

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

PG DEPARTMENT OF STATISTICS

**B.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)





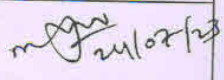
Thanjavur – 613 005, Tamil Nadu, India.

BOARD OF STUDIES IN STATISTICS

MINUTES OF THE MEETING HELD ON 24TH JULY 2023

The meeting of the Board of Studies in Statistics, for the Academic year 2023 -2024 was held on 24th July 10 A.M at Department of Statistics, Rajah Serfoji Government College(Autonomous), Thanjavur – 613 005.

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.	 24/7/23
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	 24/07/23

V.MURUGESAN, Chairperson, BOS and Head, Department of Statistics, Rajah Serfoji Government College, called the meeting to order and the following business was transacted.

1. Discussions for the new structure for B.Sc, M.Sc Programmes, were made in the context of LOCF suggestive syllabus of UGC and proposed syllabus of Integrated Board of Studies of TANSICHE. Due care is taken in framing the syllabus in such a way that 75% of the contents of the mandatory courses as specified by the TANSICHE are included in the present syllabus. Each course content is set by the teacher, who is presently teaching that course or who is specialized in that particular course. The needs of the locality, relevance, and the UGC/LOCF/TANSICHE statutory requirements, are all taken into consideration while framing the syllabus and are counter-checked by the Teacher who is the immediate senior to the teacher who has set the same.

RESOLUTION [No: BOS /STAT/2022-23/1] unanimously resolved to approve the changes made in the course structure and contents of the B.Sc, M.Sc programmes

Which will be implemented from the present academic year 2022-2023

2. Discussions for the reversion of the course credits for the B.Sc /M.Sc Programmes incorporating the Extra Credit Courses for Advanced Learners were made extensively. The extra credit courses were implemented from the academic year 2020-21. These courses were introduced to improve the knowledge base of the students in their own Discipline. These are self study courses and are optional. For UG, two courses with extra credit and for PG, two courses with extra credit are included. There should be no standing arrears for opting Extra Credit Courses and similarly, Students are not permitted to write the course as arrear, if he/she fails in the courses with extra credit. In the 5th & 6th semesters of the UG Programmes and PG Programme for 3rd & 4th semesters, these self-study extra credit courses are offered. On par with other part-IV courses, each self-study Extra Credit Courses also carries two credits, instead of four credits, as were awarded so far. For the UG programme, statistical softwares and non parametric techniques are the two self-study courses offered during the 5th and 6th semester respectively which may be pursued to add extra credits. Similarly, for the PG programme, Research methodology and Industrial statistics are self-study courses offered during the 3rd and 4th semester respectively, which may be pursued to add extra credits.

RESOLUTION [No.: BOS/STAT/2022-23/2] Unanimously resolved to introduce two new Extra Credit Courses for Advanced Learners separately for UG and PG

programme which are self-study In nature. Instead of choosing one Major Elective Course as an Extra Credit Course choice, it is resolved to offer two specific Extra Credit Courses, with two credits each, for each programme, from this Academic Year 2022- 23 onwards.

3. Discussion for the revision of three Discipline-specific electives were made. Two Discipline-specific electives are offered in UG the 5th semester and one in 6th semester. The Discipline-specific electives are to be chosen by the students, from the alternate choices. DSE1 set comprises of Operations research, Real analysis and matrix theory and simulation techniques. DSE2 set comprises of Indian official statistics, Econometric methods and Psychological and educational statistics and DSE3 set comprises of Regression analysis, Reliability and survival analysis and Programming C.

RESOLUTION [No.: BOS/STAT/2022-23/3] Unanimously resolved to introduce Discipline-specific electives, as mentioned in the course structure and it is suggested to add more choices in these electives in the next BOS meeting, as the contents are yet to be framed.

4. Discussions regarding the sector specific Skill based electives took place in the meeting. Presently, only one skill based paper in the 3rd 4th and 5th semesters. From the batch 2022-23 onwards, introduction of sector specific skill enhancement electives were suggested. Accordingly, the options are offered in all the three semesters. If a student chooses a skill based electives, in the next two semesters also. In the UGC-LOCF syllabus, there is an option for Statistics for Competitive Examinations, M.S. Excel and Office Automation As we have three field oriented courses as Discipline Specific Electives, three Derivatives papers are given as option C.

RESOLUTION [No.: BOS/STAT/2022-23/4] Unanimously resolved to introduce to specific Skill based elective courses with three sets containing three courses each, to be studied in the three semesters namely 3rd 4th and 5th semesters, in lines with the UGC-LOCF.

5. Discussions were made exhaustively on the feedback of the Students regarding the Curriculum and the need for more Practical papers/internship is understood. In the UG programme, Internship is given as an optional extra credit opportunity, in the fifth semester. In the PG programme, Internship is now made as an essential inbuilt core course component, which is expected to give exposure to the real-world statistics field and hands-on training in the field of the choice of the students.

RESOLUTION [No: BOS/STAT/2022-23/5] Unanimously resolved to recommend more Practical components in all the papers in the curriculum, wherever possible, and to introduce Internship programme as an optional extra credit for the PG programme in the third semester, subject to the approval of the forthcoming Academic Council.

A Deliberation regarding offering the allied papers was made. From the academic year 2018-19 onwards, three allied courses, namely, Statistics for Mathematics-I and III and Allied statistical practical for as the three allied courses are being offered to the students of first year B.Sc, Mathematics Programme.

The Board of Studies of statistics department may decide to continue with the statistics allied courses or to have three courses again Optimization technique-I and II and Allied statistics practical-II from the batch 2022-23 or to go for three statistics courses for the second year students from the academic year 2024-25. So, whatever be the course of action, the Board of Studies of Statistics, decided to suggest three new allied courses namely, Numerical methods, Vital statistics and Allied practical as the three allied courses to the second-year students.

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1. INTRODUCTION

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

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

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

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

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

**LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED
REGULATIONS FOR UNDER GRADUATE PROGRAMME**

Programme:	U.G.
Programme Code:	STATISTICS
Duration:	3 years [UG]
Programme Outcomes:	<p>PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study</p> <p>PO2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.</p> <p>PO3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.</p> <p>PO4: Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.</p> <p>PO5: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.</p> <p>PO6: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation</p> <p>PO7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team</p> <p>PO8: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.</p> <p>PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.</p>

- PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
- PO 11 Self-directed learning:** Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
- PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
- PO 13: Moral and ethical awareness/reasoning:** Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
- PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.
- PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including learning how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trends and demands of work place through knowledge/skill development/reskilling.

**Programme
Specific
Outcomes:**

- PSO1:** To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making.
- PSO 2:** To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment.
- PSO 3:** To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing.
- PSO 4:** Evaluate various social and economic problems in the society and develop answer to the problems as global citizens.
- PSO 5:** Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
PSO 1	Y	Y	Y	Y	Y	Y	Y	Y
PSO 2	Y	Y	Y	Y	Y	Y	Y	Y
PSO3	Y	Y	Y	Y	Y	Y	Y	Y
PSO 4	Y	Y	Y	Y	Y	Y	Y	Y
PSO 5	Y	Y	Y	Y	Y	Y	Y	Y

3 – Strong, 2- Medium, 1- Low

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.

- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	Foundation Course To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning Literature and analysing the world through the literary lens gives rise to a new perspective.	<ul style="list-style-type: none"> ➤ Instill confidence among students ➤ Create interest for the subject
I, II, III, IV	Skill Enhancement papers (Discipline centric / Generic / Entrepreneurial)	<ul style="list-style-type: none"> ➤ Industry ready graduates ➤ Skilled human resource ➤ Students are equipped with essential skills to make them employable ➤ Training on language and communication skills enable the students gain knowledge and exposure in the competitive world. ➤ Discipline centric skill will improve the Technical knowhow of solving real life problems.
III, IV, V & VI	Elective papers	<ul style="list-style-type: none"> ➤ Strengthening the domain knowledge ➤ Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature ➤ Emerging topics in higher education/ industry/ communication network / health sector etc. are introduced with hands-on-training.

IV	Elective Papers	<ul style="list-style-type: none"> ➤ Exposure to industry moulds students into solution providers ➤ Generates Industryready graduates ➤ Employment opportunities enhanced
V Semester	Elective papers	<ul style="list-style-type: none"> ➤ Self-learning isenhanced ➤ Application of the concept to real situationis conceived resulting in tangible outcome
VI Semester	Elective papers	<ul style="list-style-type: none"> ➤ Enriches the studybeyond the course. ➤ Developing a research framework and presenting their independent and intellectual idea effectively.
Extra Credits: For Advanced Learners / Honors degree		<ul style="list-style-type: none"> ➤ To cater to the needs ofpeer learners / research Aspirants
Skills acquired from the Courses		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course - SEC-3	2	3.7 Skill Enhancement Course SEC-5	2	4.7 Skill Enhancement Course SEC-7	2	5.7 Value Education	2	6.7 Professional Competency Skill	2	2
					3.8 E.V.S.	-	4.8 E.V.S	2	5.8 Summer Internship /Industrial Training	2			
	2	3		2		3		2		3			3
	3	0		2		0		5		6			0
Total - 140 Credits													

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework
(LOCF) Guideline Based Credit and Hours Distribution System
for all UG courses including Lab Hours**

RAJAH SERFOJI GOVERNMENT COLLEGE (A), THANJAVUR-5

PG DEPARTMENT OF STATISTICS

B.Sc. Statistics Curriculum Design- July 2023 Onwards

**First Year
Semester-I**

Part	Course	Subject Code	List of Courses	Credit	Hours per week (L/T/P)	Exam Hours	Marks		Total
							Int.	Ext.	
I	LT1	T1T1	Language –Tamil	3	6	3	25	75	100
II	LE1	T1E1	English	3	6	3	25	75	100
III	CC1	T1ST1	Descriptive Statistics	4	4	3	25	75	100
III	CC2	T1ST2	Probability Theory	4	4	3	25	75	100
III	EC1	T1GMST1	Calculus -I and Algebra	3	4	3	25	75	100
III	EC2	T1GMST2	Calculus -II and Analytical Geometry	-	2	-	-	-	-
IV	SEC1	T1STSE1	Fundamentals of computers	2	2	3	25	75	100
IV	FC	STFC	Basic Statistics-I	2	2	3	25	75	100
Total				21	30				

Semester-II

Part	Course	Subject Code	List of Courses	Credit	Hours per week (L/T/P)	Exam Hours	Marks		Total
							Int.	Ext.	
I	LT2	T2T2	Language –Tamil	3	6	3	25	75	100
II	LE2	T2E2	English	3	6	3	25	75	100
III	CC3	T2ST3	Distribution Theory	5	5	3	25	75	100
III	CC4	T2ST4P1	Practical I (Core I, II & III)	3	3	3	25	75	100
III	EC2	T1GMST2	Calculus -II and Analytical Geometry	3	2	3	25	75	100
III	EC3	T1GMST3	Calculus – III and Vector analysis	4	4	3	25	75	100
IV	SEC2	T2STSE2	Data Analysis using Excel - I	2	2	3	25	75	100
IV	SEC3	T2STSE3	Data Analysis using Excel - II	2	2	3	25	75	100
Total				25	30				

**Second Year
Semester-III**

Part	Course	Subject Code	List of Courses	Credit	Hours per week (L/T/P)	Exam Hours	Marks		Total
							Int.	Ext.	
I	LT3	T3T3	Language –Tamil	3	6	3	25	75	100
II	LE3	T3E3	English	3	6	3	25	75	100
III	CC5	T3ST5	Estimation Theory	4	4	3	25	75	100
III	CC6	T3ST6	Sampling Techniques	4	4	3	25	75	100
III	EC4	TSTECA	Numerical Methods	3	4	3	25	75	100
III	EC5	TSTECBP	Elective Practical - (EC-IV)	-	2	-	-	-	-
IV	SEC4	T2STSE4	R programming	1	1	3	25	75	100
IV	SEC5	T2STSE5	Latex Programming	2	2	3	25	75	100
IV	EVS		Environmental Studies	-	1	-	-	-	-
Total				20	30				

Semester-IV

Part	Course	Subject Code	List of Courses	Credit	Hours per week (L/T/P)	Exam Hours	Marks		Total
							Int.	Ext.	
I	LT4	T4T4	Language –Tamil	3	6	3	25	75	100
II	LE4	T1E1	English	2	4	2	15	45	100
		T1E1P	English Practical	1	2	1	10	60 30 40	
III	CC7	T4ST7	Testing of Statistical Hypothesis	4	4	3	25	75	100
III	CC8	T4ST8	Statistical Practical-(CC-V, CC-VI & CC-VII)	3	3	3	25	75	100
III	EC5	TSTECBP	EC -Practical (EC-IV & EC -VI)	3	2	3	25	75	100
III	EC6	TSTECC	Operations Research	4	4	3	25	75	100
IV	SEC6	T4STSE6	Python Programming	2	2	3	25	75	100
IV	SEC7	T4STSE7	Big Data Analysis	2	2	3	25	75	100
IV	EVS	T4ES	Environmental Studies	2	1	3	25	75	100
Total				26	30				

