language.
2	Arm the students with the basic programming concepts.
3	Introduce different techniques pertaining problem solving skills
4	Arm the students with the necessary constructs of C++ programming.
5	To emphasis on guided practical sessions

UNIT -I : INTRODUCTION OF C ++

Introduction of C ++ : - Application of C ++ - A simple C ++ Program - More C ++ statements - Structure of C ++ Program. Tokens, Expressions and Control Structures:-Identifiers and Constants- Basic Data Types-User-Defined Data Types-Derived Data Types-Declaration of Variables- Dynamic Initialization of Variables- Reference Variables - Operators in C ++.

UNIT-II : FUNCTIONS IN C ++

Functions in C ++ : - The Main Functions - Functions Prototyping - Call by Reference - Return by Reference - Inline Functions - Function Overloading. Classes and Objects: - Specifying a class - Defining Member Function - Nesting of members Functions - Private members Functions - Arrays within a class - Static Data members - Static member Functions.

UNIT- III : CONSTRUCTORS AND DESTRUCTORS

Constructors and Destructors: - Constructors - Copy Constructor- Dynamic Constructor- Constructing Two - Dimensional Arrays - Destructors. Operator Overloading and Type Conversions:- Defining Operator Overloading - Overloading Unary Operators - Overloading Binary Operators - Overloading Binary Operators Using Friends.

UNIT-IV : INHERITANCE, EXTENDING CLASSES

Inheritance, Extending classes: - Defining Derived classes - Single Inheritance - Making a Private Member Inheritable- Multilevel Inheritance - Multiple Inheritance - Hierarchical Inheritance - Hybrid inheritance - Virtual Base Classes.

UNIT - V : POINTERS, VIRTUAL FUNCTIONS AND POLYMORPHISM

Pointers, Virtual Functions and Polymorphism: - Introduction- Pointers to Objects - this Pointer- Pointer to Derived Classes - Virtual Functions -Pure Virtual Functions.

UNIT - VI : APPLICATIONS OF COMPUTER PROGRAMMING WITH C++

Write clear, elementary C++ programs. Understand algorithmic thinking and apply it to programming. Understand problem-solving techniques.

CO-PO MAPPING FOR COMPUTER PROGRAMMING WITH C++

COs	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1	2		1	
CO2		1			1
CO3	1		2		
CO4	2		1		
CO5	1	2			

(High correlation -3, Moderate correlation-2), No correlation-(-).

Books for Study and Reference:

1. E.Balagurusamy (2001): Object Oriented Programming with C++.Second Edition, Tata McGraw Hill Publishing Company Limited.

Kunthavai Naacchiyaar Govt. Arts College (W) Autonomous, Thanjavur

SEM III	NME 2	METHODS OF STATISTICS - II	22KP3SEL02: 1	Inst.Hrs:2	Credits:2
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Course objectives:

1. The course gives the application of statistics in handling survival data.
2. The course introduces the concept of censoring and the various distributions used to analyse such data. Various models are also suggested to deal with survival data.

Co s	Statements
CO1	Know the theory behind fundamental bioinformatics analysis methods.
CO2	Describe statistical methods and probability distributions relevant for molecular biological data
CO3	Perform and interpret bioinformatics and statistical analyses with real molecular biological data.
CO4	Solve the problem of Measures of central tendency
CO5	Solve the Correlation and regression.

Unit - I: COLLECTION OF DATA

Definition of Bio - Statistics, characteristics of Statistics. Data collection of primary and secondary data - Definition and methods of collecting primary and secondary data.

Text Book 1 Chapter 4

Unit - II: CLASSIFICATION AND TABULATION

Processing of data - Classification - Objectives & types of classification. Tabulation - Objectives - Components of Tables and types of Tables. Formation of frequency distribution - discrete & continuous.

Text Book 1 Chapter 6

Unit - III: DIAGRAMMATIC REPRESENTATION

Diagrammatic representation - definition, Rules for constructing diagrams and uses. Simple bar diagram, Component bar diagram, multiple bar diagram and pie diagram. Use any one of the Agriculture data for practice.

