BHARATHIAR UNIVERSITY, COIMBATORE - 641 046 BRANCH II - STATISTICS

M.Sc., Statistics (Choice Based Credit System)

(For the candidates admitted during the academic year 2024 – 2025 and onwards)

Objective of the Course

The course aims to instill and inspire the domain knowledge on theoretical and applied aspects of Statistics in a broader spectrum. It intends to impart awareness on the importance of the conceptual framework of statistics across diversified fields and to afford practical training on the applications of statistical methods for carrying out analysis of data using sophisticated statistical software like SAS, SYSTAT, SPSS, etc., and using the programming knowledge in R and C++. The course curriculum has been designed in such a way to cater the needs of the stakeholders to get placements in industries and institutions on successful completion of the course and to provide them ample skill and opportunities to meet the challenges at the national level competitive examinations like CSIR NET in Mathematical Sciences, SET, Indian Statistical Service (ISS) of UPSC, etc.

Eligibility Criteria for Admission

A candidate who has acquired a degree in B.Sc., Statistics or B.Sc., Mathematics with Statistics as an allied / ancillary subject or as one of the subjects or B. Sc., in Mathematics with Computer Applications having Statistics as one of subjects shall be permitted to join M. Sc., STATISTICS course.

Duration of the Course

The duration of the M. Sc., STATISTICS course is two years which comprise of four semesters. A candidate who has been admitted to the course shall appear all the four semester examinations during the course of study. On successful completion of all the examinations, he / she shall qualify himself/herself for the award of the degree in M.Sc., STATISTICS.

Pattern of Choice Based Credit System

The course of study shall be based on the pattern of Choice Based Credit System (CBCS) with continuous internal assessment and comprehensive external assessment. The comprehensive external assessment shall be done at the end semester University examination. The odd semester shall begin in July and the even semester shall begin in December. Each candidate shall earn a minimum of 100 credits, which include non-scholastic courses, viz., one online SWAYAM/MOOC course of 2 credits, two value added courses each with 2 credits and two job oriented courses each with 2 credits. The non-scholastic courses shall not be considered for computing CGPA (Cumulative Grade Point Average). The break-up of total credits for the programme shall be as given under:

Core Papers – Theory	13 x 4 Credits = 52 Credits
Core Papers – Practical	04 x 4 Credits = 16 Credits
Elective Papers	03 x 4 Credits = 12 Credits
Core: Project/Dissertation	01 x 4 Credits = 04 Credits
Supportive Papers	02×3 Credits = 06 Credits
SWAYAM/MOOC Online Course	$01 \ge 2$ Credits = 02 Credits
Value Added Courses	$02 \ge 2$ Credits = 04 Credits
Job Oriented Courses	02 x 2 Credits = 04 Credits

Components for Internal Assessment

Tests, assignments, seminars and attendance shall be the components for continuous internal assessment. A maximum of 25 marks shall be allotted under continuous internal assessment in each theory paper offered by the Department. The distribution of marks is as given under:

Marks for Tests	: 15
Marks for Assignments / Seminar	: 05 (Average of Assignment and Seminar Marks)
Attendance	: 05

Distribution of Marks for Attendance

90% and above	: 5 Marks
Between 85% and 90%	: 4 Marks
Between 80% and 85%	: 3 Marks
Between 75% and 80%	: 2 Marks
Between 70% and 75%	: 1 Mark

Distribution of Continuous Internal Assessment Marks for Core - Practical Paper

Record Work	: 10 Marks
Test	: 25 Marks
Attendance	: 05 Marks

Award of Degree

A candidate who secures a minimum of 50% of marks in the continuous internal assessment as well as in the end semester University examination and also a minimum of 50% of marks in aggregate comprising both continuous internal assessment and end semester University examination in each paper shall be declared to have passed the course for the award of the degree in M.Sc., Statistics.