**Third Year
Semester-V**

Part	Course	Subject Code	List of Courses	Credit	Hours per week (L/T/P)	Exam Hours	Marks		Total
							Int.	Ext.	
III	CC9	T5ST9	Stochastic Processes	4	5	3	25	75	100
III	CC10	T5ST10	Regression Analysis	4	5	3	25	75	100
III	CC11	T5ST11	Actuarial Statistics	4	5	3	25	75	100
III	CC12	T5ST12	Matrix and Linear Algebra	3	5	3	25	75	100

III	EC7	TSTECD	Statistical Quality Control	3	4	3	25	75	100
III	EC8	TSTECE	Population Studies	3	4	3	25	75	100
IV	VE	T5VE	Value Education	2	2	2	25	75	100
IV			Internship / Industrial Training	2	-	-	-	-	-
Total				25	30				

Semester-VI

Part	Course	Subject Code	List of Courses	Credit	Hours per week (L/T/P)	Exam Hours	Marks		Total
							Int.	Ext.	
III	CC13	T6ST13	Design of Experiments	5	6	3	25	75	100
III	CC14	T6ST14	Demography	5	6	3	25	75	100
III	CC15	T6ST15	Practical – (CC-XIII & CC XIV)	4	4	3	25	75	100
III	EC9	TSTECE	Economic and official statistics	3	6	3	25	75	100
III	EC10	TSTECEG	Time Series & Index Numbers	3	6	3	25	75	100
IV	PCS	T6STPC	Professional Competency Skill	2	2	2	25	75	100
V			Extension Activity	1	-	-	-	-	-
Total				23	30				

Total Credits: 140

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	11	14	11	14	22	21	93
Part IV	4	4	3	5	4	2	22
Part V	-	-	-	-	-	1	1
Total	21	24	20	25	26	24	140

*Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

(Signature)
H.O.D of Statistics
Rajah Serfoj Govt. College (Auto)
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Elective Courses	
Sl.No	Generic Elective Course
1	Calculus -I and Algebra
2	Calculus -II and Analytical Geometry
3	Calculus – III and Vector analysis
4	Office Automation
5	Computer informatics
6	Fundamental Information Science
7	Cyber Crime and its security
8	Econometrics
9	Health Statistics
10	Genetical statistics
Discipline Specific	
11	Numerical Methods
12	Operations Research
13	Statistical Quality Control
14	Population Studies
15	Economic and official statistics
16	Time Series & Index numbers
17	Queueing Theory
18	Non-parametric analysis
19	Indian official statistics
20	Fundamentals of reliability theory

Sl.No	Skills Enhancement Course
1	Fundamentals of computers
2	Data analysis using Excel
3	R programme
4	Python programming
5	Big data analysis
6	Data mining
7	Data Science with Inferential statistics
8	Fundamentals of SPSS
9	Fundamentals of Matlab
10	Latex programming

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or Overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Paper Type	Credit	Nos	Total
Language	3	8	24
Core- Papers	4	15	60
Allied / Elective	3	8	24
Ability Enhancement Compulsory Course (AECC) Soft Skill	2	15	30
Extension Activity	1	2	2
Total			140

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


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

Title of the Course		Descriptive Statistics					
Paper Number		CORE I					
Category	Core	Year	I	Credits	4	Course Code	T1ST1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	-	--	4		
Pre-requisite		Basic arithmetic					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. It explains the important concepts of statistics and statistical data. 2. It provides to formulate the visualization of frequency distribution. 3. Also they measure the averages, dispersions, lack of symmetry, moments, relationship among variables. 4. Estimate and predict the unknown and future values. 5. Study of non-linear and consistency of the data. 					
Course Outline		<p>Unit-I Statistics: Collection of Data: Primary and secondary data - Methods of collecting primary data - Sources of secondary data. Classification-Types - Formation of frequency distribution-Tabulation - parts of a Table - Types. Diagrammatic representation - Types. Graphical representation - Graphs of frequency distributions. Merits and Limitations of diagrams and graphs.</p> <p>Unit-II Measures of Central tendency: Introduction-Definitions-Types - Mean-Median-Mode-Geometric mean-Harmonic Mean-Weighted mean - Merits and Demerits-Measures of Dispersion: Introduction - Definition - Types - Range - Quartile deviation - Mean deviation - Standard deviation - Co-efficient of variation -- Lorenz curve - Merits and Demerits.</p> <p>Unit-III Skewness: Introduction-Definition-Types-Karl Pearson's - Bowley's - Kelly's methods - Their merits and demerits. Kurtosis: Introduction-Definition-Types-Its merits and demerits. Moments: Introduction - Definition-Types - Raw, Central moments.</p> <p>Unit-IV Correlation analysis: Introduction - Definition - Types - Ungrouped and Grouped data - Probable error - properties - Rank correlation - Partial and Multiple correlations concept only - Regression analysis: Introduction - Definition - Regression Equations (two variable only) .</p> <p>Unit-VTheory of Attributes: Introduction - Definition-Classes and Class frequencies-Consistency of data-Independence of attributes-Association of attributes-Yule's coefficient and -Coefficient of Colligation.</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"> 1. Gupta, S.P. (2017): Statistical Methods, Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition. 2. Gupta S.C and Kapoor, V.K. (2002). Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd., New Delhi
Reference Books	<ol style="list-style-type: none"> 1. Goon A.M. Gupta. A.K. and Das Gupta, B (1987). Fundamental of Statistics, vol.2 World Press Pvt. Ltd., Kolkatta 2. G.U.Yule and M.G. Kendall (1956). An introduction to the theory of Statistics, Charles Griffin. 3. M.R. Spiegel (1961). Theory and problems of Statistics, Schaum's outline series. 4. Anderson, T.W. and Sclove SL. (1978). An introduction to statistical analysis of data, Houghton Mifflin&co. 5. Pillai, R.S., and Bagavathi (2003): Statistics, S. Chand and Company Ltd., New Delhi.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject https://en.wikipedia.org/wiki/Statistics https://en.wikipedia.org/wiki/Descriptive_statistics https://socialresearchmethods.net/kb/statdesc.php http://onlinestatbook.com/2/introduction/descriptive.html

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

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

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

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

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

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

CLO-6: Ability to apply in data

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

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

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

Level of Correlation between PSO's and CO's

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Probability Theory					
Paper Number		CORE II					
Category	Core	Year	I	Credits	4	Course Code	T1ST2
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	-	--	4		
Pre-requisite		Basic Knowledge on events and set theory					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To describe the importance and scope of probability theory and to predict the chance of an experimental outcomes. 2. It provides the study of random variable, distribution function, mathematical expectation, 3. Generating function and law of large numbers. 4. Two-dimensional variables and its distributions 					
Course Outline		<p>Unit-I Theory of Probability: Introduction-Basic terminology-Definition - Axiomatic approach – Types of Events - Conditional Probability - Addition and Multiplication theorems of Probability for 'two' events (Statement and Proof) - Boole's inequality (Statement)-Bayes' theorem of Probability (Statement and Proof with numerical illustration -very simple problems)</p> <p>Unit-II Random variables and Distribution functions: Introduction-Discrete random variable: Probability mass function- Discrete distribution function, Properties. Continuous random variable : Probability density function and properties, measures of central tendency, dispersion, Skewness and kurtosis for continuous Probability distribution.</p> <p>Unit-III Two dimensional random variables - Joint probability mass function-Marginal probability function, Conditional probability function. Two dimensional distribution functions-Marginal distribution functions - Joint density function-Marginal density function - Conditional distribution function - Conditional probability density function. Transformation of One - Dimensional and Two Dimensional random variable (concept only).</p> <p>Unit-IV Mathematical Expectations: Introduction- Expected value of a random variable (Discrete and Continuous)-Expected value of function of a random variable - Properties of Expectation-Properties of variance-Covariance.</p> <p>Unit-V Generating functions: M.G.F-Properties Characteristic Function: Properties-Inversion theorems (Statement only)- Uniqueness theorem (Statement only). Chebychev's Inequality (Statement and Proof). Law of Large Numbers (L.L.N): Convergence in probability - Properties: Weak L.L.N - properties-Bernoulli's L.L.N (Statement and Proof) - Khinchin's theorems (Statement only).</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.Gupta S.C. and Kapoor V.K (2015): Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
Reference Books	1. Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics. 2. Hogg. R.V. and Craig. A.T. (1978) : Introduction to Mathematical Statistics, McGraw Hill Publishing Co. Inc. New York. 3. Mood A.M. Graybill, F.A. and Bose. D.C. (1974): Introduction to the theory of Statistics, McGraw Hill Publishing Co. Inc. New York. 4.Sanjay Arora and Bansilal (1989): New Mathematical Statistics, Satyaprakashan, New Delhi
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject www.khanacademy.org/math/statistics-probability/random-variables-stats-library https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to


- CLO-1:** Understand concepts of probability and Identify the different approaches of probability theory
- CLO-2:** Define the random variable and its respective probability values and to compare a discrete and continuous random variable.
- CLO-3:** Calculate the expected value of a random variable variance, covariance, moments and find the conditional expectation and variance of bi-variate random variable.
- CLO-4:** Estimate the measures of central values, Dispersions, Skewness and Kurtosis through the generating function
- CLO-4:** Calculate the mean and variance through some law of large numbers.
- CLO-5:** Understand bivariate random variables and its distributions
- CLO-6:** Application of probability theory in real life


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

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

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

Level of Correlation between PSO's and CO's


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Title of the Course		FUNDAMENTALS OF COMPUTERS					
Paper Number		SEC - I					
Category	SEC	Year	I	Credits	2	Course Code	T1STSE1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		2	-	--	2		
Pre-requisite		Basic Knowledge on events and set theory					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. Understanding Information Systems: An interconnected environment for managing and processing data using a computer 2. Identify the Windows screen elements and parts of a window. 3. Indicate the names and functions of the Word interface components. 4. Create slide presentations that include text, graphics, animation, and transitions. 5. Computer network is an interconnection between two or more hosts/ computers. Different types of networks include LAN, WAN, MAN, etc. 					
Course Outline		<p>Unit-I Knowing computer: What is Computer, Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices. Applications of IECT; Connecting keyboard, mouse, monitor and printer to CPU and checking power supply.</p> <p>Unit-II Windows: Introduction to Windows, Starting Windows, Desk Top, Task Bar, Start Up Menu Working with programs and icons- Adding, removing, starting and quitting programs and icon.</p> <p>Unit-III MS-Word: Overview of Word Processing, Parts of word window, Types of Menus .Opening, creating saving, cut, copy and paste. print and print preview. Find and Replace, Header& Footer, save & save as, Borders and shading, Bullets & Numbering.</p> <p>Unit-IV MS-PowerPoint: Overview of MS-PowerPoint, Slides, PowerPoint views, Auto content wizard, Custom Animation, Transition and build effects, Printing slides and important shortcut keys.</p> <p>Unit-V Introduction to Internet, WWW and Web Browsers: Basic of Computer networks; LAN, WAN; Concept of Internet; Applications of Internet; connecting to internet.</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>					
Recommended Text		<ol style="list-style-type: none"> 1. Microsoft Office 2007 Training Guide, BPB Publications-2010 2. Fundamentals of Computers, V Rajaraman 6th edition PHI Learning Private Limited 2014 					

Reference Books	1. Sanjay Saxena: A First Course in Computers. Vikas Publishing House. 2. Peter Norton: Computing Fundamentals. 6th Edition, McGraw Hill-Osborne,2007 3. Alexis Leon and Marthews Leon: Introduction to Computers, Leon Vikas,1999
Website and e-Learning Source	e-books, https://www.amazon.in/FUNDAMENTALS-COMPUTERS-Balagurusamy/dp/0070141606 https://www.flipkart.com/fundamentals-of-computers/p/itmczynp8gmbhj

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1: Outline the computer fundamentals and various problem solving concepts in computers.

CLO-2: Describe the basic computer organization, software, computer languages, software development life style and the need of structured programming in solving a computer problem.

CLO-3: The students will be able to explain the general concepts of the Word processors

CLO-4: Use design layouts and templates for presentations.