Unit – IV: MEASURES OF CENTRAL TENDENCY AND DISPERSION

Measures of central tendency – Mean, Median, Mode. Measures of dispersion – Range and standard deviation – Simple problems. Use any one of the weather data for practice.
Text Book 1 Chapter 9,10

Unit – V: CORRELATION AND REGRESSION ANALYSIS

Correlation – definition, Types of correlation, Methods of studying correlation – Karl Pearson's coefficient of correlation, Rank Correlation (without repeated ranks), simple Regression lines (two variables only)-simple problems. Use any one of the medical data for practice.

Text Book 1 Chapter 12,13

Unit – VI: APPLICATIONS

To apply the various models are also suggested to deal with survival data. Compute the Measures of central tendency, dispersion, correlation and regression.

Text Book

1. Statistics theory and practice- R.S.N.Pillai, Bagavathi
2. Bio-statistics – P.Ramakrishna
3. Statistical methods for Biologists – S. Palanichamy & M.Manoharan.
4. Bio-Statistics – Gurusamy.

CO-PO Mapping for Bio statistics

Cos	Pos					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	-	-	-
CO2	-	-	2	-	1	-
CO3	1	-	2	-	-	-
CO4	-	1	-	1	-	-
CO5	1	-	-	-	-	1

High correlation - (3), Moderate correlation- (2), No correlation-(-).

Kunthavai Naacchiyaar Govt. Arts College (W) Autonomous, Thanjavur

SEM-III	NME 2	SURVIVAL ANALYSIS	22KP3SEL02:2	Hrs:2	Credit:2
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Course Objectives:

1. Students should know the steps involved in qualitative data collection.
2. Students should know the types of qualitative data typically collected in a qualitative study.
3. Identify and discuss the role and importance of research in the social sciences.
4. This course describes the various methods used for modeling and evaluating survival data.

Course Outcomes:

Cos	Statements
CO1	After completing this course we will be able to describe survival data format it appropriately for analysis and understanding.
CO2	Apply the knowledge for Survival analysis including survival time and event censoring and survival function and hazard functions.
CO3	Learn how to select and apply appropriate scaling and scoring metrics, how to create an analysis plan and how to present survey findings in useful tables and charts.
CO4	To design a good qualitative purpose statement and a good central question in qualitative research
CO5	To create scientific knowledge, to integrate ideas into a solution, to propose an action plan, to formulate a new classification scheme

Unit – I : STATISTICAL SURVEY

Organizing a statistical survey- Planning the survey, Executing the survey - Drafting an effective questionnaire, difference between questionnaire and schedule.

Unit – II: CENSUS AND SAMPLE METHOD

Sampling - Census and Sample method. Sampling and Non-sampling errors.

Unit – III:. COLLECTION OF DATA

Collection of data - Primary data - methods of collecting primary data. Internet Survey and Telephone Survey. Secondary data - methods of collecting secondary data and precautions while using secondary data.

Unit – IV: CLASSIFICATION OF DATA

Classification of data – Types of Classification - Chronological classification, Geographical classification, Quantitative classification and Qualitative classification. Formation of discrete frequency distribution and Formation of continuous frequency distribution.

Unit – V: TABULATION OF DATA

Tabulation of data - Parts of a table and general rules of tabulation. Types of tables - simple and complex table, Machine tabulation and Cross tabulation – Practical Survey and Report Writing.

Unit – VI: APPLICATIONS

Planning the survey based on the data. Collection of data of the data.

Text Book

Gupta. S.P, Statistical Methods , Sultan Chand & Sons, New Delhi.

CO-PO Mapping for Statistical Survey Analysis

Cos	Pos					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-		2	-	-
CO2	-	-	2	-	1	1
CO3	-	-	1	-	-	-
CO4	1	-	-	2	1	-
CO5	1	-2	-	-	1	1

High correlation - (3), Moderate correlation- (2), No correlation-(-)

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SEM III	ECC3	ADVANCED QUANTIDATIVE APPTITUDE - II	22KP3ECCS3:1	Ins.Hrs.	Credits: 3
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UNIT - I : TEACHING

Teaching - Nature , Objective , Characteristics.

UNIT - II : RESEARCH APTITUDE

Research Aptitude- Meaning , Characteristics and Types , Steps of Research , Method of Research.

UNIT - III : REASONING

Reasoning - Series, Codes, Relationship.

