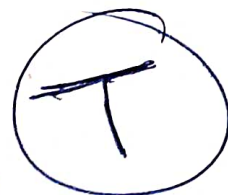


**RAJAH SERFOJI GOVERNMENT COLLEGE  
(AUTONOMOUS)  
THANJAVUR-5**

2023



**PG DEPARTMENT OF STATISTICS**

**M.Sc., STATISTICS  
SYLLABUS**

**FROM THE ACADEMIC YEAR  
2023-2024**

**TAMILNADU STATE COUNCIL FOR HIGHER  
EDUCATION, CHENNAI – 600 005**

**RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)**

Reaccredited of A grade by NACC

(Affiliated to Bharathidasan University, Tiruchirappalli)




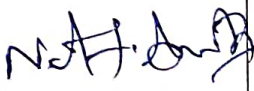


Thanjavur – 613 005, Tamilnadu, India.

**BOARD OF STUDIES IN STATISTICS**

**MINUTES OF THE MEETING HELD ON 24<sup>TH</sup> JULY 2023**

The meeting of the Board of Studies in Statistics, for the Academic year 2023 -2024 was held on 24<sup>th</sup> July 10 A.M at Department of Statistics, Rajah Serfoji Government College (Autonomous), Thanjavur-05.

The following members attended the meeting:

S.No	NAME	MEMBERS	ADDRESS	SIGNATURE
1	Prof. V. Murugesan	Chairperson	Assistant Professor and Head, Department of Statistics, RSGC(A), Thanjavur – 5.	 24/07/23
2	Dr.H. Alexis Selvaraj	Subject Expert & university Nominee	Associate Professor and Head, Department of statistics, Thanthai Periyar Govt. Arts and Science College(A), Trichy -23.	 24/07/23
3	Dr. M. Vijayakumar	Subject Expert & Academic Council Nominee	Associate Professor, Department of Statistics, Annamalai University, Annamalai Nagar – 608 002.	
4	Dr. R. Arumugam	Subject Expert	Assistant Professor (SG), Department of Mathematics, Periyar Maniammai University, Deemed to be university, Vallam, Thanjavur – 613 403.	 24.7.23
5	Mr. P. Jayakumar	Industrialist	Survey Supervisor, Ministry of Statistics, NSSO, (FOD) Thanjavur (SR) – 613 007.	
6	Mr. N. Arokiya Joseph Antony	Alumini	Statistician & Management, Meenakshi Mission Hospital, Thanjavur – 5.	
7	Prof. M. Rajan	Faculty Member	Department of Statistics, RSGC(A), Thanjavur -5	 24/7/23
8	Dr. A. Joshua Joseph	Faculty Member	Department of Statistics, RSGC(A), Thanjavur -5	

9	Dr. G. Arivazhagan	Faculty Member	Department of Statistics, RSGC(A), Thanjavur -5	<i>G. Arivazhagan</i> 24/7/23
10	Dr. P. Merina	Faculty Member	Department of Statistics, RSGC(A), Thanjavur -5	<i>P. Merina</i> 24/7/23
11	Prof. R. Anitha	Faculty Member	Department of Statistics, RSGC(A), Thanjavur -5	<i>R. Anitha</i> 24/7/23
12	Prof. S. Irudayaraj	Faculty Member	Department of Statistics, RSGC(A), Thanjavur -5	<i>S. Irudayaraj</i>
13	Dr. R. Ramajayam	Faculty Member	Department of Statistics, RSGC(A), Thanjavur -5	<i>R. Ramajayam</i>
14	Dr. R. Lakshmajayam	Faculty Member	Department of Statistics, RSGC(A), Thanjavur -5	<i>R. Lakshmajayam</i>
15	Prof. S. Malathi	Faculty Member	Department of Statistics, RSGC(A), Thanjavur -5	<i>S. Malathi</i> 24/7/23

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1. Cognitive Domain

(Lower levels: K1: Remembering ; K2: Understanding ; K3: Applying;  
Higher levels: K4: Analysing ; K5: Evaluating; K6: Creating)
  2. Affective Domain
  3. Psychomotor Domain
  - 2 Structure of Course

Course Code	Course Name		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			
Links to other Courses			
<b>Learning Objectives:</b> (for teachers: what they have to do in the class/lab/field)			
<b>Course Outcomes:</b> (for students: To know what they are going to learn)			
CO1:			
CO2:			
CO3:			
CO4:			
CO5:			
<b>Recap:</b> (not for examination) Motivation/previous lecture/ relevant portions required for the course) [ This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I		17	
II		17	
III		17	
IV		17	
V		17	
Extended Professional Component (is a part of internal component only, Not to	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)		

be included in the External Examination question paper)		
Skills acquired from the Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<b>Learning Resources:</b>		
<ul style="list-style-type: none"> <li>• Recommended Texts</li> <li>• Reference Books</li> <li>• Web resources</li> </ul>		
<b>Board of Studies Date:</b>		

## 2. Learning and Teaching Activities

### 2.1 Topic wise Delivery method

Hour Count	Topic	Unit	Mode of Delivery

### 2.2 Work Load

The information below is provided as a guide to assist students in engaging appropriately with the course requirements.

Activity	Quantity	Workload periods
Lectures	60	60
Tutorials	15	15
Assignments	5	5
Cycle Test or similar	2	4
Model Test or similar	1	3
University Exam	1	3
Total		90 periods

### 3. Tutorial Activities

Tutorial Count	Topic

**4. Laboratory Activities****5. Field Study Activities****6. Assessment Activities****6.1 Assessment Principles:**

Assessment for this course is based on the following principles

1. Assessment must encourage and reinforce learning.
2. Assessment must measure achievement of the stated learning objectives.
3. Assessment must enable robust and fair judgments about student performance.
4. Assessment practice must be fair and equitable to students and give them the opportunity to demonstrate what they learned.
5. Assessment must maintain academic standards.

**6.2 Assessment Details:**

<b>Assessment Item</b>	<b>Distributed Due Date</b>	<b>Weightage</b>	<b>Cumulative Weightage</b>
Assignment 1	3 <sup>rd</sup> week	2%	2%
Assignment 2	6 <sup>th</sup> Week	2%	4%
Cycle Test – I	7 <sup>th</sup> Week	6%	10%
Assignment 3	8 <sup>th</sup> Week	2%	12%
Assignment 4	11 <sup>th</sup> Week	2%	14%
Cycle Test – II	12 <sup>th</sup> Week	6%	20%
Assignment 5	14 <sup>th</sup> Week	2%	22%
Model Exam	15 <sup>th</sup> Week	13%	35%
Attendance	All weeks as per the Academic Calendar	5%	40%
University Exam	17 <sup>th</sup> Week	60%	100%

## CONTENTS

- a. Academic Schedule
- b. Students Name List
- c. Time Table
- d. Syllabus
- e. Lesson Plan
- f. Staff Workload
- g. Course Design(content, Course Outcomes(COs), Delivery method, mapping of COs with Programme Outcomes(POs), Assessment Pattern in terms of Revised Bloom's Taxonomy)
- h. Sample CO Assessment Tools.
- i. Faculty Course Assessment Report (FCAR)
- j. Course Evaluation Sheet
- k. Teaching Materials (PPT, OHP etc)
- l. Lecture Notes

- m. Home Assignment Questions
- n. Tutorial Sheets
- o. Remedial Class Record, if any.
- p. Projects related to the Course
- q. Laboratory Experiments related to the Courses
- r. Internal Question Paper
- s. External Question Paper
- t. Sample Home Assignment Answer Sheets
- u. Three best, three middle level and three average Answer sheets
- v. Result Analysis (CO wise and whole class)
- w. Question Bank for Higher studies Preparation (GATE/Placement)
- x. List of mentees and their academic achievements

### Programme Outcomes (PO) and Programme specific outcome(PSO)

The student post graduated in Statistics under the M.Sc. Statistics Programme should be able to have

<b>Programme Outcomes (Pos)</b>	<p><b>PO1: Disciplinary Knowledge:</b> a good theoretical knowledge of the domain Statistics and its methods and techniques.</p> <p><b>PO2: Mathematical knowledge:</b> sharpening mathematical knowledge needed to understand higher levels of Statistics understand multidimensional issues of data.</p> <p><b>PO3: Application knowledge:</b> understanding application of Statistics in various domain. Also understand the interdisciplinary nature of Statistics while applying it. Industrial oriented programming languages are introduce to undertake and solve practical problem in industry.</p> <p><b>PO4: Critical Thinking:</b> examine basic statistical issues in a more logical and methodical manner in a real data given.</p> <p><b>PO5: Analytical Reasoning:</b> to develop capability to identify logical issues in practicing with data, analyze and synthesize data from a variety of sources and accordingly draw conclusions. To acquire capacity for taking central and state government comparative</p>
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	<p>examination (UGC NET, SET, SLET, TNPSC, SSC, TRB, RBI, UPSC, ISS/IES,ICMR,ICAR etc..)</p> <p><b>PO6: Problem Solving skills:</b> The students will be able to examine various hypotheses involved, and will be able to identify and consult relevant resources to find their rational answers. Also get mathematical problem solving.</p> <p><b>PO7: Research Related Skills:</b> The students should be able to develop original thinking for formulating new problems and providing their solutions.</p> <p><b>PO8: Computational skills:</b> acquire computing skills necessary for solving real life problems in par with the requirement of a job</p> <p><b>PO 9 Team work:</b> experience in team work by engaging in team projects and team assignments. Also have original thinking and creative presentation</p> <p><b>PO 10: Communication and soft skills:</b> Interactive skills and presentation skills</p>
<p><b>Programme Specific Outcomes (PSOs)</b></p>	<p><b>PSO1 – Placement</b> To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.</p> <p><b>PSO 2 - Entrepreneur</b> To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.</p> <p><b>PSO3 – Research and Development</b> Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.</p> <p><b>PSO4 – Contribution to Business World</b> To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p><b>PSO 5 – Contribution to the Society</b> To contribute to the development of the society by collaborating with stakeholders for mutual benefit.</p>

## 7. Template for PG Programme in Statistics

## M.Sc., Statistics Curriculum Design

Semester-I	Credit	Semester-II	Credit	Semester-III	Credit	Semester-IV	Credit
1.1. Core-I	4	2.1. Core-IV	4	3.1. Core-VII	4	4.1. Core-X	4
1.2. Core-II	4	2.2. Core-V	4	3.2. Core-VIII	4	4.2. Core-XI	3
1.3. Core - III	4	2.3. Core - VI	4	3.3. Core - IX	4	4.3. Core - XII	3
-----		-----		-----		Practical- IV(Core X,XI &XII based on Python)	2
1.4 Elective (Generic / Discipline Centric)- I	3	2.4 Elective (Generic / Discipline Centric) - III	3	3.4 Elective(Generic / Discipline Centric) - V	3	4.4 Elective(Generic / Discipline Centric) - VI	3
1.5 Elective (Generic / Discipline Centric)-II	3	2.5 Elective (Generic / Discipline Centric)-IV	3	3.5 Core Industry Module - Statistical Quality Control	3	4.5 Project with Viva-Voce	3
1.6 Ability Enhancement Course- Soft Skill -1	2	2.6 Ability Enhancement Course - Soft Skill -2	2	3.6 Ability Enhancement Course- Soft Skill -3	2	4.6 Ability Enhancement Course- Soft Skill -4	2
Skill Enhancement Course SECI	2	2.7 Skill Enhancement Course SEC 2 -Practical - II(Core IV &VI based on R programming)	2	3.7 Skill Enhancement Course - Practical- III(Core VII, VIII &IX based on Python)	2	4.7 Skill Enhancement Course - Professional competency skill	2
Practical-I (Core II &III based on R programming)				3.8 Internship/ IndustrialActivity	2	4.8 Extension Activity	1
	22		22		24		23
						<b>Total Credit Points</b>	<b>91</b>

Credit Distribution for PG Programme in Statistics  
**M.Sc Statistics M.Sc. Statistics Curriculum**  
**Design- July 2023 Onwards**


Part	Sub. Code	Course	Semester-I Title	HRS/ Week (L/T/P)	Credit	Exam. Hours	Marks		Total
							Int.	Ext	
III	T1PSTC1	CC1	Real Analysis & Linear Algebra	7 (6 + 1)	5	3	25	75	100
	T1PSTC2	CC2	Sampling Methods	7 (6 + 1)	5	3	25	75	100
	T1PSTC3	CC3	Distribution Theory	6 (5 + 1)	4	3	25	75	100
EC-I (Group A)	TPSTECA	EC1	Population Studies	5 (4 + 1)	3	3	25	75	100
	TPSTECB		Categorical Data Analysis						
EC-II (Group B)	TPSTECC	EC2	Bayesian Inference	5 (4 + 1)	3	3	25	75	100
	TPSTECD		Clinical Trials						
			<b>Total</b>	<b>30</b>	<b>20</b>	<b>-</b>	<b>125</b>	<b>375</b>	<b>500</b>
			<b>Semester-II</b>						
III	T2PSTC4	CC4	Estimation Theory	6 (5 + 1)	5	3	25	75	100
	T2PSTC5	CC5	Measure and Probability Theory	6 (5 + 1)	5	3	25	75	100
	T2PSTC6	CC6	Time Series Analysis	6 (5 + 1)	4	3	25	75	100
EC- III (Group C)	TPSTECE	EC3	Simulation Analysis	4 (3 + 1)	3	3	25	75	100
	TPSTECF		Actuarial Statistics						
EC-IV (Group D)	TPSTECG	EC4	Survival Analysis	4 (3 + 1)	3	3	25	75	100
	TPSTECH		Econometrics						
IV	T2PSTSP1	SEC 1	Statistical Practical -I (Core II,III, IV & VI-Based on R Programming)	4	2	3	25	75	100
			<b>Total</b>	<b>30</b>	<b>22</b>		<b>150</b>	<b>450</b>	<b>600</b>

Internship during Summer Vacation. The Credits shall be awarded in Semester - III  
Statement of Marks

Part	Sub. Code	Course	Semester-III Title	HRS/ Week (L/T/P)	Credit	Exam. Hours	Marks		Total
							Int.	Ext.	
III	T3PSTC7	CC7	Testing of Statistical Hypothesis	6 (5 + 1)	5	3	25	75	100
	T3PSTC8	CC8	Multivariate Analysis	6 (5 + 1)	5	3	25	75	100
	T3PSTC9	CC9	Linear Models	5 (4 + 1)	5	3	25	75	100
	T3PSTC10	CC10	Design of Experiments (Industry Module)	5	4	3	25	75	100
EC-V (Group E)	TPSTECI	EC5	Operations Research	5 (4 + 1)	3	3	25	75	100
	TPSTECJ		Data Base Management System						
IV	T3PSTSP2	SEC 2	Statistics Practical-II (Core VII & VIII Based on Python)	3	2	3	25	75	100
			Internship / Industrial Activity (Carried out in Summer Vacation at the end of I year – 30 hours)	-	2	-	-	-	-
			<b>Total</b>	<b>30</b>	<b>26</b>		<b>150</b>	<b>450</b>	<b>600</b>
			<b>Semester-IV</b>						
III	T4PSTC11	CC11	Stochastic Processes	6 (5+1)	5	3	25	75	100
	T4PSTC12	CC12	Machine Learning Techniques	6 (5+1)	5	3	25	75	100
	T4PSTC13	CC13	Project with viva voce	9	7	3	25	75	100
EC- VI (Group F)	TPSTECK	EC6	Non-Parametric Inference	5 (4 + 1)	3	3	25	75	100
	TPSTECL		Reliability Theory						
VI	T4PSTS3	PCS	Professional Competency Skill Enhancement Course Training for Competitive Examinations <ul style="list-style-type: none"> <li>• Mathematics for NET / UGC - CSIR/ SET / TRB Competitive Examinations (2 hours)</li> <li>• General Studies for UPSC / TNPSC / Other Competitive Examinations (2 hours)</li> </ul> OR Statistics for Advanced Research Studies (2 hours)	4	2		25	75	100
V			Extension Activity	-	1	-	-	-	-
			<b>Total</b>	<b>30</b>	<b>23</b>		<b>125</b>	<b>375</b>	<b>500</b>