CLO-5: Describe and explain the characteristics of the internet and World Wide Web.

CLO-6: Utilize a Search Engine.

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		BASIC STATISTICS-I (Foundation Course-1)					
Paper Number		Foundation Course					
Category	FC	Year	I	Credits	2	Course Code	STFC
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		2	-	--	2		
Pre-requisite		Basic Knowledge on events and set theory					
Objectives of the Course		The main objectives of this course are: 1. Science, by definition, is a systematic body of knowledge which studies the cause and effect relationship and endeavors to find out generalization.					
Course Outline		<p>Unit-I introduction: Origin, growth, Etymology of statistics, meaning, definition, statistics as data, Statistics as methods, nature, object, science or arts, statistical thinking, - theoretical question only.</p> <p>Unit-II importance, – statistics in states, economics, business, astronomy, education, accounting, research and planning - theoretical question only.</p> <p>Unit-III functions of statistics- limitation of statistics – Distrust of statistics, fallacies statistics - - theoretical question only.</p> <p>Unit-IV statistical Survey – planning and design enquiry , object, scope, statistical unit, sources of data, method of data collection, the frame, standard of accuracy, type of enquiry, execution of survey method - - theoretical question only.</p> <p>Unit-V Growth of Indian Statistics – CSO History and Function, - NSSO History and Function – ISO History and Function – ISI History and Functions – ISS History and Functions –Theoretical question only.</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		<p>1. Pillai, R.S., and Bagavathi (2003): Statistics, S. Chand and Company Ltd., New Delhi.</p> <p>2. Gupta, S.P. (2017): Statistical Methods, Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition.</p>					
Reference Books		<p>1. Goon A.M. Gupta. A.K. and Das Gupta, B (1987). Fundamental of Statistics, vol.2 World Press Pvt. Ltd., Kolkatta</p> <p>2.G.U.Yule and M.G. Kendall (1956). An introduction to the theory of Statistics, Charles Griffin.</p>					

Website and e-Learning Source	e-books: https://onlinestatbook.com/Online_Statistics_Education.pdf http://www.academia.dk/BiologiskAntropologi/Epidemiologi/PDF/Basic_Statistics_A_Primer_for_the_Biomedical_Sciences_4th_Ed.pdf
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Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1: Recognize and differentiate between key terms.

CLO-2: Apply various types of sampling methods to data collection.

CLO-3: Create and interpret frequency tables.

CLO-4: The NSSO decides the topic of a particular round of the survey.

CLO-5: The National Sample Survey Organisation also prepares reports on agricultural production.

CLO-6: CSO looks after the various statistical activities taking place in the country

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Distribution Theory					
Paper Number		Core III					
Category	Core Course	Year	I	Credits	5	Course Code	T2ST3
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		5		--	5		
Pre-requisite		Calculus					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To learn discrete distributions 2. To learn continuous distributions 3. to understand Distributions generated from mathematical functions 4. learn normal distribution and its properties 5. understand about sampling distributions 					
Course Outline		<p>Unit I Binomial distribution – moments, recurrence relation, mean deviation, mode, moment generating function, characteristic function, cumulants. Fitting of Binomial Distribution. Poisson distribution – moments, mode, recurrence relation, moment generating function, characteristic function, cumulants. Fitting of Poisson distribution.</p> <p>Unit II Geometric distribution – lack of memory, moments, m.g.f.- Hyper-geometric distribution – mean, variance, approximation to Binomial, recurrence relation</p> <p>Unit III Normal Distribution – chief characteristics of the normal distribution and normal probability curve, mean, median, mode, m.g.f. characteristic function, moments, mean deviation, Area property – Rectangular distribution – moments, m.g.f, characteristic function, mean deviation about mean.</p> <p>Unit-IV Exponential distribution – m.g.f., characteristic function, memory less property – Gamma distribution – m.g.f, cumulants and central moments – Beta distribution – First kind and second kind – mean and variance.</p> <p>Unit-V Functions of Normal random variables leading to t, Chi-square and F-distributions (derivations and properties).</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>					
Recommended Text		<p>1.Gupta, S.C. Kapoor, V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi 2.Goon, A.M. Gupta M.K. and Das Gupta B (1977) An Outline of Statistical Theory, Vol I, 6/e, World Press, Calcutta.</p>					

	3. Hogg, R.V. and Graig, A.T. (1978) : Introduction to Mathematical Statistics, A/e, Mc.Graw Hill Publishing Co.Inc., New York.
Reference Books	1. Mood, A.D. Graybill, F.A. and Boes, D.C (1974): Introduction to the Theory of Statistics, 3/e, Mc.Graw Hill, New York.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject www.khanacademy.org/math/statistics-probability/random-variables-stats-library https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 identify discrete distributions appeared in real life situations

CLO-2 understand some continuous distributions and its applications

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

CLO-4 understand normal distribution and its properties

CLO-5 understand sampling distributions and its applications in real life

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


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

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

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

Level of Correlation between PSO's and CO's


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Title of the Course		Major Practical –I					
Paper Number		CORE – IV (CC1, CC2 & CC3)					
Category	Core Course	Year	II	Credits	3	Course Code	T2ST4P1
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		3	-	--	3		
Pre-requisite		Basic Knowledge in practical					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. The main purpose of using statistics is to plan the collected data in terms of experimental designs and statistical surveys. 2. Statistics is considered a mathematical science that works with numerical data. 					
Course Outline		<p>Unit-I Formation of frequency distribution –Diagrammatic representation – Graphical representation - Measures of Central tendency - Measures of Dispersion – skewness</p> <p>Unit-II Correlation and regression analysis – theory of attributes – yule’s and colligation</p> <p>Unit-III Baye’s theorem. Random variables - one and two dimensional - (Discrete and Continuous Function) – mathematical Expectation.</p> <p>Unit-IV Fitting of Binomial and Poisson distribution</p> <p>Unit-V Normal distribution – area property method and fitting of normal</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		<ol style="list-style-type: none"> 1. Gupta S.C. and Kapoor V.K (2015): Fundamentals of Mathematical Statistics, Sultan Chand & Sons. 2. Gupta, S.P. (2017): Statistical Methods, Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition. 					
Reference Books		<ol style="list-style-type: none"> 1. Pillai, R.S., and Bagavathi (2003): Statistics, S. Chand and Company Ltd., New Delhi. 2. Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics. 3. Mood, A.D. Graybill, F.A. and Boes, D.C (1974): Introduction to the Theory of Statistics, 3/e, Mc.Graw Hill, New York. 					
Website and e-Learning Source		<p>e-books, tutorials on MOOC/SWAYAM courses on the subject https://en.wikipedia.org/wiki/Descriptive_statistics www.khanacademy.org/math/statistics-probability/random-variables-stats-library</p>					

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1: Statistical Techniques provide scientific approaches to develop the domain of human knowledge.

CLO-2: It helps in giving a brief description of the main feature of the entire data. Essential for comparison:

CLO-3: The most commonly used techniques for investigating the relationship between two quantitative variables are correlation and linear regression.

CLO-4: The practical uses of probability distributions are: To calculate confidence intervals for parameters and to calculate critical regions for hypothesis tests.

CLO-5: To determine the accuracy of medical test results by taking into consideration how likely any given person is to have a disease and the general accuracy of the test.

CLO-6: For univariate data, it is often useful to determine a reasonable distributional model for the data.

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

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

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RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)
THANJAVUR-612 005.

Title of the Course		Data Analysis using Excel – I							
Paper Number		SEC -2							
Category	SEC	Year	I	Credits	2	Course Code	T2STSE2		
		Semester	II						
Instructional Hours per week		Lecture	2	Tutorial	-	Lab Practice	--	Total	2
		Pre-requisite		Basic Knowledge in practical					
Objectives of the Course		The main objectives of this course are: 1. To Import data into Excel from any source. 2. To Explore the Power Query editor window. 3. To Explore the Power Pivot window. 4. To Extract data from a folder of files.							
Course Outline		Unit-I: MS Excel options-ribbon-sheets-saving Excel file as PDF,CSV and older versions-using Excel shortcuts-copy, cut, paste, Hide, unhide and Link Unit-II: The data in rows, columns and sheet-using paste special options-Formatting cells, rows, columns and sheets. Unit-III: Protecting and un protecting cells, rows, columns and sheets with or without password-page layout and printer properties. Unit-IV Logical functions-Date and Time functions. Unit-V Information functions –statistical functions-text functions.							
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. Excel 2016 Bible, by John Walkenbach. 2. Excel 2016 for Dummies, by Greg Harvey. 3. Excel: Quick Start Guide from Beginner to Expert, by William Fischer.							
Reference Books		1.MS EXCEL Formula tricks and shortcut keys EBook 2. Statistical Data Analysis Using Ms-Excel by Dr. B. G. Kore PDF Online. ISBN 9789351648598 from Nirali Prakashan.							
Website and e-Learning Source		e-books, tutorials on MOOC/SWAYAM courses on the subject https://en.wikipedia.org/wiki/Descriptive_statistics www.khanacademy.org/math/statistics-probability/random-variables-stats-library							

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1: Excel Basics and Work with Cells and Worksheets.

CLO-2: Calculate Your Data and Format your Workbook.

CLO-3: Add Charts and graphics, Collaborate with Others.

CLO-4: Analyze the statistical data, and basic entries for statistical packages.

CLO-5: Work with Macros and the Web.

	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

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

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THANJAVUR-613 005.

Title of the Course		Data analysis using Excel – II					
Paper Number		SEC -3					
Category	SEC	Year	I	Credits	2	Course Code	T2STSE3
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		2	-	--	2		
Pre-requisite		Basic Knowledge in practical					
Objectives of the Course		The main objectives of this course are:					
Course Outline		Unit-I Charts: simple bar chart-multiple bar chart-subdivided bar chart-pie chart-donut chart-line chart-histogram-scatter plot. Unit-II Descriptive statistics : min, max-measures of central tendency –partition values-dispersion Unit-III Skewness and kurtosis-correlation coefficient and linear regression. Unit-IV Testing of hypothesis –large sample test-Z test-compute p-values Unit-V small sample t-test - paired test, F- test, chi-square test of independence and Goodness of fit test.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this Course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		1. MS EXCEL Formula tricks and shortcut keys EBook 2. Statistical Data Analysis Using Ms-Excel by Dr. B. G. Kore PDF Online. ISBN 9789351648598 from Nirali Prakashan.					
Reference Books		1. Excel 2016 Bible, by John Walkenbach. 2. Excel 2016 for Dummies, by Greg Harvey. 3. Excel: Quick Start Guide from Beginner to Expert, by William Fischer.					
Website and e-Learning Source		e-books, tutorials on MOOC/SWAYAM courses on the subject https://en.wikipedia.org/wiki/Descriptive_statistics www.khanacademy.org/math/statistics-probability/random-variables-stats-library					

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1: Use advanced functions and productivity tools to assist in developing worksheets.

CLO-2: Manipulate data lists using Outline, Autofilter and PivotTables.

CLO-3: Use Consolidation to summarise and report results from multiple worksheets.

CLO-4: Record repetitive tasks by creating Macros.

CLO-5: Protect data in worksheets and workbooks.

	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

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

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THANJAVUR-613 005.

Title of the Course		Estimation Theory					
Paper Number		Core – V					
Category	Core	Year	II	Credits	4	Course Code	T3ST5
		Semester	III				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4		--	4		
Pre-requisite		Number theory and Arithmetic					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To Emphasize on the Concept of Point Estimation and Interval Estimation. 2. To learn properties of a good estimator 3. To understand various methods of estimation 					
Course Outline		<p>Unit I Point estimation – Estimator – Consistency and Unbiasedness – Efficiency and asymptotic efficiency – Estimators based on sufficient statistics – Neyman Factorization theorem (statement only) – Simple illustrations</p> <p>Unit II Minimum variance unbiased estimators – Cramer – Rao Inequality – Rao Blackwell theorem – Simple illustrations</p> <p>Unit III Methods of Estimation – Methods of Maximum likelihood and moments – Properties of estimators obtained by these methods – Simple illustrations</p> <p>Unit-IV Method of Minimum Chi-Square-Method of Minimum Variance-Methods of moments -Methods of Least squares- Interval estimation.</p> <p>Unit-V Notion of Bayes estimation – concept of prior, posterior and conjugate priors. Simple problems involving quadratic error loss function – Notion of Minimax estimation – Simple illustrations.</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		<ol style="list-style-type: none"> 1. Gupta S.C. and Kapoor V.K. (2007) : Fundamentals of Mathematical Statistics, Sultan Chand Sons, New Delhi. 2. P.R. Vittal(2002) : Mathematical Statistics, Margham Publications, Chennai. 3. Ashok K. Bansal(2007): Bayesian Parametric Inference, Narosa Publishing House. 4. Mood, A.M. Graybill, F.A. and Boes D.C. (1974): Introduction to Theory of Statistics, McGraw – Hill. 					