UNIT - IV : LOGICAL REASONING

Logical Reasoning - Alphabet test , Number Related Test , Missing Numbers.

UNIT - V : DATA INTERPRETATION

Data Interpretation - Bar chart , Pictograph , Line graphs, Pie - chart.

Books for study Reference:

1. Dr.K.Kautilye - Teaching and Research Aptitude

UGC-NET/SET) - General Paper -I .

2. Upkar`s - Teaching and Research Aptitude

UGC-NET/SET) - General Paper -I .

SEM IV	CC12	SAMPLING THEORY	22KP4812	Ins.Hrs.6	Credits: 5
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Course Objectives:

1. To learn scientific view to conduct the survey in proper way to collect the data about specific perspective.
2. To Learn variety of probability and non probability sampling methods for selecting a sample from a population.
3. To study the various Sampling techniques and apply them practically.

Course Outcomes:

CO	STATEMENTS
1	Understand the basic principles underlying survey design and estimation.
2	Apply the different sampling methods for designing and selecting a sample from a population.
3	Implement Cluster sampling, Ratio and Regression estimation in real life problems.
4	To apply various sampling methods for agricultural data.
5	To use practical applications of ratio and regression method of estimation.

Unit - I

Simple Random Sampling - procedure of selecting a random sample, estimation of mean, variance and proportions-SRS for variables-SRS for attributes. Estimation of sample size.

Unit - II

Stratified Random Sampling - Introduction, principles of stratification, advantages of stratification, notations, estimation of population mean and its variance, , allocation of sample size in different strata. formation of strata, determination of number of strata.post stratification-deep stratification.

Unit- II

New systematic Random Sampling - Introduction, comparison of systematic with simple and stratified random samples for some specified populations-population with periodic variations-auto-correlated populations-two-dimensional systematic sampling.

Unit - III

Cluster Sampling - Introduction, Notations, Equal Cluster Sampling, Estimator of Means and its Variance, Relative efficiency of Cluster Sampling and Optimum Cluster size.

Cluster sampling for proportions-unequal cluster sampling. Estimators of mean and their variances. Relative efficiency of unequal cluster sampling.

UNIT - IV

Multi Stage Sampling - Sampling procedure, Two-Stage Sampling with equal first-stage units, estimation of mean and its variance, Two-Stage Sampling with unequal first-stage Units and Estimators of Mean and their Variances.

UNIT-V

Multiphase Sampling - Introduction, Double Sampling for Stratification, Optimal Allocation, Double Sampling for difference estimator, Double Sampling for Ratio Estimator and Double Sampling for Regression Estimator.

Book for study:

Daroga Singh and F.S.Chaudhary, Theory and analysis of Sampling Survey Design, New Age International (P) Ltd., Chennai.

Books for Reference:

- 1.Cochran W.G. (1984), Sampling Techniques, Wiley Eastern Ltd.
2. Des Raj (1976): Sampling Theory, Tata-Mcgraw Hill.

CO-PO MAPPING FOR SAMPLING THEORY

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1	2		1	
CO2	2		1		1
CO3			1		
CO4	1		2		1
CO5		2		2	

(High correlation -3, Moderate correlation-2), No correlation(-).

Text Book:

1. Daroga Singh and F.S.Chaudhary, Theory and analysis of Sampling Survey Design, New Age International (P) Ltd., Chennai.

Reference Books:

1. Moorthy, M.N (1967)- Sampling Theory and Methods, Statistical Publishing Society, Calcutta.
2. Cochran, W.G. (1994) - Sampling Techniques, Wiley Easter Lt

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SEM IV	CC13	TESTING OF STATISTICAL HYPOTHESIS	22KMS13	Ins.Hrs.6	Credits: 4
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Course Objectives:

1. Transformations and moments of random variables for the familiar of distributions.
2. Inequalities and convergence theorems, sufficient statistics by using the various powerful tests.

Course Outcomes:

CO	Statements
1	To obtained the gained the SPRT procedure for using the various most powerful invariant tests.
2	To provide the knowledge of parametric and non parametric tests.
3	Understand problem of statistical inference, problem of testing of hypothesis and construct SPRT in case of Binomial, Poisson, and Normal Distribution.
4	Understand Generalized Neyman Pearson lemma, unbiased test, UMPUT and their existence in case of exponential family and similar tests and tests with Neyman structure.
5	Developed the knowledge for the field for fundamental lemma's and theorems.