**TOTAL CREDITS 91**

  
**H.O.D of Statistics**  
**Rajah Serfoji Govt. College (Auto)**  
**Thanjavur-5.**

  
**CONTROLLER OF EXAMINATIONS,**  
**RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)**  
**THANJAVUR-613 005.**

**Consolidated Table for Credits Distribution**

	Category of Courses	Credits for each Course	Number of Courses	Number of Credits in each Category of Courses	Total Credits	Total Credits for the Programme
PART A	Core	4	12	48	72	80 (CGPA)
	Project with viva voce	3	1	3		
	Industry aligned Programmes-	3	1	3		
	Elective (Generic and Discipline Centric)	3	6	18		
PART B (i)	Skill Enhancement (Term paper and Seminar & Generic / Discipline - Centric Skill Courses) (Internal Assessment Only)	2	4	8	8	11 (Non CGPA)
PART B (ii)	Ability Enhancement (Soft skill)	2	4	8	10	
PART B (iii)	Summer Internship	1	2	2		
PART C	Extension Activity	1	1	1	1	91

## 8. Template for Semester

Code	Category	Title of the Paper	Marks (Max 100)		Duration for UE	Credits
			CIA	UE		
<b>Semester –I</b>						
Part A	Core I		25	75	3 Hrs	4
	Core II		25	75	3 Hrs	4
	Core III		25	75	3 Hrs	4
	Elective I	Elective-I (Choose one from Group-A)	25	75	3 Hrs	3
	Elective II	Elective-I I (Choose one from Group-B)	25	75	3 Hrs	3
Part B	Skill Enhancement Course -SEC 1	Practical – I (Core II & III Based on R Programming)	25	75	3 Hrs	2
	Ability Enhancement Course (AECC 1)	Soft Skill I	Performance based assessment			2
<b>Semester-II</b>						
Part A	Core IV		25	75	3 Hrs	4
	Core V		25	75	3 Hrs	4
	Core VI		25	75	3 Hrs	4
	Elective III	Elective-III (Choose one from Group-C)	25	75	3 Hrs	3
	Elective IV	Elective-IV (Choose one from Group-D)	25	75	3 Hrs	3
Part B	Skill Enhancement Course -SEC 2	Practical – II (Core IV & VI Based on R Programming)	25	75	3 Hrs	2
	Ability Enhancement Course (AECC 2)	Soft Skill II	Performance based assessment			2

Semester-III						
Part A	Core VII		25	75	3 Hrs	4
	Core VIII		25	75	3 Hrs	4
	Core IX		25	75	3 Hrs	4
	Elective / ED V	Elective-VI /ED-V (Choose one from Group-E)	25	75	3 Hrs	3
	Core Industry Module	ED-IV (Choose from outside the Department) Statistical Quality Control	25	75	3 Hrs	3
Part B						
	Skill based (Term paper and Seminar)	Practical – III (Core VII, VIII & IX Based on Python)	25	75	3 Hrs	2
	Ability Enhancement Course (AECC 3)	Soft Skill III	Performance based assessment			2
	Internship / Industrial - Vacation Activity					2
Semester-IV						
Part A	Core X		25	75	3 Hrs	4
	Core XI		25	75	3 Hrs	4
	Core XII		25	75	3 Hrs	4
	Project with viva voce XIII		25	75	3 Hrs	3
	Elective VI	Elective-VI (Choose one from Group – F)	25	75	3 Hrs	3
Part B	Skill Enhancement Course -SEC 4	Professional Competency Skill Enhancement Course	Internal Assessment			2
	Ability Enhancement Course (AECC4)	Soft Skill IV	Performance based assessment			2
Part C	Extension Activity	Performance based assessment				1
<b>Total Credits</b>						<b>91</b>

### Elective Courses

Courses are grouped (Group A to Group F) so as to include topics from Pure Statistics(PS), Applied Statistics(AS), Industrial Components(IC) and IT Oriented(ITC) courses for flexibility of choice by the stakeholders / institutions.

#### Semester I : Elective I and Elective II

Elective I to be chosen from Group A and Elective II to be chosen from Group B

##### Group A: (PS/AS/IC/ITC)

1. Categorical Data Analysis
2. Population Studies

##### Group B:(PS/AS/IC/ITC)

1. Bayesian Inference
2. Clinical Trials

#### Semester II : Elective III & Elective IV

Elective III to be chosen from Group C and Elective IV to be chosen from Group D

##### Group C:(PS/AS/IC/ITC)

1. Actuarial Statistics
2. Simulation Analysis

##### Group D :(PS/AS/IC/ITC)

1. Survival Analysis
2. Econometrics

#### Semester III : Elective V

Elective V to be chosen from Group E.

##### Group E: (PS/AS/IC/ITC)

1. Operations Research
2. Database Management System

#### Semester IV : Elective VI

Elective VI to be chosen from Group F.

##### Group F:(PS/AS/IC/ITC)

1. Non-parametric Inference
2. Reliability Theory

## **Skill Enhancement Courses**

**Skill Enhancement Courses are chosen so as to keep in pace with the latest developments in the academic / industrial front and provides flexibility of choice by the stakeholders / institutions.**

### **Group G (Skill Enhancement Courses) SEC:**

- Computational Statistics using R / Python
- Statistical documentation using LATEX / other packages
- Operation Research using TORA
- Numerical analysis using SCILAB
- Differential equations using SCILAB
- Industrial Statistics using latest programming packages
- Research Tools and Techniques

### **Ability Enhancement Courses**

- Soft Skill courses

### **Extra Disciplinary Courses for other Departments (not for Statistics students)**

Students from other Departments may also choose any one of the following as Extra Disciplinary Course.

ED-I: Statistics for Life Sciences

ED-II: Statistics for Social Sciences

ED-III: Financial Mathematics

ED-IV: Optimization Techniques

ED-V: History of Statistics

## 9. Instructions for Course Transaction

Courses	Lecture Hrs	Tutorial Hrs	Lab Practice	Total hrs
Core	75	15	--	90
Electives	75	15	--	90
ED	75	15	--	90
Lab Practice Courses	45	15	30	90
Project	20	--	70	90

## 10. Testing Pattern (25+75)

### 13.1 Internal Assessment

**Theory Course:** For theory courses there shall be three tests conducted by the faculty concerned and the average of the best two can be taken as the Continuous Internal Assessment (CIA) for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

**Computer Laboratory Courses:** For Computer Laboratory oriented Courses, there shall be two tests in Theory part and two tests in Laboratory part. Choose one best from Theory part and other best from the two Laboratory part. The average of the best two can be treated as the CIA for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

There is no improvement for CIA of both theory and laboratory, and, also for University End Semester Examination.

## 14. Different Types of Courses

### (i) Core Courses ( Illustrative )

1. Real Analysis and Linear Algebra
2. Sampling Methods
3. Distribution Theory
4. Estimation Theory
5. Measure and Probability Theory
6. Time Series Analysis
7. Testing of Statistical Hypotheses
8. Linear Models
9. Multivariate Analysis
10. Design of Experiments
11. Stochastic Process
12. Machine Learning Techniques

### (ii) Elective Courses (ED within the Department Experts) (Illustrative)

1. Categorical Data Analysis
2. Population Studies
3. Bayesian Inference
4. Clinical Trials
5. Actuarial Statistics
6. Simulation Analysis
7. Survival Analysis
8. Econometrics
9. Operations Research
10. Database Management System
11. Non-parametric Inference
12. Reliability Theory

### (iii) Elective Courses (ED from other Department Experts)

### (iv) Skill Development Courses

### (v) Institution-Industry-Interaction ( Industry aligned Courses)

Programmes /course work/ field study/ Modelling the Industry Problem/ Statistical Analysis / Commerce/Pharma-Industry related problems / MoU with Industry/Research Institutes and the like activities.

## Syllabus for Course of M.Sc., Statistics

Title of the Course		Real Analysis and Liner Algebra					
Paper Number		CORE I					
Category	Core	Year	I	Credits	5	Course Code	TIPSTC1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		6	1	--	7		
Pre-requisite		Post graduate level Vector Algebra and Matrix Theory					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. To provide recollection as well as building Mathematical foundation in Real Analysis and Matrix Theory</li> <li>2. To understand concepts and definition of metric space and theorems related to it</li> <li>3. To know integration and differentiation concepts and its application, to know real functions in one variable as well as several variables, understand it on numerical problems</li> <li>4. To know Linear space and its basis. Rank of a matrix, characteristic roots and its multiplicity, Different types of inverses, numerical examples and real life application</li> <li>5. To know Different types of matrices, orthogonality, canonical forms, decomposition of matrix, quadratic forms, numerical examples and real life applications</li> </ol>					
Course Outline		<p><b>UNIT-I :</b> Metric Space – open, closed sets – Intervals (rectangles), Real valued Continuous functions- Discontinuities - compact sets, Bolzano – Weirstrass theorem, Heine – Borel theorem.</p> <p><b>Unit II:</b> Derivatives - maxima and minima - Riemann integral &amp; Riemann – Stieltjes integral with respect an increasing integrator – properties of R.S. integral. Functions of several variables.</p> <p><b>Unit III:</b> Basic properties of matrices (orthogonal, idempotent, Kronecker product, projection operators etc); rank of a matrix; characteristic roots and polynomial, multiplicity of characteristic roots; Cayley Hamilton theorem; inverse of a matrix and determinants;</p> <p><b>Unit IV:</b> Reduction of matrices, Echelon form, Hermite canonical form, diagonal reduction, rank factorization, triangular reduction Jordan form; Symmetric matrices and its properties.</p> <p><b>Unit V:</b> Matrix differentiation; Generalized inverse and its properties, Moore-Penrose inverse; Application of g-inverse; Quadratic forms, transformation and reduction of quadratic form; applications of quadratic forms.</p>					

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

<b>Recommended Text</b>	1.Rudin, Walter (1976) : Principles of Mathematical Analysis, McGraw Hill. 2. Apostol, T.M. (1985) : Mathematical Analysis, Narosa, Indian Ed. 3. Graybill, F.A. (1983) : Matrices with application in Statistics, 2nd ed. Wadsworth. 4. Rao, C.R. & Bhimasankaran, P.(1992) : Linear algebra, Tata McGraw Hill Pub. Co. Ltd. 5. Searle, S.R. (1982) : Matrix Algebra useful for Statistics, John Wiley and Sons, Inc.
<b>Reference Books</b>	1. Royden, H.L.(1995) : Real analysis, 3ed., Prentice Hall of India. 2. Rangachari, M.S.(1996) : Real Analysis, Part 1, New Century Book House. Ash, 3. R.B. (1972): Real analysis and probability, Academic press. 4. Biswas, S. (1984): Topics in Algebra of Matrices, Academic Publications. 5. David, A. Harville(1997) : Matrix algebra from a statistician's perspective, Springer. Hoffman, K. and Kunze, R. (1971) : Linear Algebra, 2nd ed. Prentice Hall, Inc
<b>Website and e-Learning Source</b>	e-books, tutorials on MOOC/SWAYAM courses on the subject 1. <a href="https://www.jirka.org/ra/realanal.pdf">https://www.jirka.org/ra/realanal.pdf</a> 2. <a href="http://synechism.org/primer/primer-real-analysis.pdf">http://synechism.org/primer/primer-real-analysis.pdf</a> 3. <a href="http://www.astronomia.edu.uy/progs/algebra/Linear_Algebra,_4th_Edition_(2009)LipschutzLipson.pdf">http://www.astronomia.edu.uy/progs/algebra/Linear_Algebra,_4th_Edition_(2009)LipschutzLipson.pdf</a> 4. <a href="https://nptel.ac.in/courses/111/101/111101134/">https://nptel.ac.in/courses/111/101/111101134/</a> 5. <a href="https://nptel.ac.in/courses/111/106/111106051/">https://nptel.ac.in/courses/111/106/111106051/</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

- CLO 1:** Get a Mathematical foundation in Real analysis and Matrix Theory to understand univariate and multivariate concepts in Statistical Theory
- CLO 2:** Get a clear understanding R.S. integral, partial differentiation in several variable functions, get theoretical knowledge by understanding the need and application of theorems like Bolzano - Weirstrass theorem, Heine– Borel theorem
- CLO 3:** Understand concepts in matrix theory -rank and factorization, inverse of matrix, g-inverses and its applications, characteristic roots and its multiplicity, canonical forms and decomposition of matrix, orthogonality, quadratic forms and its index, solving linear system.
- CLO 4:** Able to get solve numerical problems and evaluate and interpret outcome
- CLO 5:** analyze real life problems and explore research problems


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
**H.O.D of Statistics**  
 Rajah Serfoj Govt. College (Auto)  
 Thanjavur-5.

  
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 THANJAVUR-613 005.