A candidate who secures a minimum of 7.5 out of 10 CGPA (Cumulative Grade Point Average) and above in aggregate comprising both continuous internal assessment and end semester University examination shall be declared to have passed the examination in FIRST CLASS WITH DISTINCTION, if the candidate has passed all the examination prescribed for the course in the first appearance.

A candidate who secures a minimum of 6.0 out of 10 CGPA and above comprising both continuous internal assessment and end semester University examination in aggregate shall be declared to have passed the examination in FIRST CLASS.

A candidate who clears all the papers prescribed for the course in the FIRST APPEARANCE shall be eligible for Ranking/Distinction.

Pattern of Question Paper – (for core - theory and elective subjects)

The question paper for each of the core and elective papers shall consist of three sections. While Section A shall contain 10 objective type questions, Section B and Section C shall contain questions of descriptive nature. Internal choice (either / or type) shall be given in Section B and Section C. In Section A, there shall be two questions each with four multiple choices from each of the five units. In Sections B and C, there shall be one question with internal choice (either/or type) from each of the five units. The composition of the question paper shall be as given below:

Time: Three Hours

Max. Marks: 75

Section A – $(10 \times 1 = 10)$ Answer *All* the questions Each question carries *one* mark

Choose the correct answer

Q. No.1. – Q. No. 10 - Objective questions with four multiple choices

Section B – $(5 \times 5 = 25)$ Answer all the questions Each question carries *five* marks

Q. No. 11 - Q. No. 15 - Questions with internal choices (either (a) or (b) type)

Section C – $(5 \times 8 = 40)$ Answer all the questions

Each question carries *eight* marks

Q. No. 15 - Q. No. 20 - Questions with internal choices (either (a) or (b) type

Pattern of Question Paper – (for core – practical subjects)

The question paper for each of the core - practical papers (Statistics Practical I and II, Programming Lab I and II, Statistical Software Practical using SPSS and MINITAB, and Statistical Software Practical using R shall consist of four questions with internal choice. The maximum marks for each of the practical papers shall be 60. A candidate shall attend all the four questions, each of which shall carry 15 marks. The composition of the question paper shall be as given below:

Time: Three Hours

Max. Marks: 60

Answer all the questions Each question carries *fifteen* marks

Q. No. 1 – Q. No. 4 - Questions with internal choices (either (a) or (b) type)

Pattern of Question Paper – (for supportive subject)

The question paper for each of the supportive papers shall consist of three sections. While Section A shall contain 5 objective type questions, Section B and Section C shall contain questions of descriptive nature. Internal choice (either / or type) shall be given in Section B and Section C. In Section A, there shall be one question each with four multiple choices from each of the five units. In Sections B, there shall be one question with internal choice (either/or type) from each of the five units and in Section C, there shall be three questions with internal choice (either/or type from all the five units. The composition of the question paper shall be as follows:

Time: Two Hours

Max. Marks: 38

Section A – $(5 \times 1 = 5)$ Answer *All* the questions Each question carries *one* mark

Q. No.1. – Q. No. 5 - Objective questions with four multiple choices

Section B – $(5 \times 3 = 15)$ Answer all the questions Each question carries *three* marks

Q. No. 6 - Q. No. 10 - Questions with internal choices (either (a) or (b) type)

Section C – $(3 \times 6 = 18)$ Answer all the questions Each question carries *six* marks

Q. No. 11 – Q. No. 13 - Questions with internal choices (either (a) or (b) type)

M. Sc., Statistics

Syllabus (with effect from 2024 – 25)

Program Code: STAC



DEPARTMENT OF STATISTICS Bharathiar University (A State University, Accredited with "A⁺⁺" Grade by NAAC and 21th Rank among Indian Universities by MHRD-NIRF) Coimbatore 641 046, INDIA

BHARATHIAR UNIVERSITY, COIMBATORE 641046 DEPARTMENT OF STATISTICS

MISSION

The Department of Statistics aims to instill and inspire the domain knowledge on theoretical and applied aspects of Statistics in a broader spectrum. It intends to impart awareness on the importance of the conceptual framework of statistics across diversified fields and to afford practical training on the applications of statistical methods for carrying out analysis of data using sophisticated statistical software. The curriculum of post-graduate programme of the Department is designed in such a way to cater the needs of the stakeholders to get placements in industries and institutions on successful completion of the course and to provide them ample skill and opportunities to meet the challenges at the national level competitive examinations. The departments strive to enhance its potentials and capabilities to provide good quality education in statistics by acquiring recognition of the funding agencies.