UNIT - I : STATISTICAL HYPOTHESIS

Statistical Hypothesis - Simple and Composite, Null and Alternative Hypothesis. Concept on Critical Region, Types of errors, Level of Significance, Power of a test. Optimum tests - Most Powerful Test (MPT), Uniformly Most Powerful Test (UMPT) and Neyman - Pearson Lemma - Simple Problems.

UNIT - II : LIKELIHOOD RATIO TEST

Likelihood Ratio Test - Definition and Properties - Likelihood ratio test for a mean of a Normal Population, equality of means of two Normal Population, Variance of Normal Population, equality of Variances of two Normal Populations.

UNIT - III : HYPOTHESIS TESTING

Hypothesis testing - Prior and Posterior odds, Base factor for Simple VS Simple Hypothesis, Base factor for Composite VS Composite Hypothesis. Lindley's Procedure for test of Significance, Lindley's Paradox and Decision Theoretic Approach to testing Problems.

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UNIT - IV : SEQUENTIAL ANALYSIS

Sequential Analysis - Wald's Sequential Probability Ratio Test, Properties, efficiency and Fundamental Identity of Sequential Analysis.

UNIT - V : NON - PARAMETRIC TESTS

Non - Parametric tests - Advantages and Disadvantages - Sign test, Median test, test for randomness, Wald - Wolfowitz run test, Kolmogrow - Smirnov (one and two samples) tests and Mann Whitney Wilcoxon U-test.

UNIT - VI : APPLICATIONS

Transformations and moments of random variables for the familiar of distributions. Inequalities and convergence theorems, sufficient statistics by using the various powerful tests.

CO-PO MAPPING FOR TESTING OF STATISTICAL HYPOTHESIS

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1		1	2		
CO2		2		1	
CO3	2	1			
CO4		2			
CO5				1	

(High correlation -3, Moderate correlation-2), No correlation(-).

Test Books:

1. Gupta S.C. and Kapoor V.K (1993), Fundamental of Mathematical Statistics, Sultan Chand & Sons, New Delhi (Unit I, Unit II and Unit V).
2. Radhakrishna Rao C., Linear Statistical Inference and its Applications - Second Edition, Wiley Eastern Limited (Unit IV).
3. Leonard T. and Hsu.JSJ, Bayesian Methods, Cambridge University Press (Unit III).

Books for Reference:

1. Rohatgi. V and Saleh (2002), Statistical Inference, Asia Publications.
2. Lehmann.E.L, Testing of Statistical Hypothesis, John Wiley.
3. Gibbons.J.D, Non - Parametric Statistical Inference, Duxbury.
4. Berger J.O, Statistical Decision Theory and Bayesian Analysis, Sriges Verlog.

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KUNTHAVAI NAACHIYAAR GOVT. ARTS COLLEGE (W) AUTONOMOUS, THANJAVUR- 7

SEM IV	CC14(P)	PRACTICAL - IV (Sampling and Testing of Statistical Hypothesis)	22KP4S14P	Ins.Hrs.6	Credits:4
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Course Objectives:

Practiced into the sampling methods and distribution techniques based on relevant data. This course is based on both Based on CC IX and CC XI and will provide practical knowledge to the students on various topics elaborated in these two courses so that they can apply the relevant concepts to real life problems.

Course Outcomes:

CO	STATEMENT
1	Estimate the parameter of a distribution from sample and give conclusions.
2	Hands on experience in implementation of concepts in Measure and Probability theory.
3	Analyse and Solve the problems related to distribution function.
4	Apply regression analysis technique real life problems.
5	Practice and Implement various sampling methods, Ratio and Regression estimation in real life problems.

UNIT -I : ESTIMATION OF MEAN AND VARIANCE

Estimation of mean and Variance of the population and variance of the estimator of the mean using simple random sampling and stratified random sampling with proportional allocation and optimum allocation.

UNIT- II : ESTIMATION OF MEAN AND VARIANCE

Estimation of mean and variance of population using systematic random sampling.