Title of the Course		Sampling Methods					
Paper Number		CORE II					
Category	Core	Year	I	Credits	5	Course Code	T1PSTC2
		Semester	I				
Instructional Hours per week	Lecture		Tutorial		Lab Practice	Total	
	5		1		1	7	
Pre-requisite		Post graduate Statistical Inference					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. To cover sampling design and analysis methods</li> <li>2. To explain and compare various sampling procedures.</li> <li>3. To understand the concepts of bias and sampling variability and strategies for reducing the bias and sampling variability.</li> </ol>					
Course Outline		<p><b>UNIT-I :</b> Simple Random Sampling – procedure of selecting a Random sample – Estimation of Population Parameters – Estimation of Population proportion – Confidence Limits – Estimations of sample size – PPS selections Methods .</p> <p><b>UNIT-II :</b> Estimation in PPSWR total and its sampling variance – PPSWOR – Midzuno Method – Ordered Estimators – Des Raj’s ordered Estimators – Unordered estimators – Horvitz Thompson estimators.</p> <p><b>UNIT-III :</b> Stratified Sampling – Allocation Problems – Systematic Sampling Methods – Balanced, Modified and Centered systematic sampling methods – Yates corrected estimator.</p> <p><b>UNIT-IV :</b> Ratio Estimation – Unbiased Ratio Type estimators – Regression Estimation - Double Sampling for Ratio and Regression Estimation.</p> <p><b>UNIT-V:</b> Multistage sampling – Two Stage sampling with equal and unequal first stage units – Optimum allocation – Equal and Unequal first stage Units.</p>					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / applied survey techniques adopted in Economics and Statistics department of Tamil Nadu State Government.</p> <p>(To be discussed during the Tutorial hour)</p>					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

<b>Recommended Text</b>	1. S.Sampath (2005) : Sampling Theory and Methods, Narosha Publishing House. 2. W.G. Cochran (1965) : Sampling Techniques, Wiley and Sons
<b>Reference Books</b>	1.M.N.Murthy(1967) : Sampling Theory and Methods: Statistical Publishing Society, Calcutta Parimal Mukhopadhyay (2005) : Theory and Methods of Survey Sampling , Prentice Hall of India 2.P.V.Sukhatme, B.V.Sukhatme, S.Sukhatme and C.Asok (1984) L Theory of Same Surveys with Applications, IASRI, New Delhi
<b>Website and e-Learning Source</b>	E-books, online tutorials taken from MOOC/SWAYAM platform for this subject. 1. <a href="https://nptel.ac.in/courses/111/104/111104073/">https://nptel.ac.in/courses/111/104/111104073/</a> 2. <a href="https://nptel.ac.in/content/storage2/courses/111104073/Module14/Lecture42.pdf">https://nptel.ac.in/content/storage2/courses/111104073/Module14/Lecture42.pdf</a> 3. <a href="https://www.mooc-list.com/tags/sampling-methods">https://www.mooc-list.com/tags/sampling-methods</a> 4. <a href="https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/referencespapers.aspx?referenceid=1452788">https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/referencespapers.aspx?referenceid=1452788</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

1. To apply basics and advanced levels of sampling methods for different types of data.
2. To draw a conclusion about the best sampling procedure.
3. To use practical applications of ratio and regression method of estimations.
4. To analyze data from multi-stage sampling methods.
5. To estimate the hidden responses using randomized response techniques.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	M	S	S	M
CO2	M	S	S	S	M	S	S	S	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	M	M	S	S	M	M	S

### 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

  
H.O.D of Statistics  
Rajah Serfoji Govt. College (Auto)  
Thanjavur-5.

  
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THANJAVUR-613 005.

Title of the Course		Distribution Theory							
Paper Number		CORE III							
Category	Core	Year	I	Credits	4	Course Code	TIPSTC3		
		Semester	I						
Instructional Hours per week		Lecture	5	Tutorial	-	Lab Practice	1	Total	6
Pre-requisite		Post graduate level Statistical probability distributions.							
Objectives of the Course		<p>1. To provide theoretical knowledge on the concept of functions of random variables and its usage.</p> <p>2. To educate the knowledge on the both discrete and continuous distributions.</p> <p>3. To acquire the knowledge on deriving its characteristics of distributions.</p>							
Course Outline		<p><b>Unit I:</b> Brief review of distribution theory, functions of random variables and their distributions using Jacobian of transformation, Laplace and Cauchy distribution, lognormal distribution, gamma distribution.</p> <p><b>Unit II:</b> Sampling distributions, Non-central chi-square, t and F distributions and their properties (Derivation, concept only)</p> <p><b>Unit III:</b> Distributions of quadratic forms under normality and related distribution theory – Cochran's and James theory.</p> <p><b>Unit IV:</b> Order statistics their distributions and properties, Joint and marginal distributions of order statistics, extreme value and their asymptotic distributions</p> <p><b>Unit V:</b> Kolmogorov Smirnov distributions, life distributions, exponential, Weibull and extreme value distributions Mills ratio, distributions classified by hazard rate.</p>							
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved</p> <p>(To be discussed during the Tutorial hour)</p>							
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill							
Recommended Text		<ol style="list-style-type: none"> <li>1. Rohatgi V.K (1976), Introduction to probability theory and mathematical statistics, John Wiley and Sons., New York.</li> <li>2. Rohatgi, V.K. and Md. Whsanes Saleh, A.K.(2002): An introduction to probability &amp; Statistics, John Wiley and Sons.</li> <li>3. Johnson, N.L, Kemp, A.W, and Kotz. S (2005). Univariate Discrete Distributions 3<sup>rd</sup> Edition, John Wiley and Sons., New York.</li> <li>4. Johnson, N.L, Kotz. S and Balakrishnan, N (2014) Continuous Univariate Distributions, Vol. II, John Wiley and Sons, (Asia), Singapore.</li> </ol>							

<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Rao, C.R. (1973) : Linear statistical inference and its applications, 2ed, Wiley Eastern.</li> <li>2. Mood, A.M. &amp; Graybill, F.A. and Boes, D.C. : Introduction to the theory of statistics, McGraw Hill.</li> <li>3. Johnson, S. &amp; Kotz, (1972): Distributions in Statistics, Vol. I, II &amp; III, Houghton &amp; Mifflin.</li> <li>4. Dudewicz, E.J., Mishra, S.N. (1988) : Modern mathematical statistics, John Wiley. Searle, S.R. (1971) : Linear models, John Wiley</li> </ol>
<b>Website and e-Learning Source</b>	e-books, online tutorials taken from MOOC/SWAYAM platform for this subject., <ol style="list-style-type: none"> <li>1. <a href="https://swayam.gov.in/nd2_cec20_ma01/preview">https://swayam.gov.in/nd2_cec20_ma01/preview</a></li> <li>2. <a href="https://nptel.ac.in/courses/111/104/111104032/">https://nptel.ac.in/courses/111/104/111104032/</a></li> <li>3. <a href="https://swayam.gov.in/nd2_cec20_ma01/preview">https://swayam.gov.in/nd2_cec20_ma01/preview</a></li> </ol>

**Course Learning Outcome (for Mapping with POs and PSOs)**

**CLO-1:** To understand the knowledge on importance of the random variables and its role in the distribution theory.

**CLO-2:** To interpret the properties of special univariate continuous distributions, truncated Normal distribution and few non-central distributions.

**CLO-3:** To explain the moments for the data come from the univariate and bivariate distributions.

**CLO-4:** To interpret the distributions of order statistics with regard to Median, Sample Range and Joint distribution of order two.

**CLO-5:** To identify the data distribution based on one sample and two samples using KS tests.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	M	S	M
CO2	M	S	S	M	M	S	M	M	M	M
CO3	S	S	S	S	S	S	S	M	S	M
CO4	M	S	S	S	S	S	M	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

**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**

  
**H.O.D of Statistics**  
**Rajah Serfoj Govt. College (Aut.)**  
**Thanjavur-5.**

  
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**RAJAH SERFOJ GOVT. COLLEGE (AUTONOMOUS)**  
**THANJAVUR-613 005.**

Title of the Course		Population Studies					
Paper Number		EC 1					
Category	EC- I	Year	I	Credits	3	Course Code	TPSTECA
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		
Pre-requisite		Post graduate level demographic determinants of population studies					
Objectives of the Course		1.To provide building of basic knowledge for demographic factors responsible for Population 2. List the factors which cumulatively affect change in population. 3. To enumerate the factors of population growth 4. To current status and benefits of population statistics 5. To discuss the Indian population policies.					
Course Outline		<b>UNIT-I</b> :Demography, Sources of Demographic data, census, registration of vital events and sample survey - Demographic Determinants of Population change – births, Deaths, Migrants, Marriages <b>Unit II:</b> Concept of Natural increase of Population and Growth of Population- Measurement and Indicators of Demographic Determination: Fertility, Mortality, Migration, Marriage <b>Unit III:</b> Data Sources – Census – Vital Registration System – National Sample Survey – sample Registration System – Adhoc Surveys – Standard Fertility Survey – National Family Health Survey <b>Unit IV:</b> Population Theories – history and Development of Population Theories – Mercantilist and Related Theories. <b>Unit V:</b> Indian Population Policy – kinds of Population policy, Fertility Influencing Policy, Anti-National Policy, Population Education					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this Course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Recommended Text	1. Raj, Hans 1984: Fundamental of Demography (Population Studies with special reference to India), 3 <sup>rd</sup> Edition, Delhi: Surjeet Publications 2. Bhende, Asha S and Tara Kanitkar 1994. Principles of Population Studies 6 <sup>rd</sup> Edition Mumbai: Himalaya Publication House.
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<b>Reference Books</b>	1. Heer David M 1987. Society and Population, 2 <sup>nd</sup> Edition Delhi: Prentice Hall India 2. Kumaresana, Harsha 2004. Population Education Delhi: Dominant Publishers and Distributors
<b>Website and e-Learning Source</b>	e-books, Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] 1. <a href="https://nptel.ac.in/courses/109/104/109104045/">https://nptel.ac.in/courses/109/104/109104045/</a> 2. <a href="https://swayam.gov.in/nd1_noc19_hs39/preview">https://swayam.gov.in/nd1_noc19_hs39/preview</a> 3. <a href="https://nptel.ac.in/courses/109/104/109104150/">https://nptel.ac.in/courses/109/104/109104150/</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** Get a age and sex the most widely used characteristic of population study.

**CLO 2:** List some of the factors which are influenced by fundamental aspects of human societies.

**CLO 3:** Usually there are coverage, classification and sampling errors, in sampling method for population data.

**CLO 4:** Underlying the mercantilist theory was the belief wealth was finite.

**CLO 5:** analyze real life problems and explore research problems


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
**H.O.D of Statistics**  
 Rajah Serfoj Govt. College (Auto)  
 Thanjavur-5.

  
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 THANJAVUR-613 005.

Title of the Course		Categorical Data Analysis					
Paper Number		EC 1					
Category	EC 1	Year	I	Credits	3	Course Code	TPSTECB
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		
Pre-requisite		Post graduate level student should be able to categorical data management					
Objectives of the Course		<p>1. To provide the knowledge of analyze categorical data using logistic regression to calculate adjusted odds of association and test hypothesis.</p> <p>2. Practical exercises done will enable students to analyze and interpret data and also to draw valid conclusions. This will enable students to face real time applications.</p> <p>3. Provides a platform for pursuing higher studies leading to research studies.</p>					
Course Outline		<p>UNIT I Categorical Response Data- Response/Explanatory Variable Distinction- Nominal/Ordinal Scale Distinction - Probability Distributions for Categorical Data- Binomial Distribution, Multinomial Distribution.</p> <p>UNIT II Contingency Tables: Probability Structure for Contingency Tables, Joint, Marginal, and Conditional Probabilities, Sensitivity and Specificity in Diagnostic Tests, Independence, Binomial and Multinomial Sampling, Comparing Proportions in Two-by-Two Tables, Difference of Proportions.</p> <p>UNIT III Chi-Squared Tests of Independence, Pearson Statistic and the Chi-Squared Distribution, Likelihood-Ratio Statistic, Tests of Independence, Example: Gender Gap in Political Affiliation, Residuals for Cells in a Contingency Table, Partitioning Chi-Squared, Comments About Chi-Squared Tests</p> <p>UNIT IV Testing Independence for Ordinal Data, Linear Trend Alternative to Independence, Alcohol Use and Infant Malformation, Extra Power with Ordinal Tests, Choice of Scores, Trend Tests for <math>1 \times 2</math> and <math>2 \times J</math> Tables, Nominal-Ordinal Tables</p> <p>UNIT V Statistical Inference and Model Checking, Inference about Model Parameters, Snoring and Heart Disease Revisited, The Deviance, Model Comparison Using the Deviance, Residuals Comparing Observations to the Model Fit.</p>					

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

<b>Recommended Text</b>	1. An Introduction to Categorical Data Analysis Second Edition ALAN AGRESTI, University of Florida Gainesville, Florida 2. Azen, R., & Walker, C. M. (2011). Categorical data analysis for the behavioral and social sciences. New York: Routledge. ISBN: 1848728360
<b>Reference Books</b>	1. Agresti, A. (2013). Categorical data analysis. New York: Wiley. ISBN: 0470463635 2. Bilder, C.R. (2015). Analysis of categorical data with R. Boca Raton, FL: CRC Press. ISBN: 1439855676 3. Long, J.S. (1997). Regression models for categorical and limited dependent variables. Thousand Oaks, CA: Sage. 4. Menard, Scott. (2010). Logistic Regression: From Introductory to Advanced Concepts and Applications. Thousand Oaks, CA: Sage. ISBN: 1412974836 5. Wickens, T.D. (1989). Multiway contingency tables analysis for the social sciences. Hillsdale, NJ: Erlbaum. ISBN: 0805803777
<b>Website and e-Learning Source</b>	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] 1. <a href="https://nptel.ac.in/courses/111/105/111105041/">https://nptel.ac.in/courses/111/105/111105041/</a> 2. <a href="https://nptel.ac.in/courses/111/106/111106112.">https://nptel.ac.in/courses/111/106/111106112.</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** Identify when not to use standard linear regression.

**CLO 2:** Implement nonlinear regression such as logistic regression.

**CLO 3:** Estimate model parameters using nonlinear regression.

**CLO 4 :** Make inference about the parameters and the model.

**CLO 5:** Implement goodness of fit criteria to settle for an optimum model.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
**H.O.D of Statistics**  
**Rajah Serfoji Govt. College (Auto)**  
**Thanjavur-5.**

  
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**THANJAVUR-613 005.**

Title of the Course		Bayesian Inference					
Paper Number		EC 2					
Category	EC 2	Year	I	Credits	3	Course Code	TPSTECC
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		
Pre-requisite		Post graduate level student should be able to Bayesian statistics with calculus					
Objectives of the Course		<p>1. To provide us with a rational and mathematically sound procedure for incorporating our prior beliefs, with any evidence at hand, in order to produce an updated posterior belief.</p> <p>2. Statistical inference method that uses Bayes' theorem to revise the probability of a hypothesis as new evidence or information is obtained.</p> <p>3. To Intuitive and solid model testing and comparison</p>					
Course Outline		<p><b>UNIT-I:</b> Bayesian point estimation: as a prediction problem from posterior distribution. Baye's estimators for (i) absolute error loss (ii) squared error loss (iii) 0-1 loss.</p> <p><b>Unit II:</b> Generalization to convex loss functions. Evaluation of the estimate in terms of the posterior risk. Theorem - prior and posterior distributions. Conjugate priors and Jeffrey's priors, examples.</p> <p><b>Unit III:</b> Bayesian interval estimation: Credible intervals. Highest posterior density regions. Interpretation of the confidence coefficient of an interval and its comparison with the interpretation of the confidence coefficient for a classical confidence interval.</p> <p><b>Unit IV:</b> Bayesian testing of hypotheses: Specification of the appropriate form of the prior distribution for a Bayesian testing of hypothesis problem. Prior odds Posterior odds.</p> <p><b>Unit V:</b> Baye's factor for various types of testing hypothesis problems depending upon whether the null hypothesis and the alternative hypothesis are simple or composite.</p>					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>					
Skills acquired from this Course		<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>					

<b>Recommended Text</b>	1. Berger, J.O: Statistical Decision Theory and Bayesian Analysis, Springer Verlag 2. Robert, C.P and Casella, G.Monte Carlo: Statistical Methods, Springer Verlag 3. Leonard, T and Hsu, J.S.J: Bayesian Methods, Cambridge University Press
<b>Reference Books</b>	1. Degroot, M.H: Optimal Statistical Decisions, McGraw Hill 2. Bernardo, J.M and Smith, A.F.M: Bayesian Theory, John Wiley and Sons 3. Robert, C.P: The Bayesian Choice: A Decision Theoretic Motivation, Springer Verlag
<b>Website and e-Learning Source</b>	<a href="https://online.courses.swayam2.ac.in/imb21_mg33/preview">https://online.courses.swayam2.ac.in/imb21_mg33/preview</a> . <a href="https://www.cse.iitk.ac.in/users/piyush/courses/bml_winter17/bayesian_ml.html">https://www.cse.iitk.ac.in/users/piyush/courses/bml_winter17/bayesian_ml.html</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** Understand the concepts of prior and posterior distributions.