Program Educational Objectives (PEOs)

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ssful completion of the M. Sc., Statistics program, the graduates will be able to:
Get employment in government, public, private, industrial, health, business,
banking, agricultural and educational sectors
Expand their knowledge to set their career in research and higher studies
Comprehend the statistical concepts and principles for interdisciplinary research
Excel in statistical computing
Acquire proficiency in adopting statistical software for data analysis
Nurture advancement in statistical theory and applications
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Program Specific Outcomes (PSOs)

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On succ	essful completion of M. Sc., Statistics program, the students will be expected to:
PSO1	Comprehend the theoretical aspects of statistics
PSO2	Recognize the application of statistics in diversified fields
PSO3	Develop computer programs and codes for statistical computation
PSO4	Utilize statistical software effectively for data analysis
PSO5	Understand the conditions and limitations of statistical methods in application
PSO6	Critically analyze statistical data and make interpretations

Program Outcomes (POs)

IIogiai	
On succ	essful completion of the M. Sc., Statistics program, the graduates will be able to:
PO1	Possess adequate knowledge in theory and applications
PO2	Adopt conceptual ideas, principles and methods in diversified fields of study
PO3	Utilize analytical skills for basic mathematical computation
PO4	Utilize software skills for statistical computation
PO5	Prepare to participate in competitive examinations at the state and national level
PO6	Acquire skills to meet the challenges in job placements
PO7	Gain impetus to move for learning at higher level
PO8	Gain effective skills to perform data analysis using statistical tools
PO9	Identify potential areas of applications of statistical theory
PO10	Recognize the importance and value of statistical principles and approach for
FUIU	problem solving on a diversified disciplines

BHARATHIAR UNIVERSITY, COIMBATORE 641 046 BRANCH II - STATISTICS

Course Title: M.Sc. (Statistics) | Course Code: STAC (For the candidates admitted during 2024 – 2025 and onwards)

List of Core/Elective/Supportive Subjects to be offered

CORE Subjects

- 1. Real Analysis and Linear Algebra
- 2. Measure and Probability Theory
- 3. Distribution Theory
- 4. Sampling Theory and Methods
- 5. Official Statistics
- 6. Statistical Estimation Theory
- 7. Multivariate Statistical Analysis
- 8. Statistical Quality Control and Reliability Theory
- 9. Statistics Practical I
- 10. Testing Statistical Hypotheses
- 11. Linear Models and Design of Experiments
- 12. Programming in R
- 13. Statistical Software Practical using SPSS and MINITAB
- 14. Stochastic Processes
- 15. Biostatistics and Survival Analysis
- 16. Statistics Practical II
- 17. Statistical Software Practical using R
- 18. Project & VIVA-VOCE

ELECTIVE Subjects

- 1. Operations Research
- 2. Econometrics
- 3. Data Mining and Big Data
- 4. Robust Statistics
- 5. Machine Learning Using Python
- 6. Demography and Vital Statistics
- 7. Applied Regression Analysis

SUPPORTIVE Subjects (for students of other departments)

- 1. Descriptive Statistics
- 2. Statistical Methods for Biologists
- 3. Elements of Operations Research

VALUE ADDED COURSES

- 1. Basics of Biostatistical Analysis
- 2. Elements of Actuarial Mathematics
- 3. Data Analysis using STATISTICA
- 4. Essentials of Data Analytics Capstone