UNIT- III : ESTIMATION OF MEAN AND VARIANCE

Estimation of mean and variance of population using cluster sampling, multi-stage sampling.

UNIT - IV : NON - PARAMETRIC TESTS

Non - Parametric tests - Advantages and Disadvantages - Sign test, Median test, test for randomness.

UNIT - V : NON - PARAMETRIC TESTS

Wald - Wolfowitz run test, Kolmogrow - Smirnov (one and two samples) tests and Mann Whitney Wilcoxon U-test.

UNIT- VI : APPLICATIONS

Practiced into the sampling methods and distribution techniques based on relevant data. This course is based on both Based on CC IX and CC XI and will provide practical knowledge to the students on various topics elaborated in these two courses so that they can apply the relevant concepts to real life problems.

CO-PO MAPPING FOR PRACTICAL - III (ESTIMATION THEORY, SAMPLING)

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	1		2		
CO2	2	1			
CO3		2		1	
CO4	1		1		
CO5		1			1

Text Books:

1. Rohatgi.V.L." An introduction to probability theory and Mathematical Statistics", Wiley Eastern limited.
2. Cochran, W.G. (1994) - Sampling Techniques, Wiley Easter Lt
3. Lehmann.E.L, Testing of Statistical Hypothesis, John Wiley.

SEM IV	MBE 3	DEMOGRAPHY	22KP4SELS3:1	Ins.Hrs.6	Credits: 5
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Course Objectives:

1. To identify appropriate sources of data and to perform basic demographic analyses using various techniques across populations.
2. To learn the main theories used to understand population studies and societal change.
3. Gain the knowledge of vital events of fertility, mortality, migration and life tables and their relevant field theory and practical situations.

Course Outcomes:

CO	Statements
1	Understand the measures of mortality, fertility and interdisciplinary nature of demography, balancing equation, use of indices.
2	Describe the concept of life tables.
3	Apply Quasi, stable population models.
4	To learn out the vital events of fertility, mortality and migration and life tables for based on the population studies.
5	Real data implementation of various demographic concepts as outlined above through practical assignments.

UNIT - I : VITAL STATISTICS AND DEMOGRAPHY

Definition of vital statistics and demography - concepts of population and measurement of population, uses of vital statistics, sources of collecting Vital Statistics, parts of demography,

UNIT - II : : MEASUREMENT FERTILITY RATE

Concepts and definitions of Sex Ratio, Rate of a Vital Event, Cohort, Generation, Marriages, Divorce, Separation, Stable Population, Stationary Population, Fertility and Mortality. Birth Rates - Crude Birth Rate, General Fertility Rate, Specific Fertility Rate and Total Fertility Rate (only concepts and formulae).

UNIT - III : MEASUREMENT MORTALITY RATE

Measurement of Mortality - Crude Death Rate, Specific Death Rate, Infant Mortality Rate, Standardized Death Rate - Direct and Indirect method of standardization (No problems), Central Mortality Rate and Force of Mortality.

UNIT - IV : LIFE TABLE

Life Table - Assumptions, Descriptions, Construction and Uses of Life Table. Definitions of l_x , d_x , $n p_x$, P_x , q_x , L_x and e_{0x} . Expectation of life - Curate expectation and complete expectation of life. Basic theorems with proof.

UNIT - V : REPRODUCTION RATES

Reproduction Rates - Gross Reproduction Rates and Net Reproduction Rates - Graduation of Mortality Rates - Makehem's Graduation Formula, Gompertz Makehem formula for Mortality,

UNIT - VI : APPLICATIONS OF DEMOGRAPHY

To identify appropriate sources of data and to perform basic demographic analyses using various techniques across populations. To learn the main theories used to understand population studies and societal change.

CO-PO MAPPING FOR DEMOGRAPHY

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1		1	2		
CO2	1	2			
CO3	2		1		
CO4		1		2	
CO5		1		1	

(High correlation -3, Moderate correlation-2), No correlation(-).

Text Book:

1. Gupta S.C. and Kapoor V.K (1993), Fundamental of Mathematical Statistics, Sultan Chand & Sons, New Delhi (Unit I, Unit II and Unit V).
2. Peter R Cox, Demography, Fifth edition, Vikas Publishing House, New Delhi. (unit I and Unit II).