**CLO 2:** Be able to difference between classical and Bayesian inference

**CLO 3:** Application of various loss and risk functions

**CLO 4:** Be able to apply the concept of Bayesian inference in different fields of applications

**CLO 5:** Develop the Bayesian frame work for data analysis and its flexibility and be able to demonstrate


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
**H.O.D of Statistics**  
Rajah Serfoj Govt. College (Au.)  
Thanjavur-5.

  
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RAJAH SERFOJ GOVT. COLLEGE (AUTONOMOUS)  
THANJAVUR-613 005.

Title of the Course		Clinical Trials					
Paper Number		EC 2					
Category	EC 2	Year	1	Credits	3	Course Code	TPSTECD
		Semester	1				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		
Pre-requisite		Post graduate level student should be able to Clinical Data Management					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. Explain key concepts in the design of clinical trials.</li> <li>2. Describe the study designs commonly used.</li> <li>3. Identify key issues in data management for clinical trials.</li> <li>4. Describe the roles of Regulatory Affairs in clinical trials.</li> </ol>					
Course Outline		<p>UNIT I: Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio. Presentation of data: tabular and graphical, including histogram and ogives.</p> <p>UNIT II: Measures of Central Tendency: arithmetic mean, geometric mean, harmonic mean, median, mode, weighted mean. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.</p> <p>UNIT III: Probability: Definition- basic events – classical, statistical and axiomatic. Conditional Probability, laws of addition and multiplication, Baye's theorem and its applications. Binomial distribution, Poisson distribution and Normal distribution. (No derivations)</p> <p>UNIT IV: Concepts of statistic, parameter, pivotal quantity, sampling distribution and standard error. Chi-square, t and F distributions, their properties and interrelationships. sample mean, sample variance, student's t and F statistics</p> <p>UNIT V: Excel for data management, Basic data analysis and visualization in Excel</p>					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved</p> <p>(To be discussed during the Tutorial hour)</p>					
Skills acquired from this Course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

<b>Recommended Text</b>	1.Pagano M, Gauvreau K (2007). Principles of Biostatistics. Duxbury Press 2. Gupta SC, Kapoor VK (2000). Fundamentals of Mathematical Statistics, Sultan Chand Sons. 10th edition. 3.Goon AM, Gupta MK, Dasgupta B (2008). Fundamentals of Statistics, Published by Prentice Hall, 2nd edition.
<b>Reference Books</b>	1.Rohatgi VK, Saleh AK(2001). An Introduction to Probability and Statistics, John Wiley & Sons. 2. Bernard R (2010). Fundamentals of Biostatistics. Cengage Learning 3. William GC (1997). Sampling Techniques. John Wiley & sons 3rd edition.
<b>Website and e-Learning Source</b>	e-books, 1. <a href="http://lss.at.ufl.edu/">http://lss.at.ufl.edu/</a> . 2. <a href="https://elearning.wfh.org/elearning-centres/clinical-trials/">https://elearning.wfh.org/elearning-centres/clinical-trials/</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** Get clinical trial personnel a solid understanding of the steps involved in clinical data management from study site data collection through data extraction for analysis.

**CLO 2:** Ensuring Data Integrity and Quality and Improved Decision-Making.

**CLO 3:** Enhanced Patient Safety and Regulatory Compliance and Reporting.

**CLO 4:** Underlying the Cost Efficiency and Resource Management


**CLO 5:** analyze real life problems


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
**H.O.D of Statistics**  
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## Semester-II

Title of the Course		Estimation Theory					
Paper Number		CORE IV					
Category	Core	Year	I	Credits	5	Course Code	T2PSTC4
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		5	-	1	6		
Pre-requisite		Post graduate level Test of significance using probability theory.					
Objectives of the Course		<p>1. To make the students to understand the basic concepts of the statistical estimation theory.</p> <p>2. To study the properties of ideal estimators like unbiasedness, consistency, sufficiency, completeness.</p> <p>3. To educate various estimation methods like method of moments, method of maximum likelihood, interval estimate, and Baye's estimate.</p>					
Course Outline		<b>Unit I:</b> Sufficient statistics, Neyman, Fisher Factorisation theorem, the existence and construction of minimal sufficient statistics, Minimal sufficient statistics and exponential family, sufficiency and completeness, sufficiency and invariance.					
		<b>Unit II:</b> Unbiased estimation: Minimum variance unbiased estimation, locally minimum variance unbiased estimators, Rao Blackwell – theorem. Completeness- Lehmann Scheffe theorems, Necessary and sufficient condition for unbiased estimators					
		<b>Unit III:</b> Cramer- Rao lower bound, Bhattacharya system of lower bounds in the 1-parameter regular case. Chapman -Robbins inequality.					
		<b>Unit IV:</b> Maximum likelihood estimation, computational routines, strong consistency of maximum likelihood estimators, Asymptotic Efficiency of maximum likelihood estimators, Best Asymptotically Normal estimators, Method of moments.					
		<b>Unit V:</b> Bayes' and minimax estimation: The structure of Bayes' rules, Bayes' estimators for quadratic and convex loss functions, minimax estimation, interval estimation.					
Extended Professional Component (is a part of internal Component only, Not to be included in the External Examination question paper)		<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved</p> <p>(To be discussed during the Tutorial hour)</p>					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		<p>1. V.K.Rohatgi et al(2002) : An introduction to probability and statistics, John Wiley.</p> <p>Lehmann, E.L. (1983): Theory of point estimation, John Wiley.</p>					

<b>Reference Books</b>	1. Zacks, S. (1971): The theory of statistical inference, John Wiley. 2. Rao, C.R. (1973): Linear statistical inference and its applications, Wiley Eastern, 2nded. 3. Ferguson, T.S. (1967): Mathematical statistics, A decision theoretic approach, Academic press, New York and London. 4. Lindley, D.V. (1965): Introduction to probability and statistics, Part 2, Inference, Cambridge University Press.
<b>Website and e-Learning Source</b>	E-books, online tutorials taken from MOOC/SWAYAM platform for this subject. 1. <a href="https://swayamprabha.gov.in/index.php/Syllabus/detail/10774">https://swayamprabha.gov.in/index.php/Syllabus/detail/10774</a> 2. <a href="https://swayam.gov.in/nd1_noc20_ma19/preview">https://swayam.gov.in/nd1_noc20_ma19/preview</a> 3. <a href="https://nptel.ac.in/courses/111/105/111105043/">https://nptel.ac.in/courses/111/105/111105043/</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** To understand the consistency, sufficiency and unbiasedness.

**CLO 2:** To understand the concepts and derive the uniformly minimum variance unbiased estimators.

**CLO 3:** To derive the inequality including CR inequality, KCR inequality and Bhattacharya inequality.

**CLO 4:** To estimate the parameter using method of moments, method of MLE, Interval estimation and shortest with confidence intervals.

**CLO 5:** To learn the concepts and to apply simple numerical illustration for Loss function, Risk function and Bayes estimate.

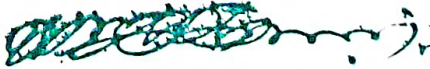
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

### 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

  
**H.O.D of Statistics**  
 Rajah Serfoji Govt. College (Autonomous)  
 Thanjavur-5.

  
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 THANJAVUR-613 005

Title of the Course		Measure and Probability Theory					
Paper Number		CORE V					
Category	Core	Year	I	Credits	5	Course Code	T2PSTC5
		Semester	II				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		5		1		--	6
Pre-requisite		Post graduate level Mathematics.					
Objectives of the Course		<p>1. This paper provides mathematical background for the knowledge of Probability Theory extended from measure theoretical approach.</p> <p>2. The students will be able to understand the basic concepts of the distribution function and random variables that help in</p> <p>3. Understanding for estimation and testing problems in Statistical Inference.</p> <p>4. The fundamentals of this course will pave the way for further research.</p>					
Course Outline		<b>Unit I:</b> Measure Theory - Limits of sequence of sets, classes of sets – Field, Sigma Field and Monotone class, Measure and Measure Space – Measurable function					
		<b>Unit II:</b> Lebesgue – Stieltjes measure, Measure integral and its properties, Dominated convergence theorem – Radon–Nikodym theorem, almost everywhere convergence, convergence in measure and convergence in mean.					
		<b>Unit III:</b> Events, sample space, different approaches to probability, random variables and random vector, Distribution functions of random variables and random vector, Expectation and moments, basic, Markov, Chebyshev's, Holder's, Minkowski's and Jensen's inequalities.					
		<b>Unit IV:</b> Independence of sequence of events and random variables, conditional probability, conditional expectation, Characteristic functions and their properties, inversion formula, convergence of random variables, convergence in probability, almost surely, in the r-th mean and in distribution, their relationships, convergence of moments, Helly-Bray theorem, continuity theorem and convolution of distributions.					
		<b>Unit V:</b> Central limit theorem, statement of CLT, Lindeberg, Levy and Liapounov forms with proof and Lindeberg Feller's form examples. Khintchine weak law of large numbers, Kolmogorov inequality, strong law of large numbers					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved</p> <p>(To be discussed during the Tutorial hour)</p>					

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	<ol style="list-style-type: none"> <li>1. Bhat, B.R. (1985): Modern probability theory, 2nd ed. Wiley Eastern.</li> <li>2. Chow, Y.S. and Teicher, H. (1979): Probability theory, Springer Verlag.</li> <li>3. Chung, K.L. et al: A course in probability theory, Academic press.</li> </ol>
Reference Books	<ol style="list-style-type: none"> <li>1. Parthasarthy, K.R. (1977): Introduction to probability and measure, MacMillan Co., Breiman, L. (1968): Probability, Addison Wesley.</li> <li>2. Munroe, M.E. (1971): Measure and integration, 2nd ed. Addison Wesley. Halmos, P.R. (1974): Measure theory, East-West.</li> <li>3. De Barr, G. (1987): Measure theory and integration, Wiley Eastern.</li> </ol>
Website and e-Learning Source	<p>E-Books, online tutorials taken from MOOC/SWAYAM platform for this subject.</p> <ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/111/101/111101005/">https://nptel.ac.in/courses/111/101/111101005/</a></li> <li>2. <a href="https://nptel.ac.in/courses/111/102/111102111/">https://nptel.ac.in/courses/111/102/111102111/</a></li> <li>3. <a href="https://nptel.ac.in/courses/111/102/111102111/">https://nptel.ac.in/courses/111/102/111102111/</a></li> </ol>

#### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1:** Resolve problems that occur in the sequences of sets and classes of sets.

**CLO-2:** Provide critical thinking in Integrals and their application to Probability Theory.

**CLO-3:** Evaluate, integrate, and apply appropriate tools in Probability and Conditional Probability.

**CLO-4:** Demonstrate the ability to apply basic methods in analyzing the convergence in Probability and rth mean and in Distribution and Characteristics functions.

**CLO-5:** Demonstrate critical thinking skills, such as problem solving using weak and strong law of large numbers and different forms of Central Limit Theorems.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	S	S	M
CO2	S	M	S	S	M	M	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

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

  
**H.O.D of Statistics**  
**Rajah Serfoji Govt. College (Auto)**  
**Thanjavur-5.**

  
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**THANJAVUR-613 005.**

Title of the Course		Time Series Analysis							
Paper Number		CORE VI							
Category	Core	Year	I	Credits	4	Course Code	T2PSTC6		
		Semester	II						
Instructional Hours per week		Lecture	5	Tutorial	-	Lab Practice	1	Total	6
		Pre-requisite		Post graduate level time series modelling					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. Understanding of various components of time series and forecasting univariate time series</li> <li>2. Apply different methods for fitting time series models</li> <li>3. Understanding various important concepts in forecasting and smoothing methods</li> <li>4. Understanding stationary and non-stationary nature of time series data</li> </ol>							
Course Outline		<b>Unit I</b> Time Series – Introduction – components of time series – stationary and non-stationary time series - differencing method to convert non stationary series – concept of co integration.							
		<b>Unit II</b> Standard statistical measures for Time Series analysis: Absolute measures – Mean absolute error, Mean error, Mean square error. Relative measures – Percentage error, Mean percentage error, Mean absolute percentage error.							
		<b>Unit III</b> Smoothing methods – Single exponential smoothing. Double exponential smoothing (Holtmethod). Triple exponential smoothing (Holt-Winter's method).							
		<b>Unit – IV</b> Decomposition method: Additive and Multiplicative decomposition – Forecast and Confidence Intervals – Kruskal-Wallis test for seasonality - Moving average Forecasting – Spencer's and Henderson's moving averages (without derivation). Stationary and Non-stationary Time series- Auto correlation function (ACF) and Partial Auto correlation function (PACF)- Portmanteau tests: Ljung-Box test and Box-Pierce test.							

	<p><b>Unit V</b>  ARIMA models: Random model ARIMA (0,0,0), Non-Stationary Random model, ARIMA(0,1,0), Stationary Auto Regressive model of order one-ARIMA (1,0,0). Stationary Moving average model of order one-ARIMA (0,0,1).-A Simple Mixed model ARIMA (1,0,1), ARIMA (1,1,1).-Seasonal Time series ARIMA(p,d,q) (P, D,Q) with ARIMA (0,1,1)(0,1,1), ARCH and GARCH models: Description and properties of these models (Without proof).</p>
Extended Professional Component (is a part of internal component only, Notto be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved  (To be discussed during the Tutorial hour)</p>
Skills acquired from this course	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Montgomery, D. C., Peck, E. A. and Vining, G. (2003): Introduction to Linear regression analysis, third edition, John Wiley and Sons, Inc.</li> <li>2. Draper, N.R. and Smith, H. (2000) : Applied Regression Analysis, 2nd edition, John Wiley &amp; Sons.</li> <li>3. Spyros Makridakis, Steven C. Wheelwright and Victor E. McGee (2012), Forecasting Methods and Applications – Second Edition, John Wiley &amp; Sons.</li> <li>4. T.M.J.A.Cooray(2008): Applied Time Series Analysis and Forecasting, NAROSA publishing house Pvt.Ltd</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Chatterjee S. and Betram Price (1977): Regression Analysis by Examples, John Wiley &amp; Sons.</li> <li>2. George E.P. Box and Gwilym M. Jenkins (1976): Time Series Analysis – Forecasting and Control, Holdne – Day Inc.</li> <li>3. Johnston J. (1984) : Econometric Methods, (3rd Edition), McGraw Hill International Book Company, New Delhi.</li> <li>4. Singh, Parashar and Singh (1997): Econometrics and Mathematical Economics (1st Edition), S. Chand &amp; Co, New Delhi.</li> </ol>
<b>Website and e-Learning Source</b>	<p><a href="http://mathforum.org">http://mathforum.org</a>, <a href="http://ocw.mit.edu/ocwweb/Mathematics">http://ocw.mit.edu/ocwweb/Mathematics</a>,  <a href="http://www.opensource.org">http://www.opensource.org</a>, <a href="http://www.mathpages.com">www.mathpages.com</a></p>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1 :** Structuring the time series data based on seasonal and non-seasonal nature.