CERTIFICATE COURSES

- 1. Design & Analysis of Clinical Trials
- 2. Basics of Six Sigma Tools

BHARATHIAR UNIVERSITY, COIMBATORE 641 046

M. Sc., Statistics Curriculum (University Department)

(For the students admitted during the academic year 2024 – 25 onwards)

Course	Title of the Course	Credite	H	ours	Max	imum I	<u>Mark</u> s
Code	The of the Course	Credits	Theory	Practical	CIA	ESE	Tota
	FIRST	SEMESTE	C R				
21S13A	Real Analysis and Linear Algebra	4	5	-	25	75	100
21S13B	Measure and Probability Theory	4	5	-	25	75	100
21S13C	Distribution Theory	4	5	-	25	75	100
21S13D	Sampling Theory and Methods	4	5	-	25	75	100
21S13E	Official Statistics	4	5	-	25	75	100
Supportive	Offered by other Departments	2	2	-	12	38	50
	Total	22					550
	SECONI) SEMEST	ER	1	1		
21S23A	Statistical Estimation Theory	4	5	-	25	75	100
21S23B	Multivariate Statistical Analysis	4	5	-	25	75	100
21S23C	Statistical Quality Control and	4	5	-	25	75	100
2102254	Reliability Theory	4	5		25	75	100
21S23EA	Elective I	4	5	-	25	75	100
21S2P1	Statistics Practical – I	4	-	5	40	60	100
Supportive	Offered by other Departments	2	2	-	12	38	50
	Total	22					550
		SEMESTI					100
21S33A	Testing Statistical Hypotheses	4	5	-	25	75	100
21S33B	Linear Models and Design of Experiments	4	5	-	20	75	100
21S33C	Programming in R	4	5	-	20	75	100
21S33EB	Elective II	4	5	-	20	75	100
21S3P2	Statistical Software Practical using SPSS and MINITAB	4	-	5	40	60	100
Supportive	Offered by other Departments	2	2	_	12	38	50
TT TT	Total	22					550
		I SEMEST	ER				
21S43A	Stochastic Processes	4	5	-	25	75	100
21S43B	Biostatistics and Survival Analysis	4	5	-	25	75	100
21S43EC	Elective III	4	5	_	25	75	100
21545LC 21S4P3	Statistics Practical – II	4	-	5	40	60	100
21S4P4	Statistical Software Practical using R	4	-	5	40	60	100
21S4PV	Project and Viva-voce*	4	5	-	25	75	100
	Total	24					600
	Grand Total	90					225
	CO=SCHOL	ASTIC CO	URSES		•	•	
		E COURS					
	SWAYAM – MOOC Course	2					50
	VALUE AD	DED COU	IRSES	u	1		
	Course 1	2					50
	Course 2	2					50
	CERTIFIC	ATE COU	RSES		1	1	ц
	Course 1	2					50
	Course 2	2					50
	- MOOC – online course shall be for	-	· · ·	·			

fourth semester).

Distribution of Marks and Credits

			Subje	cts			Total
	Core	Elective	Supportive	Swayam	VAC	JOC	Total
Marks	1800	300	150	50	100	100	2500
Credits	72	12	06	02	04	04	100