Reference Books:

Hansraj, Fundamentals of Demography, Surjeet Publications, New Dehli.

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SEM IV	MBE3	MULTIVARIATE STATISTICAL ANALYSIS	22KP4SELS3:2	Ins.Hrs.6	Credits: 5
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Course Objectives:

1. To learn and develop scientific view to deal with multidimensional datasets and its uses in the analysis of research data.
2. To understand the extensions of univariate techniques to multivariate frameworks and learn to apply dimension reduction techniques used in the data analysis.
3. Understand the characteristics of multivariate quantitative research, including strengths and weaknesses
4. Understand the principles and characteristics of the multivariate data analysis techniques

Course Outcomes:

CO	STATEMENT
1	Understand multivariate normal distribution and their real life applications.
2	Understand Wishart distribution, Hotelling T ² and Mahalanobis D ² statistic.
3	Implement dimension reduction techniques using software on real life problems.
4	Demonstrate knowledge and understanding of the basic ideas behind discriminant and clustering analysis techniques with applications.
5	Gaining the knowledge for the Multiple and Partial Correlation and their tests of significance, Multivariate Normal Distribution and its properties

UNIT : I : CONCEPTS OF MULTIVARIATE ANALYSIS DISTRIBUTION

Aspects of multivariate Analysis, Applications of Multivariate techniques - Some basics of matrix and vector algebra - Mean vectors and covariance matrices - Generalized variance - Multivariate normal distribution - multivariate normal density and its properties.

UNIT: II : DISTRIBUTION OF T²

Hotelling T² Statistic: Introduction - derivation and its distributions -Uses of T² Statistic - Properties of the T² Test. Wishart distribution - definition and properties only.

UNIT : III : PRINCIPAL COMPONENT ANALYSIS

Principle components: Introduction - population principle components - summing sample variation by principle components - Graphing the principle components.

UNIT : IV : FACTOR ANALYSIS

Factor analysis and inference for structured covariance matrices: Orthogonal factor model - methods of estimation - Factor rotation - Factor scores.

UNIT : V : CLASSIFICATION

Discrimination and classification - Separation and classification for two populations - Classification with two multivariate normal populations - Evaluating classification functions - Fisher's discriminant function - Fisher's method for discriminating among several populations.

UNIT : VI : APPLICATIONS

To learn and develop scientific view to deal with multidimensional datasets and its uses in the analysis of research data. To understand the extensions of univariate techniques to multivariate frameworks and learn to apply dimension reduction techniques used in the data analysis.

CO-PO MAPPING FOR MULTIVARIATE ANALYSIS

Cos	Pos				
	PO1	PO2	PO3	PO4	PO5
CO1	2	-	-	1	-
CO2	-	1	2	-	-
CO3	2	1	-	-	-
CO4	1	-	-	-	-
CO5	1	-	-	2	-

(High correlation -3, Moderate correlation-2), No correlation(-).

Text Book:

Richard A. Johnson and Dean W. Wichern (2003): Applied Multivariate Statistical Analysis, Third Edition, Prentice Hall of India Private Ltd, New Delhi.

Reference Book:

Anderson T.W. (1957): An Introduction to Multivariate Statistical Analysis, Wiley Eastern Private Ltd, New Delhi.

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SEM IV	CC 15	PROJECT WORK	22KP4S15PW	Ins.Hrs.6	Credits: 5
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Course objectives:

To make collected the data in our relevant field and prepare the master tables and analyzed in statistical tools. Finally the presentation and use our social phenomena.

Dissertation 80 Marks

Viva voce 20 Marks

Course Outcomes :

CO	Statements
1	Search primary or secondary dataset and collect the data for analysis. Analyze and interpret and take appropriate decisions in solving real life problems using statistical tools.
2	Use different Statistical packages for graphical interface, data analysis and interpretation.
3	Interpret and conclude the statistical analysis scientifically.
4	Write a systematic Statistical project report. Represent his/her work through power point presentation.
5	Apply the statistical techniques in the project which they had learned in the theory.