**CLO 2:** Identifying the sationarity of the time series

**CLO 3:** Modelling time series using exponential methods and Box-Jenkings model

**CLO 4:** Fitting time series model and evaluating goodness of fit

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

### 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

  
**H.O.D of Statistics**  
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 Thanjavur-5.

  
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 THANJAVUR-613 005.

Title of the Course		Simulation Analysis					
Paper Number		EC 3					
Category	EC	Year	I	Credits	3	Course Code	TPSTECE
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		3	1	--	4		
Pre-requisite		Postgraduate level student should be able to categorical data management					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. Define the basics of simulation modeling and replicating the practical situations in organizations</li> <li>2. Generate random numbers and random variates using different techniques.</li> <li>3. Develop simulation model using heuristic methods.</li> <li>4. Analysis of Simulation models using input analyzer, and output analyzer</li> <li>5. Explain Verification and Validation of simulation model.</li> </ol>					
Course Outline		UNIT I Definition of inventory - objectives of an inventory model - Reasons for maintaining inventories-types of inventories- inventory cost-variables involved in the inventory - factors affecting inventory control.					
		UNIT II Deterministic inventory model (EOQ Model): Definition types Model -I: Derivation of EOQ Model with uniform rate of demand infinite production rate, no shortage & lead time is zero - simple problems .probabilistic inventory model -definition distinguish between deterministic model and probabilistic model.					
		UNIT III Model-II: Derivation of EOQ model with several productions runs of unequal length no shortage and lead time is zero - simple problems. Model-III: Derivation of EOQ model with uniform rate of demand, finite production rate, No shortage and lead time is zero-simple problems.					
		UNIT IV Model-IV: Derivation of EOQ model with infinite production and variable order cycle time, shortage allowed and lead time is zero-simple problems. Model-v: Derivation of EOQ model with finite production, shortage allowed and lead time is zero -simple problems.					
		UNIT V Model-VI: Probabilistic model -single period model with uniform rate of demands without set-up cost (Discrete &continuous unit)- simple problems. Model-VII: Probabilistic model-single period model with instantaneous demand without set up cost (Discrete					

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

<b>Recommended Text</b>	1. Kanthi swarup, Gupta, P.K.&Manmohan: operations research – sultan and chand & sons – New Delhi. 2. Sundarresan.V, Ganapathy Subramanian K.S, Ganasen .k A.R.Publication Re-Print 2002
<b>Reference Books</b>	1. Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill International Editions – Industrial Engineering series, 4th Edition, ISBN: 0-07-100803-9 2. Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, Discrete Event system Simulation, Pearson Education, Asia, 4th Edition, 2007, ISBN: 81-203-2832-9. 3. Geoffrey Gordon, System Simulation, Prentice Hall publication, 2nd Edition, 1978, ISBN: 81-203-0140-4. 4. Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004, ISBN : 0-87692-028-8.
<b>Website and e-Learning Source</b>	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] 1. <a href="https://nptel.ac.in/noc23_ph27/preview">https://nptel.ac.in/noc23_ph27/preview</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** Describe the role of important elements of discrete event simulation and modeling paradigm

**CLO 2:** Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.

**CLO 3:** Develop skills to apply simulation software to construct and execute goal-driven system models.

**CLO 4:** Grasping how to build appropriate simulation models together with their parameterization and the analysis of simulator output data.

**CLO 5:** Interpret the model and apply the results to resolve critical issues in a real world environment.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
**H.O.D of Statistics**  
**Rajah Serfoj Govt. College (Auto)**  
**Thanjavur-5.**

  
**CONTROLLER OF EXAMINATIONS,**  
**RAJAH SERFOJ GOVT. COLLEGE (AUTO)**  
**THANJAVUR-613 06**

Title of the Course		Actuarial Statistics					
Paper Number		EC 3					
Category	EC 3	Year	I	Credits	3	Course Code	TPSTECF
		Semester	II				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		3		1		--	4
Pre-requisite		Post graduate level student should be able to categorical data management					
Objectives of the Course		The main objective of this course is to let students know different aspects of the basics of actuarial sciences.					
Course Outline		UNIT I Actuarial statistics –definition –Role of statistics in insurance companies and business organizations –utility function –concave function – concept of risk – Risk models for short term periods – Life tables.					
		UNIT II Effective Rate of Interest – Nominal Rate of Interest – Force of Interest –Relationship between $i, i(m)$ and Present value – Effective and Nominal Rate of Discount.					
		UNIT III Annuity – Types of annuity - Present values of Immediate Annuity, Annuity-due, Increasing and Decreasing Annuities. Continuous Annuity – Accumulation of Annuities – Present value and Accumulation of Annuities increasing by step and continuously.					
		UNIT IV Investment analysis –Time value of money – Methods of investment analysis: Traditional methods, Discounted cash flow methods with problems – investment under certainty (Risky investments) – certainty-equivalent method approach – Statistical distribution method – Expected value of NPV – Variance of NPV (with problems).					
		UNIT V Simulation approach to risky investments - Break-Even analysis - Discounted Mean Term (DMT) – Volatility – Volatility of Fixed Interest Securities – DMT of Zero Coupon Bond – Variation of Volatility with respect of coupon.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this Course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Recommended Text	<p>1. Shailaja D Deshmukh. Actuarial statistics – university press (India) pvt.Ltd. Hyderabad. (Units covered: 1,2,3&amp;5)</p> <p>2.Kanti Swarup, P.K. Gupta &amp; Man Mohan: Operations Research – Sultan Chand &amp; Sons (Units covered: 4&amp; first two topics in 5)</p>
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	3. ASI Study material for subject – 102, (Units covered: form third to end in 5)
<b>Reference Books</b>	1. Dickson, C. M. D. (2005): Insurance Risk And Ruin (International Series on Actuarial Science), Cambridge University Press. 2. Bowers, N. L., Gerber, H. U., Hickman, J. C., Jones, D. A. And Nesbitt, C. J. (1997): Actuarial Mathematics, Society of Actuaries, Itasca, Illinois, U.S.A
<b>Website and e-Learning Source</b>	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] <a href="https://www.amazon.in/Actuarial-Statistics-Introduction-Using-R/dp/8173716900">https://www.amazon.in/Actuarial-Statistics-Introduction-Using-R/dp/8173716900</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** To understand the concept of insurance and its different terminologies like loss function, premium etc. along with some advanced models of demography concerning insurance industry.

**CLO 2:** understand policy values, fractional premiums and survivorships

**CLO 3:** understand contingent probabilities, contingent assurances, reversionary annuities, multiple decrement table etc.

**CLO 4:** have basic knowledge as to how the insurance industry works, how the policies are designed and the way in which premiums are fixed.

**CLO 5:** Understand and practiced real life situation for expected life tables.

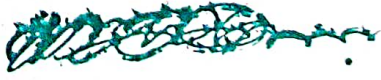
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	S	S	M	M

### 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

  
H.O.D of Statistics  
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Thanjavur-5

  
CONTROLLER OF EXAMINATIONS,  
RAJAH SERFOJ GOVT. COLLEGE (AUTONOMOUS)  
THANJAVUR-613 005.

Title of the Course		Survival Analysis					
Paper Number		EC 4					
Category	EC 4	Year	I	Credits	3	Course Code	TPSTECG
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		3	1		--	4	
Pre-requisite		Post graduate level student should be able to categorical data management					
Objectives of the Course		<p>The main objective of this course is to introduce survival analysis</p> <ol style="list-style-type: none"> <li>1. Recognize the characteristics of survival data, e.g. censoring and truncation.</li> <li>2. Determine the proper method to be used in analyzing time-to-event data (e.g., parametric, semi- parametric or non-parametric method).</li> <li>3. Understand the assumptions for the method chosen to analyze the data.</li> <li>4. Apply mathematical and graphical methods to check goodness of fit.</li> <li>5. Perform survival analysis using a computer statistical software package.</li> </ol>					
Course Outline		<b>UNIT I</b> Introduction to Survival concepts, Survival functions and hazard rates, concepts of Type I, Type II errors. Random and other types of censoring, likelihood in these cases.					
		<b>UNIT II</b> Life distributions-Exponential, Weibull, Gamma, Lognormal, Pareto distribution.					
		<b>UNIT III</b> Linear failure rate, estimation / testing under censoring setup. Life tables, failure rate, mean residual life and their elementary properties.					
		<b>UNIT IV</b> Estimation of survival functions-actuarial estimator, Product-limit (Kaplan- Meier) estimator, properties.					
		<b>UNIT V</b> Cox proportional hazards regression models with one and several covariates, exponential, Weibull, lognormal regression.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this Course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

<b>Recommended Text</b>	1. Miller, R.G. (1981) : Survival analysis, John Wiley. Cox, D.R. and Oakes, D. (1984) : Analysis of survival data, Chapman & Hall, New York. 2. Gross, A.J. and Clark, V.A. (1975) : Survival distribution: Reliability applications in the Biomedical sciences, John Wiley and Sons.
<b>Reference Books</b>	1. Elandt-Johnson, R.E. Johnson, N.L. : Survival models and data analysis, John Wiley & sons. 2. Kalbfleish, J.D. and Prentice R.L. (1980) : The statistical analysis of failure time data, John Wiley.
<b>Website and e-Learning Source</b>	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] 1. <a href="https://www.bca.edu.au/course-information/study-guides/">https://www.bca.edu.au/course-information/study-guides/</a> 2. <a href="https://www.bca.edu.au/course-information/study-guides/">https://www.bca.edu.au/course-information/study-guides/</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** To understand concepts of censoring, survival and hazard functions

**CLO 2:** To understand various survival distributions and its applications

**CLO 3:** To understand the parametric and non-parametric estimation of survival function

**CLO 4:** To develop regression model for survival data

**CLO 5:** To develop Life tables, failure rate, mean residual life


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
**H.O.D of Statistics**  
 Rajah Serfoj Govt. College (Autonomous)  
 Thanjavur-5.

  
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 RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)  
 THANJAVUR-613 005.

Title of the Course		ECONOMETRICS					
Paper Number		EC 4					
Category	EC 4	Year	I	Credits	3	Course Code	TPSTECH
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		3	1	--	4		
Pre-requisite		Post graduate level student should be able to categorical data management					
Objectives of the Course		<p>1. The purpose of this course is to give students a solid foundation in econometric techniques, various functions for economic analysis and future forecasting.</p> <p>2. Know the Scope and objectives of Econometrics</p> <p>3. Understand models of Econometrics and estimation of parameters of econometric models</p> <p>4. Understand the regression analysis.</p>					
Course Outline		<p>UNIT I Econometrics - Introduction, methodology of Econometrics Interpretation on regression - statistical versus deterministic - nature ad sources of data - Accuracy of data - Measurement of scales of variables - the role of computers.</p> <p>UNIT II Two variates regression model: Concept of population regression function - the meaning of the term linear - stochastic specification of PRF - significance of the stochastic disturbance term - sample regression function.</p> <p>UNIT III The method of least square - classical linear regression model properties of LS estimates - Gauss-Markov theorem (without proof) - C efficient of determination</p> <p>UNIT IV Regression analysis and analysis of variance - using application of Regression analysis, Prediction - reporting the results of Regression analysis - evaluating the results of Regression analysis.</p> <p>UNIT V Regression through origin - Regression on standard variables - functional forms - log linear model - semi log models - reciprocal models - Choice of functional form.</p>					

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

<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Gujarati, D.N. and Sangeetha (2008), Basic Econometrics , McGraw Hill Co, New Delhi.</li> <li>2. J.Johnston (1984), Economic methods , M cGraw Hill Co, New Delhi.</li> <li>3. Ronald J. Wonnacott and Thomas H. Wonnacott (1979) Econometris, Wiley Series.</li> <li>4. Johnson, A.C., Johnson, M. B., and Buse, R. C. (1987). Econometrics: Basic and Applied, Maxmillan.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Koutsoyannis. A (2001). Theory of Econometrics, Palgrave Macmillan.</li> <li>2. Singh, S. P., Parashar, A. K., and Singh, H. P. (1999) Econometrics and Mathematical Economics, S.Chand &amp; Co., Private Limited, New Delhi, India</li> </ol>
<b>Website and e-Learning Source</b>	<p>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</p> <ol style="list-style-type: none"> <li>1. <a href="https://www.dynamictutorialsandservices.org/2014/05/business-economics-meaning-naturescope.html">https://www.dynamictutorialsandservices.org/2014/05/business-economics-meaning-naturescope .html</a></li> <li>2. <a href="https://en.wikipedia.org/wiki/Instrumental_variables_estimation#Interpretation_as_twostage_least_squares">https://en.wikipedia.org/wiki/Instrumental_variables_estimation#Interpretation_as_twostage_least_squares</a></li> <li>4. <a href="http://www.worldcat.org/identities/lccn-n77006068">http://www.worldcat.org/identities/lccn-n77006068</a></li> <li>5. <a href="https://books.google.com/books/about/Econometric_Methods.html?id=iy7AAAAIAAJ">https://books.google.com/books/about/Econometric_Methods.html?id=iy7AAAAIAAJ</a></li> </ol>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** Identify the point estimation method for normal and non-normal cases

**CLO 2:** Classify the divisions of econometrics

**CLO 3:** Choose the first and second order random process

**CLO 4:** Utilize the applications of Markov process.

**CLO 5:** Distinguish the auto correlation and cross correlation types.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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**

  
**H.O.D of Statistics**  
**Rajah Serfoji Govt. College (Auto)**  
**Thanjavur-5.**

  
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**RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)**  
**THANJAVUR-613 005.**