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

Course Learning Outcome (for Mapping with POs and PSOs)


- Students will be able to
- CLO-1 estimate population parameters
 - CLO-2 identify good estimators and its properties
 - CLO-3 derive interval estimators of a parameter
 - CLO-4 estimate parameters using various estimation methods and identify the best among the estimators.
 - CLO-5 Handle data and can estimate population parameters
 - CLO-6 realize the application of different types of estimators


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

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

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

Level of Correlation between PSO's and CO's


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


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

Title of the Course		Sampling Techniques					
Paper Number		Core – VI					
Category	Core	Year	II	Credits	4	Course Code	T3ST6
		Semester	III				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4		--	4		
Pre-requisite		Descriptive statistics and Probability theory					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To know the basic operations of sampling 2. To study the theory and applications of SRS 3. To learn practical uses of Stratification 4. To apply Systematic and PPS Sampling in real time problems. 					
Course Outline		<p>Unit I Basic concepts of sample surveys – Advantages of Sampling – Principal steps in Sample survey, Sampling unit – Sampling frame – Census – Probability Sampling, Alternatives to probability sampling, Mean Square Error.</p>					
		<p>Unit II Simple random sampling, Methods of selection, Sampling with and without replacement – Properties of estimates, Finite population correction, Estimation of Standard error, Confidence limits – Simple random sampling for Qualitative characteristics, Sample size determination for proportions and continuous data.</p>					
		<p>Unit III Stratified random sampling, principles of stratification, Notations – Estimation of population mean and its variance – Estimated variance and confidence limits, Allocation techniques -equal allocation, proportional allocation, Neyman allocation and optimum allocation, Estimation of gain due to stratification. Estimation of sample size for continuous data.</p>					
		<p>Unit-IV Systematic sampling –Relation to cluster sampling, Estimation of population mean and its sampling variance – Comparison of systematic sampling with stratified random samples. Systematic sampling in two dimensions.</p>					
		<p>Unit-V Varying Probability sampling, Selection of one unit with PPS, PPS Sampling with replacement, Estimator for population total and its variance.</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	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Cochran, W.G. (1978) : Sampling Techniques, John Wiley Eastern 2. Murthy M.N. (1967):Sampling Theory and Methods, Statistical Publishing Society, Calcutta
Reference Books	1.Singh. D. and ChaudryF.S. (1986) : Theory and Analysis of Sample Surveys Design Wiley Eastern Ltd. 2.Sampath.S, (2001), Sampling Theory and Methods, CRC Press.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject http://ocw.jhsph.edu/courses/statmethodsforamplesurveys/pdfs/lecture2.pdf https://www.questionpro.com/blog/stratified-random-sampling/ https://www.scribbr.com/methodology/systematic-sampling/ http://home.iitk.ac.in/~shalab/sampling/chapter7-sampling-varying-probability-sampling.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

- CLO-1 Know the difference between census and sampling.
CLO-2 Understand basic operations and advantages of sampling
CLO-3 Understand widely used sampling techniques
CLO-4 Know to estimate population information using sampling
CLO-5 Apply sampling techniques in real time problems
CLO-6 identify suitable sampling technique for a real life survey


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

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

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

Level of Correlation between PSO's and CO's

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


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THANJAVUR-613 005.

Title of the Course		Numerical Methods					
Paper Number		Elective – IV (Discipline Specific)					
Category	EC4	Year	II	Credits	3	Course Code	TSTECA
		Semester	III				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4			--	4	
Pre-requisite		Basic Arithmetic and calculus					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To introduce the study of algorithms that used numerical approximation for the problems of Mathematical analysis. 2. To solve mathematical problems numerically 					
Course Outline		<p>Unit I The Solution of Numerical Algebraic - Bisection Method, Iteration Method, Newton – Raphson Method. (Simple Problems Only Without Derivation)</p> <p>Unit II Solution of Simultaneous Linear Algebraic Equations: Gauss – Elimination Method, Gauss–Jordan Method, - Gauss – Jacobi Method -(concept only) Gauss –Seidel Method (concept only) Finite Differences: Operators. Interpolation for Equal intervals: Newton’s Forward Interpolation Formula and Newton’s Backward Interpolation Formula, Evaluation of missing terms.</p> <p>Unit-III Central Difference Interpolation Formula For Equal Intervals: Gauss Forward Interpolation Formula, Gauss Backward Interpolation Formula, Sterlings Formula, Bessel’s Formula, Laplace- Everett’s Formula.</p> <p>Unit-IV Interpolation with Unequal Intervals: Divided Differences, Newton’s Divided Differences Interpolation Formula, Lagrange’s Interpolation Formula and Inverse Lagrange’s Interpolation.</p> <p>Unit-V Numerical Differentiation: Numerical Differentiation based on Newton’s Forward and Backward Interpolation Formula – Computation of Second order derivatives. Numerical Integration: General Quadrature formula for equidistant ordinates, Trapezoidal Rule, Simpson’s 1/3rd Rule, Simpson’s 3/8th Rule. (Simple Problems Only Without Derivation) Numerical Solution of Ordinary Differential Equations: Taylor Series Method, and Runge – Kutta Method. (Simple Problems Only Without Derivation)</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	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Kandasamy, P., Thilagavathy, K. (2003): Calculus of Finite Differences and Numerical Analysis, S.Chand Publications. 2. Balasubramaniam and Venkatraman(1972): Numerical mathematics part I and II by Rochouse and Sons
Reference Books	1. Kalavathy, S., and Thomson. (2004): Numerical Methods, Vijay Nico::le Publications. 2. Gupta, B.D. (2004): Numerical Analysis, Konark Publications. 3. Venkatachalapathy, S.G. (2004): Calculus of Finite Differences and Numerical Analysis, Margam Publications. 4. Gerald Wheatley, (1970): Applied Numerical Analysis, Pearson Education Publications. 5. Jain, M.K., Iyengar, S.R., Jain, R.K., (1994): Numerical Methods Problems and Solutions, New Age International Publishers.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject www.nptel.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Solve numerically equations that cannot have direct solution

CLO-2 solve system of linear equations

CLO-3 understand the need of interpolation

CLO-4 Handle numerical differentiation

CLO-5 Do integration numerically

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

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

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

CO /PSO	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 (Autc)
Thanjavur-8.

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

Title of the Course		R- Programming							
Paper Number		SEC_IV							
Category	SEC4	Year	II	Credits	3	Course Code	T3STSE4		
		Semester	III						
Instructional Hours per week		Lecture	1	Tutorial		Lab Practice	--	Total	1
		Pre-requisite		Basic Arithmetic and calculus					
Objectives of the Course		The main objectives of this course are: 1. Understand basics of R environment. 2. Able to work with R packages and their installation 3. Demonstrate exploratory data analysis (EDA) for a given data set.							
Course Outline		<p>Unit-I Data Handling: Data Collection, Entry and Classification on the aspect of Raw, Discrete and Continuous data - Univariate, Bivariate and Multivariate frequency distributions.</p> <p>Unit-II Diagrammatic representation: Plotting an appropriate graph for the given data viz. pie chart, Histograms (equal class intervals and unequal class intervals), Box and Whisker plot, stem and leaf plot, frequency polygon, Ogives with graphical summaries of data.</p> <p>Unit-III Analysis: Descriptive Statistics - measures of central tendency and measures of dispersions</p> <p>Unit-IV Comparison Measures- correlation and lines of regression.</p> <p>Unit-V Statistical Inference: Hypothesis testing and computation of p-values.</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. Sudha G. Purohit, Sharad D. Gore, Shailaja R. Deshmukh, <i>Statistics Using R</i> , Narosa, Publishing House Pvt. Ltd., 2nd Ed., Reprint 2019. Unit -I Chapter 1 (Sec: 1.4 – 1.8), Unit – II Chapter 2 (Sec : 2.1 – 2.3)							

	Unit - III Chapter 2 (Sec: 2.4 - 2.6 ; Unit - IV. Chapter 5 Sec : 5.1 - 5.6) Unit - V Chapter 4 (Sec: 4.1 - 4.6)
Reference Books	1. John Maindonald and John Braun, <i>Data Analysis and Graphics Using R</i> . Cambridge University Press, Cambridge, 2010. 2. Brian Everitt and Torsten Hothorn, <i>A Handbook of Statistical Analyses Using R</i> . Chapman & Hall/CRC, Boca Raton, FL, 2009. 3. Moore, D.S. and McCabe, G.P. and Craig, B.A, <i>Introduction to the Practice of Statistics</i> , W.H. Freeman, 2014.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject 1. https://en.wikipedia.org/wiki/Data_analysis 2. https://www.tutorialspoint.com/r/r_overview.htm 3. https://en.wikipedia.org/wiki/Case_study

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Solve numerically equations that cannot have direct solution

CLO-2 solve system of linear equations

CLO-3 understand the need of interpolation

CLO-4 handle numerical differentiation

CLO-5 do integration numerically

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

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Latex Programming							
Paper Number		SEC - V							
Category	SEC5	Year	II	Credits	3	Course Code	T3STSE5		
		Semester	III						
Instructional Hours per week		Lecture	2	Tutorial		Lab Practice	--	Total	
Pre-requisite		Basic Arithmetic and calculus							
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. Prepare a Latex document, to make scientific article and project report. 2. To include figures and tables in a Latex document. 3. To make conference proceedings and presentations. 4. Use the preamble of LaTeX file to define document class and layout options. 5. Use BibTeX to maintain bibliographic information and to generate a bibliography for a particular document. 							
Course Outline		<p>Unit-I: Beginning typesetting using LaTeX. Basics: What is LaTeX, Basics for document structuring, preamble preparation, saving a folder. Text Book: Chapter 1:-Sec 1.1, 1.2 and Chapter 2 Sec. 2.1</p> <p>Unit-II: Commands Latex commands for font colour, font size, make title, begin document, new page, sectioning. Text Book: Chapter 2, Sec 2.3 to 2.6</p> <p>Unit-III: Tables and Figures Creating Tables, Inserting figures, enumeration list, itemized list, font effects, inserting equations. Text Book: Chapter 3 Sec. 3.1 to 3.6, Chapter 6: Sec 6.1 to 6.3.</p> <p>Unit-IV: Reference and Citation Inserting references, Manual reference. Text Book: Chapter 7 Sec. 7.1 to 7.4</p> <p>Unit-V: Reference using BibTex, citing reference. Text Book: Chapter 7 Sec. 7.1 to 7.4</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill							
Recommended Text		1. Text Book : Latex for beginners Work book 5th edition, Document Reference:3722-2014, March 2014							
Reference Books		<p>1. Learning Latex, D.F.Griffits, D.J.Higham, Siam, Philadelphia, 1997</p> <p>2. Martin J. Erickson and Donald Bindner, A Student's Guide to the Study, Practice, and Tools of Modern Mathematics, CRC Press, Boca Raton, FL, 2011.</p>							

	3. L. Lamport. LATEX: A Document Preparation System, User's Guide and Reference Manual. Addison-Wesley, New York, second edition, 1994.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject 1. https://en.wikipedia.org/wiki/Data_analysis 2. https://www.tutorialspoint.com/r/r_overview.htm 3. https://en.wikipedia.org/wiki/Case_study

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Identify, analyze, develop, implement, verify and document the requirements for a computing environment.

CLO-2 Contributes to the diagnostics, troubleshooting, documenting and monitoring of technical problems using appropriate methodologies and tools.

CLO-3 LaTeX documents generally have a professional look and feel. This is because it provides a consistent formatting style that can be used to create complex documents with ease.

CLO-4 LaTeX is open-source software, which means that it is free to use and modify. It also has a large community of developers who are constantly improving and expanding the system, making it a great choice for any document project.

CLO-5 It offers a consistent and uniform layout, which can be used to create a variety of documents such as books, reports, slides, and more.