VAC: Value Added Course

JOC: Job Oriented Course

Course Code	21S13A	TITLE OF THE COURSE L		Т	Р	С
Core		Real Analysis and Linear Algebra4		1	-	4
Pre-requisite		SKIES IN BASIC MAINEMANCS AND MAINCES		bus ion	2024	4-25
Course Objecti						
The main object						
1		ng of the basic concepts of real analysis and linear algebra	a			
	•	proving the theorems in real analysis and linear algebra g of convergence of sequence and series of real numbers				
		pts which are essential for learning other courses				
Expected Cours		es ion of the course, student will be able to:				
		ctions are continuous or discontinuous			K2,	K3
•	e	ence of sequence and series of real numbers			K2,	
		ions for integrability of a real valued function			K1,	
4 Derive the	characteris	tic roots and vectors			K2,	K5
5 Determine	the nature	of quadratic forms and reduction of quadratic forms			K4,	K5
K1 - Remembe	er; K2 - Uno	lerstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 -	- C	Create	e	
Unit:1		Real Valued Functions		-	12 ho	irc
	ity and un	iform continuity of functions – Algebra of continue	ou			
Differentiability	– Algebra	a of Derivatives - Maxima and Minima of functions				
theorems - Taylo	or's theorem	n – Functions of several variables.				
Unit:2		Sequences and Infinite Series			12 ho	urs
Boundedness an		Sequences and Infinite Series a sequence - Convergence of sequences and series of		eal n	umber	·s –
absolute and conconditional and Unit:3	nditional co uniform con Ri r R-S integr	a sequence - Convergence of sequences and series of nvergence – Point - wise and uniform convergence – Te nvergence – Properties of uniform convergence. eman-Stieljtes (R-S) Intergrable Functions rals. Necessary and sufficient condition for R-S integrability	ests lit	eal nu s for y. A	umber absol 12 ho lgebra	ute, ute, urs
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- 2 Graybill, F.A. (1983). Matrices and Applications in Statistics, Wadsworth Publishing Company, Belmont, California, USA.
- 3 Rudin, W. (1985). Principles of Mathematical Analysis, McGraw-Hill, New York

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- 1 https://www.jirka.org/ra/realanal.pdf
- 2 http://synechism.org/primer/primer-real-analysis.pdf
- 3 http://www.astronomia.edu.uy/progs/algebra/Linear_Algebra,_4th_Edition__(2009)Lipschutz-Lipson.pdf
- 4 https://nptel.ac.in/courses/111/101/111101134/
- 5 https://nptel.ac.in/courses/111/106/111106051/

Course Designed By: Dr. R. Vijayaraghavan

Mappi	ng with	Progran	nme Out	comes						
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	L	S	Μ	S	L	L	L
CO2	S	S	S	L	S	Μ	S	L	L	L
CO3	S	S	S	L	S	Μ	S	L	L	L
CO4	Μ	S	S	L	Μ	Μ	S	L	L	L
CO5	Μ	S	S	L	Μ	Μ	S	L	L	L

Core	21S13B	TITLE OF THE COURSE	L	Т	Р	C
COIC	1		4	1	-	4
Pre-requisite				abus sion	2024	4-25
Course Objec	tives		VCI	51011		
The main object	ctives of this	course are to:				
2. Explore th	ne basic and	ot of measure and probability theory. advance concepts available in measure and probability. tical probability and their applications.				
Expected Cou On the succes		es tion of the course, student will be able to:				
	-	ing of measure and probability				K1
2 Compreh	end the cond	cepts of sets, functions, measure and probability space				K2
3 Provide b	basic and adv	vanced applications of measure and probability				K3
4 Identify a	application o	f inequalities in probability theory				K4
5 Explore t	he application	on of law of large numbers and central limit theorems				K5
K1 - Rememb	oer; K2 - Un	derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6	6 - 0	Create		
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Reference Books

- 1 *de* Barra, G. (2000), Measure Theory and Integration, New Age International Private Ltd., New Delhi.
- 2 Rohatgi, V. K., and Saleh, A.K.M.E. (2015), An Introduction to Probability and Statistics, Third Edition, John Wiley & Sons, NY.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

- 1 https://nptel.ac.in/courses/111/101/111101005/
- 2 https://nptel.ac.in/courses/111/102/111102111/
- 3 https://nptel.ac.in/courses/111/102/111102111/

Course Designed By: Dr. V. Kaviyarasu

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	М	Μ	L	S	S	S	Μ	Μ	М
CO2	S	М	Μ	L	S	S	S	М	Μ	М
CO3	S	М	М	L	S	S	S	М	Μ	М
CO4	М	М	М	L	S	S	S	М	Μ	М
CO5	S	М	М	L	S	S	S	М	М	М