Title of the Course		Statistics Practical –I (Based on CC-II, III, IV and VI)					
Paper Number		SEC 1					
Category	SEC 1	Year	I	Credits	2	Course Code	T2PSTSP1
		Semester	II				
Instructional Hours per week		Lecture		Tutorial	Lab Practice	Total	
		1		-	3	4	
Pre-requisite		Based on statistical techniques					
Objectives of the Course		The main objectives of this course are: The main purpose of using statistical techniques is to plan the collected data in terms of practices.					
Course Outline		<p><b>Unit-I:</b> Simple Random Sampling Estimation of Population Parameters, Estimations of sample size – PPS selections Methods , Estimation in PPSWR total and its sampling variance – PPSWOR – Midzuno Method – Ordered Estimators – Des Raj’s ordered Estimators – Unordered estimators – Horvitz Thompson estimators. Stratified Sampling – Estimate mean and variance –</p> <p><b>Unit-II:</b> Systematic Sampling Methods Ratio Estimation – Unbiased Ratio Type estimators – Regression Estimation -Double Sampling for Ratio and Regression Estimation. Multistage sampling – Two Stage sampling with equal and unequal first stage units – Optimum allocation – Equal and Unequal first stage Units.</p> <p><b>Unit-III:</b> Laplace and Cauchy distribution, lognormal distribution, gamma distribution. (Using Jacobian of transformation). Non-central chi-square, t and F distributions. Order statistics - Joint and marginal distributions. Kolmogorov Smirnov distributions, exponential, Weibull and extreme value distributions Mills ratio.</p> <p><b>Unit-IV</b> Sufficient statistics, Neyman-Fisher Factorisation theorem, Unbiased estimation: MVUE, locally MVUE, Maximum likelihood estimation, Best Asymptotically Normal estimators, Method of moments.</p> <p><b>Unit-V:</b> Time Series analysis: Absolute measures and Relative measures. Smoothing methods: Single exponential smoothing, Double exponential smoothing (Holtmethod), and Triple exponential smoothing (Holt-Winter’s method). Decomposition method: Kruskal-Wallis test for seasonality - Moving average Forecasting – Spencer’s and Henderson’s moving averages. ARIMA models: Random model Non-Stationary Random model, Stationary Auto Regressive model of order one-ARIMA . Stationary Moving average model of order one-ARIMA.</p>					
Extended Professional Component (is a part of internal component only,Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					

Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	<ol style="list-style-type: none"> <li>1. S.Sampath (2005) : Sampling Theory and Methods, Narosha Publishing House.</li> <li>2. W.G. Cochran (1965) : Sampling Techniques, Wiley and Sons</li> <li>1. Rohatgi V.K (1976), Introduction to probability theory and mathematical statistics, John Wiley and Sons., New York.</li> <li>3. Rao, C.R. (1973) : Linear statistical inference and its applications, 2ed, Wiley Eastern.</li> <li>4. V.K.Rohatgi et al(2002) : An introduction to probability and statistics, John Wiley.</li> <li>Lehmann, E.L. (1983): Theory of point estimation, John Wiley.</li> </ol>
Reference Books	<ol style="list-style-type: none"> <li>1. Mood, A.D. Graybill, F.A. and Boes, D.C (1974): Introduction to the Theory of Statistics, 3/e, Mc.Graw Hill, New York.</li> <li>2. Montgomery, D. C., Peck, E. A. and Vining, G. (2003): Introduction to Linear regression analysis, third edition, John Wiley and Sons, Inc.</li> <li>3. Draper, N.R. and Smith, H. (2000): Applied Regression Analysis, 2nd edition, John Wiley &amp; Sons.</li> </ol>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1:** To apply advanced levels of sampling methods for different types of data.

**CLO-2:** To use practical applications of ratio and regression method of estimations.

**CLO-3:** To interpret the properties of special univariate continuous distributions, truncated normal distribution and few non-central distributions.

**CLO-4:** To practice real life data for the consistency, sufficiency and unbiasedness.

**CLO-5:** Structuring the time series data based on seasonal and non-seasonal nature.

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



**H.O.D of Statistics**  
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**THANJAVUR-613 005.**

Title of the Course		Testing of Statistical Hypothesis					
Paper Number		CORE VII					
Category	Core	Year	II	Credits	5	Course Code	T3PSTC7
		Semester	III				
Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total			
	5	1	--	6			
Pre-requisite		Probability Theory					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. To get theoretical knowledge in Statistical Testing procedure</li> <li>2. To provide knowledge about Most Powerful test and how to build it</li> <li>3. To understand concepts Unbiasedness for hypotheses testing, invariance, LikelihoodRatio tests and SPRT test</li> <li>4. To develop analytical thinking in statistical testing of hypothesis.</li> </ol>					
Course Outline		<b>Unit I:</b> Uniformly most powerful tests, the Neyman-Pearson fundamental Lemma, Distributionswith monotone likelihood ratio Problems					
		<b>Unit II:</b> Generalization of the fundamental lemma, two sided hypotheses, testing the mean andvariance of a normal distribution.					
		<b>Unit III:</b> Unbiasedness for hypotheses testing, similarly and completeness, UMP unbiased tests for multi parameter exponential families, comparing two Poisson or Binomial populations, testing the parameters of a normal distribution (unbiased tests), comparing the mean and variance of twonormal distributions.					
		<b>Unit IV:</b> Symmetry and invariance, maximal invariance, most powerful invariant tests.					
		<b>Unit V:</b> SPRT procedures, likelihood ratio tests, locally most powerful tests, the concept of confidence sets, non-parametric tests.					

Extended Professional Component (is a part of internal component only, Notto be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. V.K.Rohatgi et al(2002) : An introduction to probability and statistics, John Wiley. 2. Lehmann, E.L. (1986) : Testing of statistical hypothesis, John Wiley.
Reference Books	1. Ferguson, T.S. (1967) : Mathematical statistics, A decision theoretic approach, Academic press. 2. Rao, C.R. (1973) : Linear statistical inference and its applications, Wiley Eastern, 2nd ed. 3. Gibbons, J.D. (1971) : Non-parametric statistical inference, McGraw Hill.
Website and e-Learning Source	e-books, online tutorials taken from MOOC/SWAYAM platform for this subject. 1. <a href="https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=34">https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=34</a> 2. <a href="https://nptel.ac.in/courses/103/106/103106120/">https://nptel.ac.in/courses/103/106/103106120/</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1:** To do Most Powerful test for randomized and nonrandomized test.

**CLO-2 :** To understand and classify unbiasedness and invariance concepts in testing.

**CLO-3 :** To understand theory of LR and SPRT testing and able to solve problems on it.

**CLO-4 :** To do numerical problems and able to get critical thinking to solve real life problems

**CLO-5 :** To create suitable statistical hypothesis and identify its testing procedure for real life problems.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	M	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

**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**

  
**H.O.D of Statistics**  
**Rajah Serfoj Govt. College (Aut-**  
**Thanjavur-5.**

  
**CONTROLLER OF EXAMINATIONS,**  
**RAJAH SERFOJ GOVT. COLLEGE (AUTONOMOUS)**  
**THANJAVUR-613 005.**

Title of the Course		Multivariate Analysis					
Paper Number		CORE VIII					
Category	Core	Year	II	Credits	5	Course Code	T3PSTC8
		Semester	III				
Instructional Hours per week	Lecture		Tutorial		Lab Practice	Total	
	5		1		--	6	
Pre-requisite		Univariate and Multivariate distribution theory and Linear Algebra					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. To impart basic theoretical knowledge about multivariate normal distribution, its properties to deal with multi-dimension data.</li> <li>2. To Derive inference based on multivariate statistical analysis concerning Mean vector and Covariance matrix.</li> <li>3. To provide requisite knowledge to handle multi-dimensional data with regard to dimensionality reduction using Principal Component and Factor Analysis.</li> <li>4. To imbibe skills to classify and assign a new item/object to any of the two or more populations using Discrimination and Classification.</li> <li>5. To instruct theoretical knowledge to group variables or items that belong to multi- dimensional data using Cluster algorithms</li> </ol>					
Course Outline		<b>UNIT I:</b> Multivariate Normal Distribution and Its Properties. Maximum Likelihood Estimators of Parameters, Distribution of Sample Mean Vector, Sample Dispersion Matrix.					
		<b>Unit II:</b> Partial and multiple correlation coefficients- Null distribution - Application in testing. Null distribution of Hotelling's $T^2$ statistics. Application in tests on mean vector for one and more multivariate normal populations and also on equality of the components of a mean vector in a multivariate normal population					
		<b>UNIT III:</b> Classification and discrimination procedures for discrimination between two multivariate normal populations – Linear Discriminant function, Mahalanobis Distance, tests associated with Discriminant functions, probabilities of misclassification and their estimation, classification into more than two multivariate normal populations.					
		<b>Unit IV:</b> Principal component Analysis, Canonical variables and canonical correlation, clustering-similarity measures- hierarchical algorithms- Single Linkage, Non-hierarchical Clustering.					
		<b>Unit V:</b> Contingency Tables, Correspondence Analysis for Two Dimension Contingency Table.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Anderson, T.W. (1983): An Introduction To Multivariate Statistical Analysis. 2nd Ed.Wiley. 2. Johnson,R.& Wichern(2008): Applied Multivariate Statistical Analysis, Pearson, 6ed
Reference Books	1. Brain S. Everitt and Graham Dunn (2001): Applied Multivariate Data Analysis, 2ndEd.(chap 4) 2. Neil H.Timm (2002): Applied Multivariate Analysis – Springer-Verlag 3. Dallas E.Johnson (1998) :Applied Multivariate Methods For Data Analysts- DuxburyPress 4. William R Dillon and Mathew Goldstein (1984): Multivariate Analysis Methods AndApplications, John Weily
Website and e-Learning Source	E-books, online tutorials taken from MOOC/SWAYAM platform for this subject. 1. <a href="https://nptel.ac.in/courses/111/104/111104024/">https://nptel.ac.in/courses/111/104/111104024/</a> 2. <a href="https://nptel.ac.in/courses/111/105/111105091/">https://nptel.ac.in/courses/111/105/111105091/</a> 3. <a href="https://nptel.ac.in/courses/106/106/106106139/">https://nptel.ac.in/courses/106/106/106106139/</a> 4. <a href="https://www.classcentral.com/course/swayam-applied-multivariate-analysis-13898">https://www.classcentral.com/course/swayam-applied-multivariate-analysis-13898</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO - 1:** To explain and interpret the importance of data that come from high dimensional setup using appropriate properties.

**CLO - 2:** To draw inference based on multi-variate statistical analysis concerning Mean vector and Covariance matrix.

**CLO - 3:** To reduce dimensions and identify factors from multi-dimensional data using Principal Component and Factor Analysis respectively.

**CLO - 4:** To classify and assign a new item/object to any of the two or more populations using Discrimination and Classification.

**CLO - 5:** To group variables or items that belong to multi-dimensional data using Clustering algorithms.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	M	M
CO2	S	S	S	M	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

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

  
**H.O.D of Statistics**  
**Rajah Serfoji Govt. College (Autr**  
**Thanjavur-5.**

  
**CONTROLLER OF EXAMINATION:**  
**RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)**  
**THANJAVUR-613 005.**

Title of the Course		Linear Models					
Paper Number		CORE IX					
Category	Core	Year	II	Credits	5	Course Code	T3PSTC9
		Semester	III				
Instructional Hours per week	Lecture		Tutorial		Lab Practice		Total
	4		1		--		5
Pre-requisite		UG level linear regression analysis and Statistical Inference					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. To model cross sectional data using minimum number of parameters</li> <li>2. To estimate unbiased estimators for model parameters</li> <li>3. To estimate standard errors of estimates to construct the confidence intervals.</li> <li>4. To test the goodness of fit of the models</li> </ol>					
Course Outline		<p><b>Unit I:</b> Linear Models – Classification, Estimability. The General Linear Hypothesis of Full Rank – Point Estimation (Estimation Under Normal Theory) – Gauss–Markov theorem, Tests of Hypothesis – Testing the Hypothesis <math>\beta = \beta^*</math>.</p> <p><b>Unit – II :</b>Introduction to Generalized Linear Models: Components of Generalized Linear Model, Binomial Logit Model, Poisson Loglinear Model, Deviance, Linear Probability Model, Logistic Regression Model, Probit and Inverse CDF Link Function, GLM for Counts, Inference for GLM, Deviance and Goodness of Fit, Deviance for Poisson and Binomial Models.</p> <p><b>Unit – III:</b> Methods of Estimations – ordinary least squares, generalized least square, maximize likelihood, BLUE.</p> <p><b>Unit – IV:</b> General Linear Hypothesis – four common hypotheses – reduced models – null model – saturated model.</p> <p><b>Unit – V:</b> Regression and dummy variables – grouped variables – unbalanced data - describing linear models- 1-way classification, 2-way classification, 3-way classification – main and interaction effects - Models not of full rank.</p>					

Extended Professional Component (is a part of internal Component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1 . S.R. Searle, Linear Models, John Wiley, 1971. 2. Radhakrishna Rao, "Linear Statistical Inference and its Applications" Wiley-Interscience, 2ed   2001   ISBN: 0471218758
Reference Books	1. Alan Agresti, (2002): Categorical Data Analysis, Wiley Interscience, John Wiley & Sons. 2.
Website and e-Learning Source	E-books, online tutorials taken from MOOC/SWAYAM platform for this subject.

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1:** Understand about statistical modelling

**CLO-2:** To model the given cross sectional data

**CLO-3:** To evaluate the model

**CLO-4:** Interpret the model based on the variables involved

**CLO-5:** To predict using fitted model


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

**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**

  
**H.O.D of Statistics**  
**Rajah Serfoji Govt. College (Auto)**  
**Thanjavur-5.**

  
**CONTROLLER OF EXAMINATIONS**  
**RAJAH SERFOJI GOVT. COLLEGE (AUTON.)**  
**THANJAVUR-613 005.**

Title of the Course		Design of Experiments (Industry Module)					
Paper Number		CORE X					
Category	Core	Year	II	Credits	4	Course Code	T3PSTC10
		Semester	III				
Instructional Hours per week		Lecture		Tutorial	Lab Practice	Total	
		5			--	5	
Pre-requisite		Linear Models and field experiments					
Objectives of the Course		<p>1. To get theoretical knowledge in Statistical Design of experiments and analysis of variance</p> <p>2. To build strong theoretical foundation in Orthogonal latin squares, Hyper Graeco Latinsquares, factorial and fractional factorial experiments, PIBD, inter and intra blocks, split plot, analysis covariance, Response surface methodology</p> <p>3. To develop analytical thinking in problem solving skills</p>					
Course Outline		<b>Unit I:</b> Review of basic designs; Orthogonal latin squares, Hyper Graeco Latin squares – analysis of variance – multiple comparisons – multiple range tests - Missing plot technique.					
		<b>Unit II:</b> General factorial experiments, study of 2 and 3 factorial experiments in randomized blocks; complete and partial confounding; Fractional designs for symmetric factorials; basic idea of asymmetric factorials					
		<b>Unit III:</b> General block design and its information matrix (C), criteria for connectedness, balanced and orthogonality; BIBD – recovery of inter block information; PBIBD(2).- Association scheme, Intra block analysis, Lattice Design –analysis; Youden design – intra block analysis;					
		<b>Unit IV:</b> Nested and split plot designs – Two stage nested designs, split plot designs, split plot plot designs, strip-split designs, Analysis of covariance with one, two covariates; clinical trials.					
		<b>Unit V:</b> Response surface methodology - first order and second order rotatable designs, applications:					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved</p> <p>(To be discussed during the Tutorial hour)</p>					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		<p>1. Das, M.N. and Giri, N. (1979) : Design and analysis of experiments, Wiley Eastern.</p> <p>2. John, P.W.M. (1971) : Statistical design and analysis of experiments, Macmillan.</p>					

<b>Reference Books</b>	1. Montgomery, C.D. (2001) : Design and analysis of experiments, John Wiley, NewYork. 2. Robert, O., Kuehl(2000) : Design of experiments. Statistical principles of research design and analysis, Duxbury. 3. Federer, W.T.(1963) : Experimental design; Theory and application, Oxford & IBH publishing Co.
<b>Website and e-Learning Source</b>	E-books, online tutorials taken from MOOC/SWAYAM platform for this subject. 1. <a href="https://nptel.ac.in/courses/110/105/110105087/">https://nptel.ac.in/courses/110/105/110105087/</a> 2. <a href="https://nptel.ac.in/courses/111/104/111104075/">https://nptel.ac.in/courses/111/104/111104075/</a> 3. <a href="https://nptel.ac.in/courses/110/105/110105087/">https://nptel.ac.in/courses/110/105/110105087/</a>

### 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 Graeco Latin squares, factorial and fractional factorial experiments, PIBD, inter and intra blocks, split plot, analysis covariance.