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Testing of Statistical Hypothesis					
Paper Number		Core VII					
Category	Core	Year	II	Credits	4	Course Code	T4ST7
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4			--	4	
Pre-requisite		Estimation theory and distribution theory					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To make familiar with testing concepts 2. To understand the concept of Most Powerful test 3. To understand the Likelihood ratio tests and their uses 4. To apply tests for samples from unknown distributions 					
Course Outline		<p>Unit I Statistical Hypothesis – Null and Alternative Hypothesis – Simple and Composite hypothesis – Critical region – Type-I and Type-II error – Most Powerful test – Uniformly Most powerful test – Neyman Pearson Lemma – Simple problems.</p> <p>Unit II Likelihood ratio test – Tests of mean of a normal population – Equality of two means of normal populations – test for variance of a normal population – Equality of variances of two normal populations.</p> <p>Unit III Test of equality of several means, Analysis of Variance. Correlation and Regression testing.</p> <p>Unit-IV Exact tests based on t distribution – One sample tests - one sided and two sided tests – Variance known and Variance unknown – Two sample tests – One sided and two sided - Variance known and Variance unknown.</p> <p>Unit-V Nonparametric methods – Confidence interval for distribution quantiles – Tolerance limits for distributions. Sign test, Wilcoxon test.</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>					
Recommended Text		<p>1. Robert V. Hogg and Allen T. Craig (1978), Introduction to Mathematical Statistics, 4th edition, Macmillan Publishing Co., Inc. New York</p>					

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	2. Rohatgi, V.K, and A.K.Md.EhsanesSaleh (2001), An Introduction to Probability and Statistics , John Wiley & Sons
Reference Books	1.Gupta S.C. and Kapoor V.K. (1991) : Fundamentals of Mathematical Statistics, Sultan Chand & Sons. 2.Goon A.M. Gupta M.K. and Das Gupta B (1980) : An outline of Statistical Theory, Vol.II World Press Calcutta. 3.Mood A.M. Graybill F.A. and Boes D.C.B (1980) : Introduction to the Theory of Statistics 3/e, McGraw Hill, New York. 4.Gibbons, J.D. (1971) : Non-Parametric Statistical Inference, McGraw Hill.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject http://fisher.stats.uwo.ca/faculty/kulperger/SS3858/Handouts/np-lemma.pdf https://www.sciencedirect.com/topics/mathematics/uniformly-most-powerful-test https://www.probabilitycourse.com/chapter8/8_4_5_likelihood_ratio_tests.php https://www.statisticshowto.com/probability-and-statistics/statistics-definitions/parametric-and-non-parametric-data/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

- CLO-1 frame hypotheses about population in real life research
CLO-2 identify suitable testing procedure for given hypotheses
CLO-3 Compare two populations using samples taken from them
CLO-4 Compare populations in its means and variances separately
CLO-5 identify situations to apply parametric and nonparametric tests
CLO-6 interpret results of a hypothesis testing

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Major Practical –II					
Paper Number		CORE – VIII (CC5, CC6 & CC7)					
Category	Core	Year	II	Credits	3	Course Code	T4ST8P2
		Semester	IV				
Instructional Hours per week		Lecture		Tutorial	Lab Practice	Total	
		3		-	--	3	
Pre-requisite		Basic Knowledge in practical					
Objectives of the Course		The main objectives of this course are: 1. The main purpose of using statistics is to plan the collected data in terms of experimental designs and statistical surveys.					
Course Outline		Unit-I Simple random sampling, Methods of selection, Sampling with and without replacement - Confidence limits – Simple random sampling Unit-II Stratified random sampling, stratification,– Estimation of population mean and its variance – Estimated variance and confidence limits, Allocation techniques -equal allocation, proportional Unit-III Systematic sampling –Relation to cluster sampling, Estimation of population mean and its sampling variance Unit-IV Exact tests based on t distribution – One sample tests - one sided and two sided tests – two sample tests Variance known and Variance unknown Unit-V Nonparametric methods – Sign test, Wilcoxon test.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this Course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		1. Gupta S.C. and Kapoor V.K (2015): Fundamentals of Mathematical Statistics, Sultan Chand & Sons. 2. Gupta, S.P. (2017): Statistical Methods, Sultan Chand & Sons Pvt Ltd, New Delhi, 35 th Revised Edition.					
Reference Books		1. Pillai, R.S., and Bagavathi (2003): Statistics, S. Chand and Company Ltd., New Delhi. 2. Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics. 3. Mood, A.D. Graybill, F.A. and Boes, D.C (1974): Introduction to the Theory of Statistics, 3/e, Mc.Graw Hill, New York.					
Website and e-Learning Source		e-books, tutorials on MOOC/SWAYAM courses on the subject https://en.wikipedia.org/wiki/Descriptive_statistics www.khanacademy.org/math/statistics-probability/random-variables-stats-library					

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1: . understand the principles underlying sampling as a means of making inferences about a population,

CLO-2: . understand the difference between randomization theory and model based analysis and the concepts of bias and sampling variability and strategies for reducing these,

CLO-3: be able to analyse data from multi-stage surveys,

CLO-4: The student connects between the appropriate size of the community and the appropriate method to estimate its features.

CLO-5: Different nonparametric methods in estimation, testing, model fitting, and in analyses.

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Elective Course -Practical-II					
Paper Number		EC - V (EC – IV & EC-VI)					
Category	EC	Year	II	Credits	3	Course Code	TSTECBP
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		3	-	--	2		
Pre-requisite		Basic Knowledge in practical					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. The main purpose of using statistics is to plan the collected data in terms of experimental designs and statistical surveys. 2. Find the derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formulae, Stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function. 					
Course Outline		<p>Unit-I Interpolation for Equal intervals: Newton's Forward Interpolation Formula and Newton's Backward Interpolation Formula, Evaluation of missing terms.</p> <p>Unit-II Interpolation with Unequal Intervals: Divided Differences, Newton's Divided Differences Interpolation Formula, Lagrange's Interpolation Formula and Inverse Lagrange's Interpolation.</p> <p>Numerical Integration: General Quadrature formula for equidistant ordinates, Trapezoidal Rule, Simpson's 1/3rd Rule, Simpson's 3/8th Rule.</p> <p>Unit-III Linear programming models – Graphical solution of LPP in two variables – LPP in standard form – Simplex method</p> <p>Unit-IV Transportation problem(TP) – TP formulation- North-West Corner, Least cost, Vogel's Approximation method – UV-method – Assignment problem</p> <p>Unit-V Network analysis by CPM/PERT construction of network</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"> 1. Gupta S.C. and Kapoor V.K (2015): Fundamentals of Mathematical Statistics, Sultan Chand & Sons. 2. Gupta, S.P. (2017): Statistical Methods, Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition. 					
Reference Books		<ol style="list-style-type: none"> 1. Pillai, R.S., and Bagavathi (2003): Statistics, S. Chand and Company Ltd., New Delhi. 2. Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics. 3. Mood, A.D. Graybill, F.A. and Boes, D.C (1974): Introduction to the Theory of Statistics, 3/e, Mc.Graw Hill, New York. 					

Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject https://en.wikipedia.org/wiki/Descriptive_statistics www.khanacademy.org/math/statistics-probability/random-variables-stats-library
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Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1: Acquire basic knowledge in solving interpolation with equal interval problems by various numerical methods. Estimate the missing terms through interpolation methods.

CLO-2: Develop skills in analyzing the methods of interpolating a given data, properties of interpolation with unequal intervals and derive conclusions, approximate a function using an appropriate numerical method.

CLO-3: Implement numerical methods for a variety of multidisciplinary applications and a variety of numerical algorithms using appropriate technology.

CLO-4: formulate a given simplified description of a suitable real-world problem as a linear programming model in general, standard and canonical forms

CLO-5: sketch a graphical representation of a two-dimensional linear programming model given in general, standard or canonical form

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Operations Research					
Paper Number		Elective Course – VI					
Category	EC6	Year	II	Credits	4	Course Code	TSTECC
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4		--	4		
Pre-requisite		Linear algebra					
Objectives of the Course		The main objectives of this course are: 1. Optimization techniques 2. Transportation problems 3. Game theory 4. Replacement problems 5. Network analysis					
Course Outline		<p>Unit I Formulation of Linear programming models – Graphical solution of LPP in two variables – LPP in standard form – Principles of Simplex method – Algorithm.</p> <p>Unit II Transportation problem (TP) – TP formulation- North-West Corner, Least cost, Vogel's Approximation method – UV-method – Assignment problem and algorithm.</p> <p>Unit III: Theory of Games – Basic definition – Maximin and Minimax criterion – Solution of Games with saddle points – Two-by-Two (2x2) Games without saddle point – principle of dominance – problems based on dominance rule – Graphical method for (2xn) and (mx2) games.</p> <p>Unit-IV: Replacement problems – Replacement policy for items whose maintenance cost increases with time and the value of money remains constant – Replacement policy for items whose maintenance cost increases with time and the value of money also changes with time – Replacement of items that fail completely – Group replacement policy</p> <p>Unit-V Network analysis by CPM/PERT : Basic Concept – Constraints in Network – Construction of the Network – Time calculations – Concept of slack and float in Network Analysis.</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. Kanti Swarup, P.K. Gupta and Manmohan (2007) Operations Research, Sultan Chand Sons, New Delhi. 2. S.D. Sharma (2002) : Operations Research: Kedarnath and					

	Ramnath, Meerut. 3. J.K. Sharma (2002) : Operations Research: Theory and application , Macmillan, India Ltd.
Reference Books	1. Taha : Operations Research, PHI. 2. F.S. Hiller and Liberman (1994): Operations Research, CBS Publishers and Distributions, New Delhi.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

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

CLO-2 solve problems of linear programming

CLO-3 understand transportation problems and its applications

CLO-4 solve problems using games theory

CLO-5 Do replacement problems and solve it

CLO-6 Do network analysis and get problem solving skills

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

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


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

Level of Correlation between PSO's and CO's

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Title of the Course		Python Programming					
Paper Number		SEC – VI					
Category	SEC	Year	II	Credits	2	Course Code	T4STSE6
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		2	--	--	2		
Pre-requisite		Not needed					
Objectives of the Course		<p>The main objectives of this course are</p> <ol style="list-style-type: none"> 1. To introduce the fundamentals of Python Programming. 2. To teach about the concept of Functions in Python. 3. To impart the knowledge of Lists, Tuples, Files and Directories. 4. To learn about dictionaries in python. 5. To explores the object-oriented programming, Graphical programming aspects of python with help of built in modules. 					
Course Outline		<p>Unit I BASICS : Python – Variables – Executing Python from the Command Line – Editing Python Files – Python Reserved Words – Basic Syntax-Comments – Standard Data Types – Relational Operators – Logical Operators – Bit Wise Operators – Simple Input and Output.</p> <p>Unit II CONTROL STATEMENTS: Control Flow and Syntax – Indenting – if Statement – statements and expressions- string operations- Boolean Expressions –while Loop – break and continue – for Loop. LISTS: List-list slices – list methods – list loop – mutability – aliasing – cloning lists – list parameters.</p> <p>Unit III FUNCTIONS: Definition – Passing parameters to a Function – Built-in functions- Variable Number of Arguments – Scope – Type conversion-Type coercion-Passing Functions to a Function – Mapping Functions in a Dictionary.</p> <p>Unit-IV: ERROR HANDLING: Run Time Errors – Exception Model – Exception Hierarchy – Handling Multiple Exceptions – Data Streams – Access Modes Writing .</p> <p>Unit-V: Data to a File Reading – Data From a File – Additional File Methods – Using Pipes as Data Streams – Handling IO Exceptions – Working with Directories.</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 IES-ISS/ TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)</p>					


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Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Mark Summerfield, Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009. 2. Martin C. Brown, PYTHON: The Complete Referencel, McGraw-Hill, 2001 3. E. Balagurusamy (2017), "Problem Solving and Python Programming", McGraw-Hill, First Edition.
Reference Books	1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python — Revised and updated for Python 3.2, Network Theory Ltd., 2011 3. Wesley J Chun, —Core Python Applications ProgrammingI, Prentice Hall, 2012.
Website and e-Learning Source	E-Books, tutorials on MOOC/SWAYAM courses on the subject

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Remembering the concept of operators, data types, looping statements in Python programming.

CLO-2 Understanding the concepts of Input / Output operations in file..