Cou	irse Code	21S13C	TITLE OF THE COURSE	L	Т	P	С	
Cor	e	·	Distribution Theory	4	1	-	4	
re-	requisite			Sylla Vers		202	4-2	
Cou	rse Object	tives		vers	51011			
	•		course are to:					
1.	Understan	d the advance	ced concepts of probability distributions					
2.			ties of probability distributions					
3.	Create and	d apply custo	omized probability distributions					
-		rse Outcom	tion of the course, student will be able to:					
1	1	I	ental concepts of probability distributions			K	$\overline{\mathbf{r}}$	
$\frac{1}{2}$			of continuous probability distributions			K		
2	Develop the properties of bivariate probability distributions K6							
4	1	1 1	s and obtain their sampling distributions			K		
5			blity distributions and derive the distributions of quadra	atic		K		
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Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1https://swayam.gov.in/nd2_cec20_ma01/preview2https://nptel.ac.in/courses/111/104/111104032/

Course Designed By: Dr. K. M. Sakthivel

Mappi	ng with	Progran	nme Out	comes						
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	Μ	L	S	S	S	Μ	Μ	М
CO2	S	S	Μ	L	S	S	S	Μ	Μ	М
CO3	S	S	М	L	S	S	S	Μ	Μ	М
CO4	S	S	М	L	S	S	S	М	М	М
CO5	S	S	М	L	S	S	S	М	М	М
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Course Code 21S13D	TITLE OF THE COURSE	L	Т	Р	С
Core	F S F S F S	4	1	-	4
Pre-requisite			bus ion	202	4-25
Course Objectives					
The main objectives of thi					
2. Enhance the ability of	e of theory and applications of sampling deriving the properties of methods of drawing samples cepts of sampling for effective application for designing	san	nple	surv	eys
Expected Course Outcom	nes				
<u> </u>	tion of the course, student will be able to:				
	rtance of sampling and sample surevyes			K2	
	ing methods for given situations			K2,K	
	eness of sample surveys			K1,K	
4 Design and perform s				K3,K	
	es using various sampling methods and study the properti			K1-k	K6
K1 - Remember; K2 - Un	derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6	– C	create	e	
Unit:1	Notions of Sample Survey		12	houi	:s
sampling distribution, stand non-sampling errors – non-	Census and sample survey – sampling – sampling unit, s dard error, questionnaire and schedule, sampling design -response and its effects – sample surveys – principles of survey - limitations of sampling.	— s	ampl	ing a	and
of population total, mean	Simple Random Sampling (with and without replacement): Notations and terminol and their variances and standard errors – Pooling ize. Simple random sampling for attributes -		7 - Es		ates
properties – Allocation of	Stratified Random Sampling g: Estimates of population total, mean and their varia f sample sizes – Neyman's proportional and optimu ampling with simple random sampling - Estimation of p	m	es - alloc	atio	ited ns -
Unit:4	Systematic and Cluster Sampling		12	hou	rs
Systematic sampling: Estim – systematic sampling with	nates of population total, mean, and their variances and h linear trend – comparison of systematic sampling wi - circular systematic sampling - Two stage sampling wit	th s	ndar strati	d err fied	ors and
Unit:5 Varying Prob	oability Sampling, Ratio and Regression Estimators		12	hou	rs
Varying Probability Sampl replacement) – Stratified P Horwitz – Thompson and	ling: Probability proportional to size (PPS) sampling (w PS – Selection procedures – Ordered and unordered est d Murthy's estimates. Ratio Estimates – Methods the Ratio Estimate - Regression Estimators – Differe	ima s of	ites – f est	- De imat	sraj, ion,
Unit:6 Contemporary			2	hou	rs
Expert lectures, online sem	Total Lecture Hour	rs	62	hou	rs
Books for Study					
1 Cochran, W.G. (1977).	Sampling Techniques, Third Edition, John Wiley & Sor	ıs, İ	NY.		
 Des Raj (1978), Sampli Singh D., and Chowdh Age International Priva 	ing Theory, Tata-McGraw Hill, New Delhi. ary, F. S. (2018). Theory and Analysis of Sample Surve	ey I	Desig	gn, N	lew
 Des Raj (1978), Sampli Singh D., and Chowdh 	ing Theory, Tata-McGraw Hill, New Delhi. ary, F. S. (2018). Theory and Analysis of Sample Surve	ey I	Desig	gn, N	lew