**CLO-3:** To understand clinical trial concepts and Response surface methodology

**CLO-4:** To do numerical problems and able to get critical thinking to solve problems

**CLO-5:** To choose suitable experiment and do it for real life problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	M
CO2	S	S	M	S	M	S	S	S	M	M
CO3	S	S	S	M	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	S	S	M	M	S	S	S	M	S

### 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

  
**H.O.D of Statistics**  
 Rajah Serfoj Govt. College (Autc)  
 Thanjavur-5.

  
**CONTROLLER OF EXAMINATIONS**  
 RAJAH SERFOJ GOVT. COLLEGE (AUTONOMOUS)  
 THANJAVUR-613 005.

Title of the Course		Operations Research					
Paper Number		EC 5					
Category	EC 5	Year	I	Credits	3	Course Code	TPSTECI
		Semester	III				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		
Pre-requisite		Post graduate level student should be able to categorical data management					
Objectives of the Course		<p>The main objective of this course is to introduce operations research</p> <ol style="list-style-type: none"> <li>1. To develop the optimization techniques that will be useful in the personal and professional life.</li> <li>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.</li> <li>3. To impact knowledge in concepts and tools of operations research.</li> <li>4. To understand mathematical models used in operations research.</li> <li>5. To apply these techniques constructively to make effective business decisions.</li> </ol>					
Course Outline		<b>UNIT I :</b> The General Linear Programming Problem (GLPP): Properties and Solutions of the LPP; Graphical Method, Theory and Computational Algorithm of Simplex Method, Duality Theorem.					
		<b>UNIT II</b> Transportation problem; Balanced and Unbalanced problems; Mathematical Model of Transportation Problem; Methods for finding initial basic feasible solution; North-West Corner rule, Least cost method, Vogel's approximation method, Test for Optimality; Modi method. Assignment problem; Hungarian method.					
		<b>UNIT III:</b> Sequencing Problem with 'n' jobs and 2 machines, problems with 'n' jobs and 3 machines. Integer programming- Branch and Bound method, Dynamic programming – principles of optimality, recursive equation approach, characteristic of dynamic programming problem.					
		<b>UNIT IV:</b> Game theory: Two person Zero sum games; Pure strategy; Mixed strategy ; Dominance; m x n games; Graphical solution. CPM; PERT; float and Slack; Advantages of Networks.					
		<b>UNIT V:</b> S-S policy for inventory, Inventory problems: definition, concepts of various costs - inventory models: EOQ model with constant rate of demand; EOQ model with different rates of demand; estimation of EOQ in some simple cases.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>					
Skills acquired from this Course		<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>					

<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. <b>Taha, H.A.</b>(2007).Operation Research – An Introduction, 8<sup>th</sup> Edn. Prentice Hall.</li> <li>2. <b>Sharma, S</b> (2006). Introductory Operations Research, Discovery Publishing House.</li> <li>3. <b>Starr, M.K. and Miller D.W.</b> Inventory Control Theory and Practice, Prentice Hall.</li> <li>4. <b>Wagner, H.M</b> Principles of Operations Research with applications to managerial decision Prentice-Hall.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Montgomery, D. C., Peck, E. A. and Vining, G. G. (2003): Introduction to Linear regression analysis, third edition, John Wiley and Sons, Inc.</li> <li>2. Zar, J.H. (2006): Bio-statistical Analysis, fourth edition, Pearson education.</li> <li>3. Douglas C. Montgomery (2012) Introduction to Linear Regression Analysis.</li> <li>4. Iain Pardoe (2012): Applied regression Modelling, second edition, Wiley</li> </ol>
<b>Website and e-Learning Source</b>	<p>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc]</p> <ol style="list-style-type: none"> <li>1. <a href="https://en.wikipedia.org/wiki/Linear_programming">https://en.wikipedia.org/wiki/Linear_programming</a></li> <li>2. <a href="https://www.geeksforgeeks.org/transportation-problem-set-1-introduction">https://www.geeksforgeeks.org/transportation-problem-set-1-introduction</a></li> <li>3. <a href="https://en.wikipedia.org/wiki/Network_analysis_%28electrical_circuits%29">https://en.wikipedia.org/wiki/Network_analysis_%28electrical_circuits%29</a> <a href="https://books">https://books</a></li> <li>4. <a href="http://library.net/files/books-library.online-01251340Yz1V8.pdf">library.net/files/books-library.online-01251340Yz1V8.pdf</a></li> <li>5. <a href="https://link.springer.com/chapter/10.1007/978-3-319-07863-2_55">https://link.springer.com/chapter/10.1007/978-3-319-07863-2_55</a></li> </ol>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** Understand basics and formulation of linear programming problems and appreciate their limitations; solve linear programming problems using graphical method.

**CLO 2:** Gain knowledge about sequencing problems, travelling salesman problem and various methods to solve sequencing problems.

**CLO 3:** Analyse and Solve artificial variable technique, duality theory, revised simplex method, sensitivity analysis, transportation and assignment problems.

**CLO 4:** Evaluate and apply simplex method to solve real life problems

**CLO 5:** Be able to build and solve Game theory, PERT/ CPM, simulation, investment analysis with real life applications.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
**H.O.D of Statistics**  
 Rajah Serfoj Govt. College (Auton)  
 Thanjavur-5.

  
 CONTROLLER OF EXAMINATIONS  
 RAJAH SERFOJ GOVT. COLLEGE (AUTONOM)  
 THANJAVUR-613 005.

Title of the Course		DATABASE MANAGEMENT SYSTEMS					
Paper Number		EC 5					
Category	EC 5	Year	I	Credits	3	Course Code	TPSTECJ
		Semester	III				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		4		1		--	5
Pre-requisite		Post graduate level student should be able to categorical data management					
Objectives of the Course		<ol style="list-style-type: none"> <li>1.To Understand the basic concepts and the applications of database systems</li> <li>2. Explain the role of database administration.</li> <li>3.To Master the basics of SQL and construct queries using SQL</li> <li>4.To understand the relational database design principles</li> <li>5.To become familiar with the basic issues of transaction processing and concurrency control</li> <li>6.To become familiar with database storage structures and access techniques</li> </ol>					
Course Outline		<b>UNIT I</b>					
		Databases and Database Users: Introduction, characteristics of data base intended uses of a DBMS, advantages and implication of database appro Database Systems Concepts and Architecture: Data models, schemas and DBMS architecture and data independence, database languages and inter database system environment, classification of data base management sy					
		<b>UNIT II</b>					
		Data Modelling: High level conceptual data models for database design. Entity types, entity sets, attributes, and keys. Relationships, relationship types, roles, and structural constraints. Weak entity types. ER diagrams and design issues.					
		<b>UNIT III</b>					
Relational Data Model and Relational Algebra: Brief discussion on CODD rules, relational model concepts, constraints, and schemas. Update operation on relations, basic and additional relational algebra operations, and queries in relational algebra.							
		<b>UNIT IV</b>					
		Structured Query Language (SQL): Data definition etc. in SQL2. Basic a queries in SQL. Insert, delete, update statements, and views in SQL, em Database Design: Design guidelines for relational schemas, functional Dependencies, normalization -1st, 2nd, 3rd, 4th and 5th normal forms. D design process, factors influencing physical database design guidelines, guidelines for relational systems					
		<b>UNIT V</b>					
		Record Storage and Primary File Organizations: Secondary storage devices, buffering of blocks, placing file records on disk, operations on files, heap files and sorted files, hashing techniques					

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

<b>Recommended Text</b>	<b>TEXT BOOKS:</b> 1. Ramez Elmasri and Shamkanth B. Navathe, “Fundamentals of Database Systems”, Pearson Education, 5th Edition, 2008, ISBN: 978- 81- 317 – 1625-0. 2.. Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition. 3. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition
<b>Reference Books</b>	<b>REFERENCE BOOKS:</b> 1. Fundamentals of Database Systems, Elmasri Navathe Pearson Education. 2. An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, Pearson, Eight Edition. 3. Raghu Ramakrishnan, “Database Management System”, McGraw Hill, 3rd Edition, 1997, ISBN: 0071230572 4.Gary W. Hansen and James V. Hansen, “Database Management and Design” PHI Pvt. Ltd., 2nd Edition, 1995 ISBN: 81-203-1465-4

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** Demonstrate the basic elements of a relational database management system

**CLO 2:** Ability to identify the data models for relevant problems

**CLO 3:** Ability to design entity relationship and convert entity relationship diagrams into

SQL queries on the respect data

**CLO 4:** Apply normalization for the development of application software's

**CLO 5:** Analyse different information storage scenarios and derive appropriate data models.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
**H.O.D of Statistics**  
**Rajah Serfoj Govt. College (Aut**  
**Thanjavur-5.**

  
**CONTROLLER OF EXAMINATIONS,**  
**RAJAH SERFOJ GOVT. COLLEGE (AUTONOMOUS)**  
**THANJAVUR-613 005.**

Title of the Course		Statistics Practical –II							
Paper Number		SEC 2 (CC-7 & CC-8)							
Category	SEC	Year	II	Credits	2	Course Code	T3PSTSP2		
		Semester	III						
Instructional Hours per week		Lecture	-	Tutorial	-	Lab Practice	3	Total	3
		Pre-requisite		Hands on practiced to testing of hypothesis and multivariate analysis.					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> <li>1. The main purpose of using statistics is to plan the collected data in terms of experimental and statistical surveys.</li> <li>2. It assists the students practically to make use of the statistical data, based on the statistical inference for testing of hypothesis and demographical data.</li> <li>3. This course is based on both Based on CC7 and CC8 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</li> </ol>							
Course Outline		<p><b>Unit-I</b> Uniformly Most Powerful Tests-Distributions with Monotone Likelihood Ratio Problems. Testing the Mean and variance of a Normal Distribution- Two Sided Hypotheses.</p> <p><b>Unit-II</b> UMP Unbiased Tests for Multi Parameter Exponential Families, Comparing Two Poisson, Binomial Populations, Testing The Parameters of a Normal Distribution (Unbiased Tests), Comparing The Mean And Variance Of Two Normal Distributions.</p> <p><b>Unit-III</b> Symmetry And Invariance, Maximal Invariance, Most Powerful Invariant Tests. SPRT Procedures, Likelihood Ratio Tests, Locally Most Powerful Tests- Non-Parametric Tests.</p> <p><b>Unit-IV</b> Multivariate Normal Distribution - Maximum Likelihood Estimators of parameters, Distribution of Sample Mean Vector- Partial and multiple correlation coefficients- Null distribution of Hotelling's <math>T^2</math> Statistic (a) Testing for <math>\mu = \mu_0</math> (b) Testing <math>\mu_1 = \mu_2</math> Linear Discriminant function,</p> <p><b>Unit-V</b> Mahalanobis Distance- Tests associated with Discriminant functions, probabilities of misclassification and their estimation, classification into more than two multivariate normal populations. Principal component Analysis, Canonical variables and canonical correlation, clustering-Single Linkage, Non-hierarchical Clustering - Correspondence Analysis for Two Dimension Contingency Table</p>							
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)							
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill							

Recommended Text	1. V.K.Rohatgi et al (2002) : An introduction to probability and statistics, John Wiley. 2. Lehmann, E.L. (1986) : Testing of statistical hypothesis, John Wiley 3. Anderson, T.W. (1983): An introduction to Multivariate analysis, (2nd Edn) John Wiley. 4. Johnson, A.R. and Wichern, W.D. (1988): An introduction to applied multivariate analysis, Prentice Hall, India
Reference Books	1. Ferguson, T.S. (1967) : Mathematical statistics, A decision theoretic approach, Academic press. 2. Rao, C.R. (1973) : Linear statistical inference and its applications, Wiley Eastern, 2nd ed. 3. Gibbons, J.D. (1971) : Non-parametric statistical inference, McGraw Hill. 4. Anderson, T. W. (2003): An Introduction to Multivariate Statistical Analysis, 3rd edition, John Wiley & Sons. 5. Hair, J.F., Anderson, R.E., Tatham. R.L. and Black, W.C. (2006): Multivariate Data Analysis, 5th edition, Pearson Education, Asia.

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1:** Understand Hypothesis various advanced statistical techniques for modelling and exploring practical situations.

**CLO-2:** Solving the problems related to testing of hypothesis (Large sample & small sample test)

**CLO-3:** Practiced in real life problems based on Likelihood ratio tests, locally most powerful tests and Non parametric tests.

**CLO-4:** Understand Wishart distribution, Hotelling  $T^2$  and Mahalanobis  $D^2$  statistic.

**CLO-5:** Implement dimension reduction techniques using software on real life problems.

	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

  
**H.O.D of Statistics**  
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 Thanjavur-5.

  
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 RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)  
 THANJAVUR-613 005.