CLO-3 Applying the concept of functions and exception handling

CLO-4 Analyzing the structures of list

CLO-5 Demonstrate significant experience with python program development environment

CLO-6 Tuples and maintaining dictionaries

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Big Data Analysis							
Paper Number		SEC – VII							
Category	SEC	Year	II	Credits	3	Course Code	T4STSE7		
		Semester	IV						
Instructional Hours per week		Lecture	2	Tutorial	--	Lab Practice	--	Total	2
		Pre-requisite		Not needed					
Objectives of the Course		<p>The main objectives of this course are</p> <ol style="list-style-type: none"> 1. Understand the Big Data Platform and its Use cases 2. Provide an overview of Apache Hadoop 3. Provide HDFS Concepts and Interfacing with HDFS 4. Understand Map Reduce Jobs 5. Apply analytics on Structured, Unstructured Data. Exposure to Data Analytics with R. 							
Course Outline		<p>Unit I Machine Learning: Introduction - Machine Learning Algorithms - Regression Model - Clustering - Collaborative Filtering - Association Rule Mining - Decision Tree.</p> <p>Unit II Introduction: Big data – Characteristics, Evolution, Definition, Challenges - Classification of Analytics – Challenges in collecting and validating big data - Terminologies used in big data environments.</p> <p>Unit III Interacting with Hadoop ecosystem: NoSQL – Uses, Types, Databases, Advantages, and Use in industry.</p> <p>Unit-IV NoSQL vendors, SQL versus NoSQL - NewSQL - Comparison of SQL, NoSQL and NewSQL.</p> <p>Unit-V: Mango DB: Introduction - Using Java Script Object Notation - Creating a Unique key - Support for Dynamic Queries - Storing Binary data - Replication - Sharing - Updating Information In - Place.</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 IES-ISS/ 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"> 1. Seema Acharya & Subhashini Chellappan, <i>Big Data and Analytics</i>, Bhushan Print line, 2018. 2. John V. Guttag, <i>Introduction to Computation and Programming Using Python with Application to Understanding Data</i>, The MIT Press, Cambridge, Massachusetts, London, England, 2016. 							

Reference Books	1. Multiple Authors, <i>Big data analysis for Dummies</i> , Dummies Press, 2011. 2. Anurag Srivatsava, <i>Hadoop Blueprints</i> , PACKT, 2014. 3. Dipayan Dev, <i>DL with Hadoop</i> , PACKT, 2015. Multiple Authors, <i>Hadoop Fundamentals</i> , Packet Publications, 2012.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Identify Big Data and its Business Implications.

CLO-2 Analyze Infosphere BigInsights Big Data Recommendations.

CLO-3 List the components of Hadoop and Hadoop Eco-System

CLO-4 Access and Process Data on Distributed File System

CLO-5 Manage Job Execution in Hadoop Environment

CLO-6 Apply Machine Learning Techniques using Python

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Stochastic Processes					
Paper Number		Core IX					
Category	Core	Year	III	Credits	4	Course Code	T5ST9
		Semester	V				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		5		--	5		
Pre-requisite		Probability theory					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To study the basic concepts of theory of Stochastic Processes, the most important types of Stochastic Processes, various properties and characteristics (Poisson, Markov and others). 2. To learn the notions of ergodicity, stationarity and applications. 					
Course Outline		<p>Unit I Notion and specification of Stochastic Processes – Stationary Process – Markov Chains – Definition and examples – Higher transition probabilities: Chapman – Kolmogorov equations. Classification of States and Chains</p> <p>Unit II Markov Chains – Determination of Stability of a Markov System – Limiting Behaviour – Ergodic theorem. One dimensional random walk</p> <p>Unit III Markov Processes with discrete state space: Poisson Process – Postulates of Poisson process Properties of Poisson Process – Poisson process and related distributions. Pure Birth process – Yule-Furry process. Pure Death Process – Simple Birth and Death Process.</p> <p>Unit-IV Renewal Process – Definition, related concepts and examples – Renewal equation – Elementary Renewal Theorem – Basic Renewal Theorem.</p> <p>Unit-V Applications in Stochastic Models: Queuing Systems and Models: Simple queuing models M/M/1, M/M/s queuing systems (finite and infinite) steady state solution-simple problems with finite and infinite capacities.</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Recommended Text	1. Medhi, J. (2019): Stochastic Processes, New Age International Publishers. 2. KantiSwarup, Gupta.P.K. Man Mohan.,(2010): Operations Research, Sultan Chand & Sons
Reference Books	1. Karlin ,S. and Taylor, H.M.(1975): A first Course in Stochastic Processes, Academic Press, New York. 2. Ross, S.M. (1983): Stochastic Processes. John Wiley Eastern Ltd., New York.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject http://www.randomservices.org/random/ https://www.britannica.com/science/stochastic-process

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Understand stochastic nature of random variable and different stochastic process

CLO-2 know about transition matrix and its calculations

CLO-3 understand Markov chain and its applications

CLO-4 understand Markov process and its applications

CLO-5 understand renewal process and its applications

CLO-6 know about various stochastic modeling and its applications

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Regression Analysis					
Paper Number		Core X					
Category	Core	Year	III	Credits	4	Course Code	T5ST10
		Semester	V				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		5	-	--	5		
Pre-requisite		Linear regression analysis, Estimation theory					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To understand linear and nonlinear relationships between variables and training the students in applications oriented. 2. To teach Linear Regression models, its assumptions and its properties. 3. To perform model adequacy check before using Linear Regression models 					
Course Outline		<p>Unit I Simple linear regression-Assumptions, estimation of model parameters, standard error of estimators, testing of hypotheses on slope and intercept (β's), interval estimation of model parameters.</p> <p>Unit II Standard Gauss Markov setup, least square estimation of model parameters, variance covariance of least squares estimators, estimation of error variance Tests of hypotheses – significance of regression, individual regression coefficients, subset of regressor variables.</p> <p>Unit III Model adequacy checking - residual plots for checking normality homoscedasticity and detection of outliers. Test for Lack of fit of the model. Durbin – Watson test for autocorrelation. Analytical methods for selecting a transformation generalized and weighted least squares- Detection of influential observations – Cooks statistic, DFFITS, DFBETAS.</p> <p>Unit-IV Multicollinearity – sources, effects, diagnostics, Methods of dealing with multi collinearity (collection of additional data, model respecification, Ridge regression).</p> <p>Unit-V Nonlinear regression – transformation to a linear model, their use and limitations, initial estimates (starting values), parameter estimation using iterative procedures – Gauss-Newton, steepest Descent, Marquardt's compromise.</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		<p>1. Montgomery, D. C., Peck, E. A. and Vining, G. G. (2003): Introduction to Linear regression analysis, third edition, John Wiley and Sons, Inc.</p> <p>2. Zar, J.H. (2006): Bio-statistical Analysis, fourth edition, Pearson education.</p>					

	3. Douglas C. Montgomery (2012) Introduction to Linear Regression Analysis. 4. Iain Pardoe (2012): Applied regression Modeling, second edition, Wiley
Reference Books	1. Draper, N.R. and Smith, H. (2003): Applied Regression Analysis, third edition, John Wiley and Sons, Inc. 2. Johnston, J. (1984): Econometric methods, third edition, McGraw Hill International. 3. A. Sen, M. Srivastava, Regression Analysis — Theory, Methods, and Applications, Springer-Verlag, Berlin, 2011.
Website and e-Learning Source	E-books, tutorials on MOOC/SWAYAM courses on the subject http://home.iitk.ac.in/~shalab/regression/Chapter2-Regression-SimpleLinearRegressionAnalysis.pdf http://www.mit.edu/~6.s085/notes/lecture3.pdf https://ncss-wpengine.netdna-ssl.com/wp-content/themes/ncss/pdf/Procedures/NCSS/Nonlinear_Regression.pdf https://data.princeton.edu/wws509/notes/c4.pdf http://home.iitk.ac.in/~shalab/regression/Chapter15-Regression-PoissonRegressionModels.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Estimating model parameters and testing it

CLO-2 understand linear and nonlinear models assumptions

CLO-3 check model adequacy

CLO-4 know about variable selection

CLO-5 know about nonlinear regression models

CLO-6 choose model if some of the basic assumptions are violated also

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Actuarial Statistics							
Paper Number		Core XI							
Category	Core	Year	III	Credits	4	Course Code	T5ST11		
		Semester	V						
Instructional Hours per week		Lecture	5	Tutorial		Lab Practice	--	Total	5
		Pre-requisite		Basic arithmetic					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. It develops a greater understanding of statistical principles and their application in actuarial statistics. 2. Describe the core areas of actuarial practice and relate to those areas actuarial principles, theories and models. 3. It gives the understanding of the application knowledge of the life insurance environment. 							
Course Outline		<p>Unit I Simple and compound interest, present value and accumulated values of fixed rate, varying rate of interest</p> <p>Unit Mortality : Gompertz - Makeham laws of mortality - life tables. Annuities: Endowments, Annuities, Accumulations, Assurances, Family income benefits.</p> <p>Unit III Policy Values: Surrender values and paid up policies, industrial assurances, Joint life and last survivorship, premiums.</p> <p>Unit-IV Contingent Functions: Contingent probabilities, assurances. Decrement tables. Pension funds: Capitalsums on retirement and death, widow's pensions, benefits dependent on marriage.</p> <p>Unit-V Principles of insurance, pure endowment, whole life assurance, Net premium for assurance and annuity plans-level annual premium under temporary assurance .</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill							
Recommended Text		<ol style="list-style-type: none"> 1. Hooker, P.F., Longley, L.H.-Cook (1957) : Life and other contingencies, Cambridge. 2. Alistair Neill (1977) : Life contingencies, Heinemann professional publishing. 3. Gupta and Kapoor (2001) Fundamentals of Applied Statistics 							
Reference Books		<ol style="list-style-type: none"> 1. Study material of IAI/IFoA of Actuarial Societies 2. Hosack, I.B., Pollard, J.H. and Zehnwith, B. (1999) : introductory statistics with applications in general insurance, Cambridge University. 							

Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject
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Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1 :To explain the utility theory and insurance terminologies.

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

CLO3To describe the various types of premium and their numerical evaluations.

CLO4:To explain implementation of the Life insurance policies.

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

CLO6: To understand real life problems related to insurance


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

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

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

Level of Correlation between PSO's and CO's


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Title of the Course		Matrix and Linear Algebra					
Paper Number		Core XII					
Category	Core	Year	III	Credits	3	Course Code	T5ST12
		Semester	V				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		5		--	5		
Pre-requisite		Basic vector and matrix theory					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1.To study the basic operations of transpose and inverse of matrices 2.To know the structure of orthogonal and unitary matrices 3. To learn the invariance properties of ranks 4.To know and to apply the concepts of vector space and matrix polynomials. 					
Course Outline		<p>Unit I Matrices-Transpose-Conjugate transpose- Reversal law for the transpose and conjugate transpose. Adjoint of a matrix, Inverse of a matrix, Singular and Non -Singular matrices,</p> <p>Unit II Reversal law for the inverse of product of two matrices. Commutativity of inverse and transpose of matrix, Commutativity of inverse and conjugate transpose of matrix, Orthogonal and Unitary Matrices, Product of unitary matrices, Partitioning of matrices.</p> <p>Unit III Rank of a matrix, Echelon form, Rank of transpose, Elementary transformations, Elementary matrices, Invariance of rank through elementary transformations, Reduction to Normal form, Equivalent matrices.</p> <p>Unit-IV Vector space – Linear Dependence - Basis of a vector space –Sub-space - Properties of Linearly Independent and Dependent systems, Row and Column spaces, Equality of Row and Column ranks, Rank of Sum and Product of matrices</p> <p>Unit-V Matrix polynomials, Characteristic roots and vectors, Relation between characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity, Nature of characteristic roots in case of special matrices, Cayley- Hamilton theorem.</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		1.Vasishtha.A.R (1972) : Matrices, KrishnaprakashanMandir, Meerut.					
Reference Books		1.Shanthinarayan, (2012) : A Text Book of Matrices, S.Chand& Co, New Delhi 2.M.L.Khanna (2009), Matrices, Jai PrakashNath& C					

Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject https://samples.jbpub.com/9781556229114/chapter7.pdf https://www.vedantu.com/maths/matrix-rank https://textbooks.math.gatech.edu/ila/characteristic-polynomial.html https://www.aitude.com/explain-echelon-form-of-a-matrix/
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Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

- CLO-1 Do basic operations of matrices
- CLO-2 Understand various transactions of matrices and its applications
- CLO-3 Understand various properties of matrices
- CLO-4 Able to understand vector space and its applications
- CLO-5 Able understand eigen vector and its applications
- CLO-6 Able understand vector and matrix applications