3 Sukhatme, P. V., and Sukhatme, B. V. (1970). Sampling Theory of Surveys with Applications, Asia Publishing House, New Delhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1 https://nptel.ac.in/courses/111/104/111104073/

2 https://nptel.ac.in/content/storage2/courses/111104073/Module14/Lecture42.pdf

3 https://www.mooc-list.com/tags/sampling-methods

Course Designed By: Dr. S. Gandhiya Vendhan / Dr. R. Vijayaraghavan

Mapping with Programme Outcomes

		11051411		comes						
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	Μ	L	S	Μ	S	Μ	S	S
CO2	Μ	S	Μ	L	S	Μ	S	Μ	S	S
CO3	S	S	Μ	L	S	Μ	S	Μ	S	S
CO4	S	S	Μ	L	S	Μ	S	Μ	S	S
CO5	S	S	М	L	S	N	S	М	S	S

Course Code 21S13E	TITLE OF THE COURSE	L	Т	P	С
Core	Official Statistics	4	1	-	4
Pre-requisite		Sylla Vers	bus	202	4-25
Course Objectives	economic sectors	vers	51011		
The main objectives of the	is course are to:				
1. Understand the funct	tioning of government and policies.				
	urce development in the official statistics and encourage	rese	arch		
	theoretical and applied statistics.				
3. Execute the data hand	dling tasks in various government records				
Exmanted Course Outeou	m ag				
Expected Course Outcon On the successful compl	etion of the course, student will be able to:				
-	mentals of measurement in official statistics			K	[1
	for data collection, analysis and interpretation of health,	soci	al		2
and economic.	, , ,				
	ods for presenting and preparing commentaries on officia	al		K3	,K4
statistics.				L	~ ~
	gricultural and economic statistics				15 16
statistical production.	ions that arises from measurement and processes of			K	6
-	nderstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6	6 - 0	Create))	
`					
Unit:1	Statistical System in India			hou	
	rnment Organizations, Functions of Central Statistica				
	e Survey Organization (NSSO). Organization of larg	e sc	ale s	samp	le
surveys. General and spec	cial data dissemination systems.				
Unit:2	Official Statistics		12	hou	rs
Meaning, methods of coll	lection, limitations and reliability. Principal publications	con	tainin	ıg da	ta
1 1	pulation, agriculture, industry, trade, prices, labour an	nd ei	nnlo	vmei	nt
			mpio.	,	10,
transport and communicat	tions - Banking and finance.		iipio.	,	
•	<u> </u>				
Unit:3	Agricultural and Social Statistics		12	hou	rs
Unit:3 System of Collection of A	Agricultural and Social Statistics Agricultural Statistics - Crop forecasting and estimation	n - P	12 roduc	hou tivit	rs y,
Unit:3 System of Collection of A Gragmentation of holding	Agricultural and Social Statistics	n - P gatic	12 roduc on pr	hou tivit	rs y,
Unit:3 System of Collection of A Gragmentation of holding Statistics related to indust	Agricultural and Social Statistics Agricultural Statistics - Crop forecasting and estimation gs - Support prices - Buffer stocks - Impact of irrig tries, foreign trade - Balance of payment - Inflation - Soci	n - P gatic	12 roduc on pr tatisti	hou ctivit ojec cs.	rs y, ts.
Unit:3 System of Collection of A fragmentation of holding Statistics related to indust Unit:4	Agricultural and Social Statistics Agricultural Statistics - Crop forecasting and estimation gs - Support prices - Buffer stocks - Impact of irrig tries, foreign trade - Balance of payment - Inflation - Soci Index Numbers	n - P gatic ial st	12 roduc on pr tatisti	hou ctivit ojec cs. hou	rs y, ts.