Title of the Course		Stochastic Process					
Paper Number		CORE XI					
Category	Core	Year	II	Credits	5	Course Code	T4PSTC11
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		5	1	--	6		
Pre-requisite		Post graduate level applications of probability theory and distribution theory.					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. To expose the basic concepts of the theory of stochastic processes and develops the mathematical theory of random processes.</li> <li>2. It provides the fundamentals and advanced concepts of probability theory and help them appreciate and understand the application of the mathematical tool.</li> <li>3. To describe the advanced topics related to continuous and discrete time random processes.</li> </ol>					
Course Outline		<b>Unit I:</b> Definition of Stochastic process – Specification of Stochastic Processes. Stationary Processes – Second order process, Stationarity, Gaussian processes. Martingales: Definition and properties., Martingales in discrete time - Supermartingales and submartingales - Continuous Parameter Martingales- Martingale convergence theorem and its applications					
		<b>Unit II:</b> Markov chains – Definitions and examples. Higher order transition probabilities: Chapman – Kolmogorov equation. Classification of States and Chains – Determination of Higher order Transition Probabilities -Aperiodic Chain: Limiting Behaviour. Stability of a Markov system.					
		<b>Unit III:</b> Poisson process – Poisson process and related distributions. Pure Birth Process – Birth and Death process – Simple examples. Branching process – properties of generating function of branching process – Probability of extinction – fundamental theorem of branching process.					
		<b>Unit IV:</b> Renewal theory - Renewal equation - Stopping time - Wald's equation - Elementary renewal theorem and its applications - Renewal reward processes - Residual and Excess life times - Markov renewal and Semi Markov processes					
		<b>Unit V:</b> Queuing model M/M/1: Steady State Behaviour - Steady State Solution, Waiting time distribution. Queuing Model M/M/S - Steady State Solution, Waiting time distributions – simple problem.					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Medhi, J. (1984): Stochastic Processes, New Age International Publishing Limited, New Delhi. (Reprint 2002). 2. Karlin, S. and Taylor H.M. (1996): First Course in Stochastic Process, Academic Press.
Reference Books	1. Prabhu. N.U. (1965) : Stochastic Process, Macmillan, New York. 2. Ross, S.M (1996): Stochastic Processes, 2nd Edition, John Wiley & Sons, New Delhi.
Website and e-Learning Source	E-books, online tutorials taken from MOOC/SWAYAM platform for this subject. 1. <a href="https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=34">https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=34</a> Paper: P-10. Stochastic Processes and Time Series Analysis - ISI, Kolkata 2. <a href="https://nptel.ac.in/courses/111/103/111103022/">https://nptel.ac.in/courses/111/103/111103022/</a> Stochastic Processes – IIT Guwahati 3. <a href="https://nptel.ac.in/courses/111/102/111102098/">https://nptel.ac.in/courses/111/102/111102098/</a> Introduction and Motivation for studying Stochastic Processes – IIT Delhi 4. <a href="https://www.stat.auckland.ac.nz/~fewster/325/notes/325book.pdf">https://www.stat.auckland.ac.nz/~fewster/325/notes/325book.pdf</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO- 1:** To equip their knowledge with theoretical and practical skills are necessary for the analysis of stochastic dynamical system in economic, financial mathematics, engineering, business and other fields.

**CLO- 2:** To attain knowledge about stochastic process in the time domain such as Markov processes with a discrete state space, including Markov chains, Poisson processes and birth and death processes.

**CLO- 3:** To demonstrate the specific applications to Poisson and Gaussian processes.

**CLO- 4:** To carry out derivations involving conditional probability distributions and conditional expectations.

**CLO- 5:** To define basic concepts from the theory of Markov chains and present proofs for the most important theorems.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	S	S	S	S	S	M
CO4	S	S	S	S	S	M	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

**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**

  
**H.O.D of Statistics**  
**Rajah Serfoj Govt. College (Auto**  
**Thanjavur-5.**

  
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**THANJAVUR-613 005.**

Title of the Course		Machine Learning Techniques							
Paper Number		CORE XII							
Category	Core	Year	II	Credits	5	Course Code	T4PSTC12		
		Semester	IV						
Instructional Hours per week		Lecture	5	Tutorial	1	Lab Practice	--	Total	6
		Pre-requisite		Post graduate level Programming skill.					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. Acquire theoretical knowledge on setting hypothesis for pattern recognition.</li> <li>2. Apply suitable machine learning techniques for data handling and to gain knowledge from it.</li> <li>3. Evaluate the performance of algorithms and to provide solution for various real-world applications.</li> </ol>							
Course Outline		<b>Unit I:</b> Data types – Measures of similarity and dissimilarity - Hierarchical Clustering Methods –k-means and k-medoids clustering methods – Clustering Validity measures.							
		<b>Unit II:</b> Fuzzy c-means – Fuzzy Clustering Validity Measures – Decision Trees – Building a decision tree – Tree induction algorithm – Splitting of nodes based on information gain and Gini index - Nearest Neighbor classifiers – kNN algorithm – Naïve Bayesian classifier.							
		<b>Unit III:</b> Association rules mining – Basics – Apriori algorithm – Pruning and candidate generation – Rule mining. Machine learning – Introduction - Examples of various Learning Paradigms, Perspectives and Issues, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning, VC Dimension.							
		<b>Unit IV:</b> Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees (CART), Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and Non- Linear, Kernel Functions, K-Nearest Neighbors							
		<b>Unit V:</b> Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking. Bayesian Learning, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief Networks, Mining Frequent Patterns.							

Extended Professional Component (is a part of internal component only, Notto be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	<ol style="list-style-type: none"> <li>1. Tan, T., Steinbach, M. and Kumar, V. (2006): Introduction to Data Mining, Pearson Education.</li> <li>2. Gupta, G.K. (2008): Introduction to Data Mining with case studies, Prentice – Hall of India Pvt. Ltd.</li> <li>3. Daniel T. Larose (2006): Data Mining: Methods and Models, John Wiley and Sons.</li> <li>4. Han, J. and Kamber, M. (2006): Data Mining: Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publishers.</li> </ol>
Reference Books	<ol style="list-style-type: none"> <li>1. Paolo Gludici (2003): Applied Data Mining: Statistical Methods for Business and Industry, John Wiley and sons.</li> <li>2. Rajan Chattamvelli (2009): Data Mining Methods, Narosa Publishing House, New Delhi.</li> <li>3. Wayne, W. David (1987) : A foundation for analysis in Health Sciences 4th ed., John Wiley &amp; Sons. Jerrold H. Zar (1984) : Bio statistical analysis, Prentice hall 2nd ed.</li> <li>4. Susan Milton, J. (1992) : Statistical methods in the biological and health sciences, McGraw Hill. Jain, J.R. (1982) : Statistical techniques in quantitative genetics, Tata McGraw Hill.</li> </ol>
Website and e-Learning Source	e-books, online tutorials taken from MOOC/SWAYAM platform for this subject.

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO- 1:** Recognize the characteristics of machine learning strategies.

**CLO- 2:** Apply various supervised learning methods to appropriate problems.

**CLO- 3:** Identify and integrate more than one technique to enhance the performance of learning.

**CLO- 4:** Create probabilistic and unsupervised learning models for handling unknown pattern


**CLO- 5:** Analyze the co-occurrence of data to find interesting frequent patterns.


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	M	S	M
CO2	S	S	S	S	M	S	S	S	M	M
CO3	S	S	S	S	M	S	S	M	S	M
CO4	S	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	S	S	S	M	M	S

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

  
**H.O.D of Statistics**  
 Rajah Serfoj Govt. College (Autr  
 Thanjavur-5.

  
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 RAJAH SERFOJ GOVT. COLLEGE (AUTONOMOUS)  
 THANJAVUR-813 005.

Title of the Course		PROJECT WITH VIVA VOCE											
Paper Number		CORE XIII											
Category	Core Course	Year	II	Credits	7	Course Code	T4PSTC13						
		Semester	IV										
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total								
		9	-	--	9								
Pre-requisite		Statistical Techniques Skills											
Objectives of the Course		The main objectives of this course are: To enable the students to apply the statistical techniques for solving real-life problems.											
<p><b>Course Objective:</b></p> <p>To enable the students to apply the statistical techniques for solving real-life problems.</p> <p>A good project goes a long way in providing practical training to the students. They get an opportunity through the project to apply some of the vital theoretical concepts and techniques that had learnt in the previous semesters.</p> <p>On most of the occasions, socio-economic survey market research surveys, Biostatistics and Medical related researches are periodically conducted by government agencies, private organizations. So, it is proposed to offer good project topics to the students in these practical areas. The students will be thoroughly trained through the project not only in scientific selection of sample for data collection, but also in identifying and applying appropriate statistical techniques in their projects.</p> <p>The board evaluation strategy of the project will entitle the allocation of appropriate marks to the project report preparation and the remaining marks to the project viva-voce, as indicated below:</p> <p>The maximum marks for the project/dissertation report and viva – voce examination shall be fixed as 100, which is split with the following components:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Internal Assessment Marks by the Project/Dissertation Guide:</td> <td style="text-align: right;">20 marks</td> </tr> <tr> <td colspan="2">Evaluation of Project/Dissertation Report jointly by the</td> </tr> <tr> <td>External Examiner and the Guide Conduct of Viva-Voce Examination:</td> <td style="text-align: right;">80 marks</td> </tr> </table>								Internal Assessment Marks by the Project/Dissertation Guide:	20 marks	Evaluation of Project/Dissertation Report jointly by the		External Examiner and the Guide Conduct of Viva-Voce Examination:	80 marks
Internal Assessment Marks by the Project/Dissertation Guide:	20 marks												
Evaluation of Project/Dissertation Report jointly by the													
External Examiner and the Guide Conduct of Viva-Voce Examination:	80 marks												

Title of the Course		Non Parametric Inference					
Paper Number		EC 6					
Category	EC	Year	II	Credits	3	Course Code	TPSTECK
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		
Pre-requisite		Post graduate level student should be able to categorical data management					
Objectives of the Course		<p>The main objective of this course is to introduce</p> <ol style="list-style-type: none"> <li>1. Awareness of advanced theoretical and applied information supported by the statistical sources.</li> <li>2. The significance and impact of statistical methods on the social dimensions of inter disciplinary studies.</li> </ol>					
Course Outline		<b>UNIT I:</b> Rank tests for comparing two treatments, Wilcoxon ranksum tests, Asymptotic null distribution of Wilcoxon statistics, Siegel-Tukey and Smirnov tests.					
		<b>UNIT II:</b> Power of Wilcoxon rank, sum tests, Asymptotic power, comparison with students t-test, estimating the treatment effect.					
		<b>UNIT III:</b> Block comparison for two treatments, sign test for paired comparisons, Wilcoxon signed rank test, a balanced design for paired comparisons, power of sign and Wilcoxon signed rank tests and their comparisons.					
		<b>UNIT IV:</b> Comparison of more than two treatments, the Kruskal, Wallis test, 2 x t contingency table, comparing several treatments with a control, ranking several treatments.					
		<b>UNIT V:</b> Randomized complete blocks, Friedman, Cochran, McNemar tests, Aligned ranks. Tests of randomness and independence, testing against, trend, testing for independence, zxt contingency tables.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>					
Skills acquired from this course		<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>					

Recommended Text	<ol style="list-style-type: none"> <li>1. Lehmann, E.L. (1975) : Non parameteric: Statistical methods based on Ranks, McGraw Hill.</li> <li>2. Gibbons, J.D. (1971) : Non parametric Statistical inference, McGraw Hill.</li> <li>3. Hajek, J. and Sidak, Z. (1967) : The theory of rank tests, Academic press.</li> <li>4. Hollandar, M. and Wolfe, D.A. (1973) : Non parametric statistical methods, John Wiley.</li> <li>5. Walsh, J.F. (1962) : Handbook of non parametric statistics, Van Nostrand.</li> </ol>
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<b>Reference Books</b>	1. Hollandar, M. and Wolfe, D.A.(1973) : Non parametric statistical methods, John Wiley. 2. Walsh, J.F.(1962) : Handbook of non parametric statistics, Van Nostrand.
<b>Website and e-Learning Source</b>	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] 1. <a href="https://onlinelibrary.wiley.com/doi/10.1002/binj.19750170808">https://onlinelibrary.wiley.com/doi/10.1002/binj.19750170808</a> 2. <a href="https://books.google.com/books/about/Nonparametric_Statistical_Methods.html?id=Y5s3AgAAQBAJ">https://books.google.com/books/about/Nonparametric_Statistical_Methods.html?id=Y5s3AgAAQBAJ</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** We are able to acquire the knowledge of statistics its scope and importance in various areas such as medical, engineering, agricultural and social sciences.

**CLO 2:** Gaining the knowledge of other social types of data reflecting quality characteristics including the concepts of independent and association between two or more attributes.

**CLO 3:** Analyse non parametric statistical techniques.

**CLO 4:** Formulate test and interpret various hypothesis test for location, scale and independence problems.

**CLO 5:** The students will have knowledge of various one sample tests NPT such as test of randomness, Sign test, Kolmogorov Smirnov (KS) test and Kaplan –Meier Estimator


	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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

  
H.O.D of Statistics  
Rajah Serfoji Govt. College (Aut.)  
Thanjavur-5.

  
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RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)  
THANJAVUR-613 005.

Title of the Course		Reliability Theory					
Paper Number		EC 6					
Category	EC	Year	II	Credits	3	Course Code	TPSTECL
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		
Pre-requisite		Post graduate level student should be able to probability theory					
Objectives of the Course		The main objective of this course is to introduce reliability theory and its real life applications.					
Course Outline		UNIT I : Introduction to Reliability concepts, Quality and Reliability, Reliability Modeling, Life testing and Reliability, Reliability data, Likelihood Principle, Censoring Concepts, Bathub Curves, Mean Time to Failure, Mean Time between Failures					
		UNIT II: Reliability concepts and measures; components and systems; coherent systems; Reliability of coherent system; cuts and paths; modular decomposition; bounds on system reliability; structural and reliability importance of components.					
		UNIT III: Statistical Inference, Discrete Failure Time Models and Inferences, Continuous Failure Time Models and Inferences- Exponential, Weibull, Gamma, Lognormal, Logistic and Beta Distributions.					
		UNIT IV: Reliability Plotting, Reliability Testing, Reliability Prediction, Concept of Software Reliability.					
		UNIT V: Reliability estimation based on failure times from variously censored life-tests data for parametric families, stress-strength reliability and its estimation. Kaplan – Meier estimation of reliability curve, Greenwood formula					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Recommended Text	1. Zacks, S.(1992). Introduction to Reliability Analysis: Probability Models and Statistical Methods, Springer, New York. 2. Barlow, R.E. and Proschan, F. (1985): Statistical Theory of Reliability and Life Testing; Holt, Rinehart and Winston.
Reference Books	1. Muralidharan,K. and Syamsundar,A.(2012): Statistical Methods for Quality, Reliability and Maintainability, PHI Learning Pvt. Limited 2. Miller,R.G.(1981) : Survival analysis, John Wiley. 3. Lawless, J.F. (1982): Statistical Models and Methods of Life Time Data;John Wiley.

	4. Nelson, W. (1982): Applied life Data Analysis; John Wiley. 5. Bain, L. J. and Engelhardt (1991): Statistical Analysis of Reliability and Life Testing Models; Marcel Dekker.
<b>Website and e-Learning Source</b>	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] 1. <a href="https://d-nb.info/921317158/04">https://d-nb.info/921317158/04</a>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** understand the concepts of reliability function and hazard function

**CLO 2:** learn different life time distributions and its hazard and reliability functions

**CLO 3:** understand series and parallel system

**CLO 4:** understand ageing process, convolution and mixtures process

**CLO 5:** understand reliability estimation based on failure times from variously censored life-tests data

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	S	M	M
CO2	S	S	S	S	M	S	M	S	M	M
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	S	S	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	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.

  
**H.O.D of Statistics**  
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	4. Nelson, W. (1982): Applied life Data Analysis; John Wiley. 5. Bain, L. J. and Engelhardt (1991): Statistical Analysis of Reliability and LifeTesting Models; Marcel Dekker.
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<b>CO2</b>	S	S	S	S	M	S	M	S	M	M
<b>CO3</b>	S	S	S	M	S	S	M	S	S	M
<b>CO4</b>	M	S	S	S	S	S	S	S	M	M
<b>CO5</b>	S	S	S	S	M	S	S	S	M	M

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<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

**Level of Correlation between PSO's and CO's.**

  
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