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

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

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

Correlation between PSO's and CO's

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Title of the Course		Statistical Quality Control					
Paper Number		Elective VII					
Category	Core	Year	III	Credits	3	Course Code	TSTECD
		Semester	V				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4		--	4		
Pre-requisite		Estimation theory and Distribution theory					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To impart basic theoretical knowledge about terminologies, need of control charts for quality control, construct control limits of variables and attributes. 2. To educate the learner to be able to construct control charts for defects, number of defects (c-chart); and control chart for number of defects per unit (u-chart). 3. To educate acceptance sampling plan and discuss the procedure of its implementation, compute the probability of accepting or rejecting a lot. 4. To define acceptance quality level (AQL) and lot tolerance percent defective (LTPD) of the lot; and compute the producer's risk and consumer's risk for an acceptance sampling plan. 5. To facilitate the learner to understand the difference between attributes and variables sampling plans, the advantages and disadvantages of variables sampling. 					
Course Outline		<p>Unit I Importance and need for Statistical Quality Control techniques in Industry – Causes of variations in Quality – Uses of Shewart's Control charts –Terminologies: Specification limits, Tolerance limits, 3σ limits and Warning limits - Control charts variables: Control Chart for Mean (Xbar-Chart) ,Range Chart (R-Chart) , Standard Deviation Chart (S-Chart) - Process Capability Analysis</p> <p>Unit II Control Charts for Attributes: Control Chart for Fraction Defective (p-Chart) ,p-Chart for Variable Sample Size , Control Chart for Number of Defectives (np-Chart). Control Charts for Defects: Control Chart for Number Of Defects (C-Chart)and Control Chart for Number Of Defects Per Unit (U-Chart).</p> <p>Unit III Acceptance sampling plans for attributes –Types of Acceptance Sampling plans, Methods of Inspection: 100% Inspection and Sampling Inspection , Advantages and Limitations of Acceptance Sampling. Terms used in acceptance sampling plans: Lot, Lot Size, Sample Size, Lot Quality, Acceptance Number , Probability of accepting a lot (P_a) , Acceptance Quality Level (AQL).</p> <p>Unit-IV Rectifying Sampling Plans. Single and Double sampling plans. OC, AOQ, ATI and ASN curves for Single and Double sampling plans.</p> <p>Unit-V Acceptance sampling for variables known and unknown sampling plans (one sided specification only) -Determination of n and k for one sided specification of OC curve</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. Douglas C. Montgomery (2005) : Introduction to Statistical Quality Control, John Wiley & Sons, New York. (Unit V: Chapter 16 (pages 670 to 680) 2. Gupta S.C and V.K.Kapoor (2007): Fundamentals of Applied Statistics, Sultan Chand Sons, New Delhi 3. Mahajan, M (1998) : Statistical Quality Control, DhanpatRao & Co,
Reference Books	1. Gupta, R.C.(1974): Statistical Quality Control. 2. Ekambaram, S K. (1963): Statistical basis of Acceptance sampling, Asia Publishing House. 3. Grant, E.L. and Laven Worth, R.S.: Statistical Quality Control, McGraw Hill.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject

Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 understand Industrial applications of Statistics

CLO-2 understand statistical process control and methods for it

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

CLO-4 understand the situations using special purpose control charts

CLO-5 know various product control techniques

CLO-6 To do numerical problems and able to get critical thinking to solve problems

To explore real life problems.

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Population Studies							
Paper Number		Elective – VIII							
Category	EC	Year	III	Credits	3	Course Code	TSTECE		
		Semester	V						
Instructional Hours per week		Lecture	4	Tutorial	--	Lab Practice	--	Total	4
		Pre-requisite		Not needed					
Objectives of the Course		The main objectives of this course are							
Course Outline		<p>Unit I Vital Statistics: Definition, Nature, Scope and Methods of vital statistics data - Measurement of Population – Development of Population Studies in India.</p> <p>Unit II: Risk Measures: Ratios, Proportions, and Rates – its properties, uses and simple problems; Morbidity Rates: Incidence proportions, Incidence rates, Prevalence rates – Definition, properties, uses and simple problems.</p> <p>Unit III Fertility Rates: Crude Birth Rate - General Fertility Rate - Age Specific Fertility Rate - Total Fertility Rate - Gross Reproduction Rate (GRR) - Net Reproduction Rate (NRR) - Replacement level Fertility - Birth order statistics - Child Women ratio - Order Specific Fertility Measures – Theory and Problems.</p> <p>Unit-IV Mortality Rates: Crude Death Rate - Specific death rates by Age - Sex - Causes of Death - Marital Status and other Characteristics - Infant Mortality Rate - Standardization of Death Rates (Direct and Indirect methods) – Theory and Problems.</p> <p>Unit-V Life Tables: Meaning - Uses – Expectation of life - Stationary and Stable Population – Assumptions, Description of columns and Construction of life tables – Problems on Life tables. Lotka-Dublin's Model (concept only) - Central Mortality Rate, Force of Mortality.</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 IES-ISS/ TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (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. S.C .Gupta and V.K. Kapoor (2013): Fundamental of Applied Statistics. - Sultan Chand & Sons, New Delhi.</p> <p>2.Gupta S.P (1995) , Statistical Methods, Sultan Chand & Sons, New Delhi.</p> <p>3. Goon A.M, Gupta M.A and Das Gupta (1987) , Fundamentals of Statistics, Sultan Chand & Sons, New Delhi.</p>							

Reference Books	1. Gupta S.P (1995) , Statistical Methods, Sultan Chand & Sons, New Delhi. 2. Goon A.M, Gupta M.A and Das Gupta (1987) , Fundamentals of Statistics, Sultan Chand & Sons, New Delhi.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject 1. https://www.stat.berkeley.edu/~bartlett/courses/153-fall2010/lectures/ .pdf 2. http://www.gdcboysang.ac.in/About/droid/uploads/EconomicsPart4.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Explain demographic changes in the world and their major determinants

CLO-2 Apply demographic concepts and population theories to explain past and present population characteristics

CLO-3 Evaluate the use of demographic concepts and population theories to understand contemporary socio-economic issues and current affairs

CLO-4 Assess the relationship between demographic change and policy

CLO-5 To understand human effects on natural resources, the environment, and human health.

CLO-6 Understanding these effects can lead to programs and policies that help mitigate the negative impacts people have on the environment.

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Design of Experiments					
Paper Number		Core XIII					
Category	Core	Year	III	Credits	5	Course Code	T6ST13
		Semester	VI				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		6		--	6		
Pre-requisite		Linear models					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To get theoretical knowledge in Statistical Design of Experiments and analysis of variance 2. To build strong theoretical foundation in Orthogonal latin squares, Hyper Graeco Latin squares, factorial and fractional factorial experiments, PIBD, inter and intra blocks, split plot, analysis covariance, Responsesurface methodology 3. To develop analytical thinking in problem solving skills 					
Course Outline		<p>Unit I Fundamental Principles of Experiments – Replication, Randomization and Local Control techniques – Size of experimental unit – Methods of determination of experimental units.</p> <p>Unit II Analysis of variance – One way, Two way, classification (without interaction) – Multiple range test; Newman-Keul's test – Duncan's multiple range test – Tukey's test.</p> <p>Unit III Completely Randomized Design (CRD) and its analysis – Randomized block design (RBD) and its analysis – RBD – More than one but equal number of observations per cell – Latin Square Design (LSD) and its analysis.</p> <p>Unit-IV Missing plot techniques – Meaning – Least Square method of estimating one missing observation – RBD and LSD – Two observations missing in RBD and LSD – Analysis of covariance technique in CRD and RBD (without derivation).</p> <p>Unit-V Factorial experiment – Definition – 2^2, 2^3 and factorial experiments and their analysis - 3^2 concept only – Principles of confounding – Partial and complete confounding in 2^3 – Split plot design and its analysis.</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"> 1. Das, M.N. and Giri N.C (1979) : Design and Analysis of Experiments, Wiley Eastern, New Delhi. 2. Gupta S.C. and Kapoor V.K (2007) : Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
Reference Books	<ol style="list-style-type: none"> 1. Kempthorne, (1956): Design and Analysis of Experiments, John Wiley, New York. 2. Montgomery . D. (1985): Design of Experiments, John Wiley and Sons.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 To understand analysis of variance and experimental designs

CLO-2 To have strong theoretical knowledge in Orthogonal latin squares, Hyper Graeco Latin squares

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

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

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

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

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Demography					
Paper Number		Core XIV					
Category	Core	Year	III	Credits	5	Course Code	T6ST14
		Semester	VI				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		6	-	--	6		
Pre-requisite							
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. Learn population and demographic registration 2. To learn fertility and mortality measurements 3. To understand Life table uses 4. To learn migration effect 					
Course Outline		<p>Unit I Sources of demographic data – civil registration – population census registers – errors in demographic data – methods of improvements.</p> <p>Unit II Fertility and mortality measurements – general and specific rates – standardized rates – age pyramid of sex composition gross and net reproduction rates.</p> <p>Unit III Life table – structure – construction – relationship between the function of a life table – abridged life table – population estimation – growth rates – gross and net reproduction rates component method of population projection – forces of mortality – Gompertz and Makeham's law – logistic curve fitting and its use.</p> <p>Unit-IV Spatial distribution of population –migration – kinds of migration – factors important in migration analysis – migration defining period and boundary – migration data by vital statistics and survival ratio and National Growth rate methods</p> <p>Unit-V Components of population growth and change – Demographic transition theory – Methods of population projection – component method of projection, Leslie matrix, Logistic curve and its graduation</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. Berclay, G.W.(1959) : Techniques of Population Analysis 2. Benjamin, B (1968) : Health and Vital Statistics, Allen & Unwin Srivastava, 3. O.S.(1983) : A text book of Demography , Vikas Publishing. 4. Bogue , Donald J: Principles of Demography (1976) John Willey, New York
Reference Books	1.Pathak. K.B. and Ram. F (1992): Techniques of Demography, Wiley Eastern. 2. Ram Kumar R (1986): Technical Demography, Wiley Eastern.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 to understand need of population study and its registration system

CLO-2 to understand fertility and mortality effect on population

CLO-3 to understand life table and its usage to real problems

CLO-4 to get effect of migration in population

CLO-5 to understand population growth and its effect

CLO-6: to understand the need of population study for a government

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Major Practical – III					
Paper Number		CORE– XV (Based on CCXIII and CCXIV)					
Category	CC 15	Year	III	Credits	4	Course Code	T6ST15P3
		Semester	VI				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	--	--	4		
Pre-requisite		Not needed					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. understand the basic terms used in design of experiments 2. Identify the experimental unit and recognise issues of non-independence 3. To equip students with the basic concepts and tools for analyzing the continuous process of population renewal throughout time. 4. To make them aware of interrelations of demographic dynamics (fertility, mortality, migration) and a range of contextual factors (social, economic, and political) 					
Course Outline		Unit I Analysis of variance – One way, Two way, classification, Multiple range test; Duncan’s multiple range test - Completely Randomized Design (CRD) and its analysis – Randomized block design (RBD)					
		Unit II Latin Square Design (LSD) and its analysis. Missing plot techniques – Meaning – Least Square method of estimating one missing observation – RBD and LSD – Two observations missing in RBD and LSD					
		Unit III Analysis of covariance technique in CRD and RBD - Factorial experiment – Definition – 2^2 , 2^3 and factorial experiments analysis - 3^2					
		Unit-IV Fertility and mortality measurements – general and specific rates – standardized rates – age pyramid of sex composition gross and net reproduction rates.					
		Unit-V Life table – structure – construction – relationship between the function of a life table – abridged life table – population estimation – growth rates – gross and net reproduction rates					
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 IES-ISS/ TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (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"> 1. Gupta S.C. and Kapoor V.K. (2007) :Fundamentals of Applied Statistics , 4thedition ,Sultan Chand & Sons Publishers, New Delhi. 					

	2. Gupta S.P. (2011) :Statistical Methods , Sultan Chand & Sons Publishers, NewDelhi. 3. O.S.(1983) : A text book of Demography , Vikas Publishing.
Reference Books	3. Kempthorne, (1956): Design and Analysis of Experiments, John Wiley, New York. 4. Montgomery . D. (1985): Design of Experiments, John Wiley and Sons. 3. O.S.(1983) : A text book of Demography , Vikas Publishing.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

- CLO-1:** understand the potential practical problems in its implementation.
CLO-2: appreciate the advantages and disadvantages of a design for a particular experiment.
CLO-3: construct optimal or good designs for a range of practical experiments and describe how the analysis of the data from the experiment should be carried out.
CLO-4: comprehend the basic concepts and definitions in Demography
CLO-5: Relate the history of population growth to the present day structure and composition of population.