VIII. Continuous Internal Assessment System

	Maximum	Components			Passing Minimum
		Attendance	CIA	Seminar / Assignment	
Theory	25	05	15	05	10
Practical*	40	05	15	20 (Record)	16

* Department specific

IX. Question Pattern

	Part A	Part B	Part C
Semester Exam: Theory (75)	20 x 1=20 (Answer All)	5 x 5= 25 (Internal choice)	3 x 10 =30(Open choice)
Semester Exam: Practical (60)	5 x 10 = 50*	---	---
CIA Exam: Theory (50)	10 x 1=10 (Answer All)	4 x 5= 20 (Internal choice)	2 x 10 =20(Open choice)
Model Exam Theory (75)	20 x 1=20 (Answer All)	5 x 5= 25 (Internal choice)	3 x 10 =30(Open choice)
*Model Exam: Practical (50)	5 x 10 = 50	---	---

* Department specific

X. Question Allocation and Blooms Taxonomy for (Direct) Assessment

Unit	Section & Marks	Question Number	Blooms Level	Action Verbs
I	A (1 mark)	1-4	I / II	<i>Level I: Choose, Define, Find, How, Label, List, Match, Name, Select, Show, Tell, What, When, Where, Which, Who, Why</i>
	B (5 mark)	21 (a) and (b)	I / II	
	C (10 mark)	26	I / II	
II	A (1 mark)	5-8	I / II	<i>Level II: Classify, Compare, Contrast, Demonstrate, Explain, Extend, Illustrate, Infer, Interpret, Outline, Relate, Show, Summarize, Translate</i>
	B (5 mark)	22 (a) and (b)	I / II	
	C (10 mark)	27	I / II	
III	A (1 mark)	9-12	I / II	<i>Level III: Apply, Build, Choose, Construct, Develop, Experiment with, Identify, Interview, Make use of, Model, Organize, Plan, Select, Solve, Utilize</i>
	B (5 mark)	23 (a) and (b)	III / IV	
	C (10 mark)	28	III / IV	
IV	A (1 mark)	13-16	I / II	<i>Level IV: Analyze, Assume, Categorize, Discover, Dissect, Distinguish, Divide, Examine, Function, Inference, Inspect, Motive, Relationships, Simplify, Survey, Take part in, Test for, Theme</i>
	B (5 mark)	24 (a) and (b)	III / IV	
	C (10 mark)	29	V / VI	
V	A (1 mark)	17-20	I / II	<i>Level V: Agree, Appraise, Assess, Award, Conclude, Criteria, Criticize, Decide, Deduct, Defend, Determine, Disprove, Estimate, Evaluate, Importance, Influence, Interpret, Judge, Justify, Mark, Measure, Opinion, Perceive, Prioritize, Prove, Rate, Recommend, Rule on, Select, Support, Value</i>
	B (5 mark)	25 (a) and (b)	V / VI	
	C (10 mark)	30	V / VI	
				<i>Level VI: Adapt, Combine, Compile, Compose, Construct, Create, Delete, Design, Develop, Discuss, Elaborate, Estimate, Formulate, Happen, Imagine, Improve, Invent, Make up, Maximize, Minimize, Modify, Original, Originate, Plan, Predict, Propose, Solution, Solve, Suppose, Test, Theory</i>

BL	No. Of Questions (Sections)			Total Marks	% of Marks
	A	B	C		
I. Remembering	12	4	2	12	50
II. Understanding	08				
III. Applying	-	4	2	20	33
IV. Analyzing	-				
V. Evaluating	-	2	1	10	17
VI. Creating	-				
Total Questions	20	10	5	120	100

XI. Teaching Methodology Adopted: (department specific) + Department may adopted at least a 20 % of ICT enabled classes out of total hours of each course work and proper documents (Date, Hour, Course and unit, name of the faculty and sign of the representative student) to be maintained for the same

XII. Outline of Learning Outcomes - based Curriculum Frame work (LOCF)
(All the following categories of courses will be given with definition, procedure and system of implementation)

1. CC : Core Course : 13 Theory + 1 Practical + 1 Project (15)
2. MBE : Major Based Elective : 3 Theory
3. NME : Non Major Elective : 2 Theory
4. ECC - Extra Credit Course
- (A) SS-Self Study : 2
- (B) Add on Course : 1

* Add-on Certificate Courses with 10-30 contact Hrs conducting by Course Coordinator of the Department / College