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		Economic & Official Statistics					
Paper Number		Elective – IX					
Category	Core	Year	III	Credits	3	Course Code	TSTECF
		Semester	VI				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		6		--	6		
Pre-requisite		Not needed					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1.To understand Indian official statistical system and data collection 2.To know Indian economic and agricultural surveys 3.To know index numbers and consumer price index 4.To know time series analysis 5.To learn demand analysis and its concepts 					
Course Outline		<p>Unit I Indian Statistical System: Data Collection for Governance – NSSO and its role in national data collection. NSSO reports and publications</p> <p>Unit II Economic Statistics: Information collection for Socio-Economic Survey – Agricultural, Industrial, Crime Statistics and Statistical methods applied to analyse large volumes of data</p> <p>Unit III Index numbers: Basic problems in construction of index numbers. Methods- Simple and Weighted aggregate-Average of price relatives-Chain base method. Criteria of goodness-Unit test , Time Reversal Factor Reversal and Circular tests.</p> <p>Unit-IV Time Series: Measurement of Trend : Graphic, Semi-averages, Moving averages. Least Squares – Straight line, Second degree parabola, Exponential curve. Measurement of Seasonal variation by Ratio-to-Moving average method.</p> <p>Unit-V Demand Analysis: Introduction-Demand and Supply, Price elasticity of demand and supply, partial and cross elasticities of demand. Types of data required for estimating elasticity. Methods of estimating demand functions: Leontief 's and Pigou's methods.</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 IES-ISS/ TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (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		3. Gupta S.C. and Kapoor V.K. (2007) :Fundamentals of Applied Statistics , 4 th edition ,Sultan Chand &Sons Publishers, New Delhi.					

4. Gupta S.R. (2011): Statistical Methods, Sultan Chand

5. Spyros Makridakis, Steven C. Wheelwright and Rob J Hyndman (2003): Forecasting Methods and Applications, 3rd Edition, John Wiley and Sons Inc.
6. Websites of Government of India – Ministry of Statistics & Programme Implementation

Reference Books	1. Spyros Makridakis, Steven C. Wheelwright and Rob J Hyndman (2003) : Forecasting Methods and Applications, 3 rd Edition, John Wiley and Sons Inc. . 2. Irving W. Burr (1974): Applied Statistical Methods, Academic Press.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

- CLO-1 : understand Indian official statistics and offices related to it
 CLO-2 understand Indian surveys for collecting official statistics
 CLO-3 know uses of index numbers
 CLO-4 know demand analysis and its need
 CLO-5 to understand economic India by knowing agricultural and economic surveys
 CLO-6 to know the time series and prediction

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

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

CO /PO	PSO1	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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Title of the Course		Times Series & Index Number					
Paper Number		Elective – IX					
Category	EC	Year	III	Credits	3	Course Code	TSTECG
		Semester	VI				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		6	--	--	6		
Pre-requisite		Not needed					
Objectives of the Course		The main objectives of this course are					
Course Outline		<p>Unit I Analysis of Time Series – definition and uses, Additive and Multiplicative Models in Time Series, Components of Time Series - Secular Trend, Seasonal variation, Cyclic Variations and Irregular fluctuations- Definition and Concepts.</p> <p>Unit II Measurement of Trend – Graphic method, Method of Semi-Averages, Method of Moving Averages and Method of Least Squares. Fitting of Straight line trend and Parabolic trend (theory and problems).</p> <p>Unit III Measurement of Seasonal Variations – Method of Simple Averages, (problems) Ratio to Moving Average method by additive and multiplicative model (problems), Ratio to Trend Method and Link Relative Method (concepts and procedure only).</p> <p>Unit-IV Index Numbers – Definition and Uses, Types of Index Numbers, Problems involved in the construction of Index Numbers. Construction of Simple Index Numbers. – Simple aggregate method and Simple average of Price Relatives using A.M & G.M. Construction of Weighted Index Numbers – Laspeyres, Paasches, Dorbish and Bowley, Marshall - Edgeworth and Fisher's Ideal Index Numbers(Problems).</p> <p>Unit-V Construction of Weighted Average of Price relatives Index Numbers using A.M & G.M. Fixed Base Index Numbers and Chain Base Index Numbers. Tests of adequacy of a good Index Number – Time Reversal Test, Factor Reversal Test, Unit test and Cyclic test.</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 IES-ISS/ TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (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. S.C .Gupta and V.K. Kapoor (2013): Fundamental of Applied Statistics. - Sultan Chand & Sons, New Delhi.</p> <p>2. Gupta S.P (1995) , Statistical Methods, Sultan Chand & Sons, New Delhi.</p> <p>3. Goon A.M, Gupta M.A and Das Gupta (1987) , Fundamentals of Statistics, Sultan Chand & Sons, New Delhi.</p>					
Reference Books		<p>1. Gupta S.P (1995) , Statistical Methods, Sultan Chand & Sons,</p> <p>2. Goon A.M, Gupta M.A and Das Gupta (1987) , Fundamentals of Statistics, Sultan Chand & Sons, New Delhi.</p>					

Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject 1. https://www.stat.berkeley.edu/~bartlett/courses/153-fall2010/lectures/1.pdf 2. http://www.gdcboysang.ac.in/About/droid/uploads/EconomicsPart4.pdf
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Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 Acquire the knowledge about the time series analysis

CLO-2 Fitting of trend by Moving Average method

CLO-3 Carry out the time series data, its applications to various fields and components of time series

CLO-4 Use appropriate experimental data an index numbers

CLO-5 Give statistical interpretation of the business statistics

CLO-6 Use fixed Base Index Numbers and Chain Base Index Numbers

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		STATISTICS FOR MATHEMATICS – I (For B.Sc., Mathematics Students)					
Paper Number		ELETIVE-I					
Category	EC1	Year	I	Credits	3	Course Code	T1GSMA1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	-		4		
Pre-requisite		Basic Knowledge on events and statistical techniques					
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To develop the students ability to deal with numerical and quantitative issues in mathematics 2. To enable the use of statistical and algebraic techniques wherever relevant. 3. To have a proper understanding of Statistical applications in mathematics 					
Course Outline		<p>Unit-I Measures of central tendency – Mean, Median, Mode, Geometric Mean, Harmonic Mean and Quartiles. Measures of Dispersion – Quartile deviations and Standard deviation. Measures of Skewness and Kurtosis.</p> <p>Unit-II Probability- Axiomatic and classical probability – Simple Problems. Addition multiplication theorem of Probability – Simple Problems.</p> <p>Unit-III Concept of random variable – discrete and continuous, distribution functions, probability mass function, probability density function, mathematical expectation and Moment generating functions.</p> <p>Unit-IV Bivariate Probability distribution – discrete and continuous, marginal and conditional distributions.</p> <p>Unit-V Correlation – Definition, Types of Correlation, Karl Pearson's Co-efficient of correlation, Rank Correlation Co-efficient – Linear Regression equations.</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		<p>S.C. Gupta and V.K. Kapoor – Fundamentals of Mathematical Statistics, Sultan & Sons, New Delhi.</p> <p>S.P. Gupta, <i>Statistical Methods</i>, Sultan Chand & Sons, Educational Publisher, New Delhi, 46th Edition, 2021</p>					
Reference Books		<ol style="list-style-type: none"> 1. Holcomb, Z. C. (2017). Fundamentals of Descriptive Statistics, Routledge, New York, US 2. Agarwal, B. L. (2006). Basic Statistics, New Age International Private Limited, New Delhi, 					

Website and e-Learning Source	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] 1 https://nptel.ac.in/courses/111/105/111105041/ 2 https://nptel.ac.in/courses/111/106/111106112/
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Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1: Acquire the knowledge of Statistics and its scope. Learning measures of central tendencies and dispersions.

CLO-2: Learning the basic idea probability tools and concepts

CLO-3: Aware the discrete and continuous distributions with mathematical functions.

CLO-4: Compute correlation, regression and curvilinear regression to represent real life problems.

CLO-5: Application of statistical theory in real life

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

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

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

Level of Correlation between PSO's and CO's

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Title of the Course		STATISTICS FOR MATHEMATICS – II (For B.Sc., Mathematics Students)							
Paper Number		ELETIVE-II							
Category	EC2	Year	i	Credits	3	Course Code	TIGSMA2		
		Semester	II						
Instructional Hours per week		Lecture	4	Tutorial	-	Lab Practice		Total	4
Pre-requisite		Basic Knowledge on events and statistical techniques							
Objectives of the Course		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To construct probability distribution for discrete random variables (Binomial and Poisson distributions) 2. To use normal distribution to find probabilities for continuous random variables. 3. To compute estimations for a mean and proportions (large or small samples) 							
Course Outline		<p>Unit-I Discrete Distributions – Binomial and Poisson Distributions – Constants and M.G.F. (Simple Problems).</p> <p>Unit-II Continuous Distributions – Normal, Exponential and Uniform Distributions – Constants and M.G.F.</p> <p>Unit-III Beta, Gamma – Definition, Mean and Variances. 't', F and Chi-square distribution – (Definitions and Derivation of the distribution)</p> <p>Unit-IV Test of Significance for large Samples – Single mean, difference between mean, single proportion and difference between proportion.</p> <p>Unit-V Test of Significance for Small Samples – 't' test for Single mean, Difference between means, Paired 't' test and Simple Correlation, Chi-square test for goodness of fit and independence of attributes.</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		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill							
Recommended Text		<p>S.C. Gupta and V.K. Kapoor – Fundamentals of Mathematical Statistics, Sultan & Sons, New Delhi.</p> <p>S.P. Gupta, <i>Statistical Methods</i>, Sultan Chand & Sons, Educational Publisher, New Delhi, 46th Edition, 2021</p>							
Reference Books		<ol style="list-style-type: none"> 1. Holcomb, Z. C. (2017). Fundamentals of Descriptive Statistics, Routledge, New York, US 2. Agarwal, B. L. (2006). Basic Statistics, New Age International Private Limited, New Delhi, 							

Website and e-Learning Source	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] 1 https://nptel.ac.in/courses/111/105/111105041/ 2 https://nptel.ac.in/courses/111/106/111106112/
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Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to
CLO-1: Practiced to the discrete distributions and match the real life situations with probability concepts.

CLO-2: Distinguish between discrete and continuous random variables.

CLO-3: Learn to sampling distributions and special continuous distributions

CLO-4: Test of Significance for large Samples match the real life situations.

CLO-5: Practiced the test of Significance for small Samples match the real life situations.

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

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

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

Level of Correlation between PSO's and CO's

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STATISTICS PRACTICAL

Title of the Course		Elective Course Practical - I (For B.Sc., Mathematics Students)			
Paper Number		ELETIVE-III			
Category	EC3	Year	I	Credits	3
		Semester	II		
				Course Code	T29SMA2P T1GSMAP1
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total
		2	-	2	2
Pre-requisite		Basic Knowledge on events and statistical techniques			
Objectives of the Course		The main objectives of this course are: 1. To provide students with demonstrate their understanding of descriptive statistical data 2. Demonstrate knowledge of probability and the standard statistical distributions. 3. Demonstrate knowledge of fixed-sample and large-sample statistical properties of point and interval estimators.			
Course Outline		Unit-I Measure of Central Tendency- Arithmetic Mean, Median, Mode - Geometric Mean - Harmonic Mean Unit-II Measure of Dispersions Range, Q.D and M.D - Standard Deviation and Co-efficient of variation. Coefficient of skewness -Karl Pearson's and Bowley's method Unit-III Correlation and Regression Analysis - Computation of Karl Pearson's co-efficient of correlation - Spearman's rank correlation and Regression lines. Unit-IV Fitting of Binomial, Poisson and Normal distributions. Unit-V Test of significance based on Normal Distribution and Student's t - distribution for mean, proportions, and simple correlation. Chi-square test. Test of goodness of fit and Test for independence of attributes.			
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		S.C. Gupta and V.K. Kapoor - Fundamentals of Mathematical Statistics, Sultan & Sons, New Delhi. S.P. Gupta, <i>Statistical Methods</i> , Sultan Chand & Sons, Educational Publisher, New Delhi, 46 th Edition, 2021			
Reference Books		1. Holcomb, Z. C. (2017). <i>Fundamentals of Descriptive Statistics</i> , Routledge, New York, US 2. Agarwal, B. L. (2006). <i>Basic Statistics</i> , New Age International Private Limited, New Delhi,			

Website and e-Learning Source	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] 1 https://nptel.ac.in/courses/111/105/111105041/ 2 https://nptel.ac.in/courses/111/106/111106112/
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Course Learning Outcome (for Mapping with POs and PSOs)

- Students will be able to
- CLO-1:** Learn variables and select the suitable data types and understand types of the diagrams and the graphs.
- CLO-2:** Identify the correct and efficient ways of solving problems
- CLO-3:** Practiced to the realized concept of preliminary tools for univariate and bivariate distributions
- CLO-4:** Practiced to fitting of discrete and continuous distributions
- CLO-5:** Demonstrate knowledge of fixed-sample and large-sample statistical properties of point and interval estimators.

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

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

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

Level of Correlation between PSO's and CO's

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