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Unit:3 System of Collection of A fragmentation of holding Statistics related to indust Unit:4 Index Numbers: Price, Q Limitations, Tests for ind	Agricultural and Social Statistics Agricultural Statistics - Crop forecasting and estimation gs - Support prices - Buffer stocks - Impact of irrig tries, foreign trade - Balance of payment - Inflation - Soci Index Numbers	n - P gatic ial structure	12 roduc on pr tatisti 12 ction, Who	hou ctivit ojec cs. hou Use	rs y, ts. rs es,
Unit:3 System of Collection of A fragmentation of holding Statistics related to indust Unit:4 Index Numbers: Price, Q Limitations, Tests for ind	Agricultural and Social Statistics Agricultural Statistics - Crop forecasting and estimation gs - Support prices - Buffer stocks - Impact of irrig tries, foreign trade - Balance of payment - Inflation - Soci Index Numbers Quantity and Value indices. Price Index Numbers: Con dex numbers, Chain Index Number. Consumer Price In	n - P gatic ial structure	12 roduc on pr tatisti 12 ction, Who	hou ctivit ojec cs. hou Use	rs y, ts. rs es,
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Unit:3 System of Collection of A fragmentation of holding Statistics related to indust Unit:4 Index Numbers: Price, Q Limitations, Tests for inc Price Index and Index of I Unit:5 National Income – Me approaches - Applications coefficient, Lorenz curves	Agricultural and Social Statistics Agricultural Statistics - Crop forecasting and estimation gs - Support prices - Buffer stocks - Impact of irrig- tries, foreign trade - Balance of payment - Inflation - Soci Index Numbers Quantity and Value indices. Price Index Numbers: Con- dex numbers, Chain Index Number. Consumer Price In Industrial Production – Construction of index numbers an National Income easures of national income - Income, expenditure as s in various sectors in India. Measurement of income in s, Application of Pareto and Lognormal as income distributed	and and and	12 roducon on production 12 ction, who ses. 12 production lity: n.	hou ctivit ojec cs. hou Use plesa hou	rs y, ts. rs es, ile rs on 's
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Unit:3 System of Collection of A Gragmentation of holding Statistics related to indust Unit:4 Index Numbers: Price, Q Limitations, Tests for inc Price Index and Index of I Unit:5 National Income – Me approaches - Applications coefficient, Lorenz curves Unit:6 Contemporary Expert lectures, online ser Books for Study 1 Allen R. G. D. (1975)	Agricultural and Social Statistics Agricultural Statistics - Crop forecasting and estimation gs - Support prices - Buffer stocks - Impact of irrig- tries, foreign trade - Balance of payment - Inflation - Soci Index Numbers Quantity and Value indices. Price Index Numbers: Con- dex numbers, Chain Index Number. Consumer Price In Industrial Production – Construction of index numbers an National Income easures of national income - Income, expenditure as s in various sectors in India. Measurement of income in s, Application of Pareto and Lognormal as income distrib y Issues minars – webinars D. Index Numbers in Theory and Practice, Macmillan.	and and butio	12 roduc on pr tatisti 12 ction, Who ses. 12 prod ality: n. 2	hou ctivit ojec cs. hou Use olesa hou Gini	rs y, ts. rs es, ile rs on 's rs
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Unit:3 System of Collection of A fragmentation of holding Statistics related to indust Unit:4 Index Numbers: Price, Q Limitations, Tests for inc Price Index and Index of I Unit:5 National Income – Me approaches - Applications coefficient, Lorenz curves Unit:6 Contemporary Expert lectures, online ser Books for Study 1 Allen R. G. D. (1975) 2 C. S. O. (1995). Statisti 4 C. S. O. (1995). Statisti 4 C. S. O. (1999). Guide 5 Mukhopadhyay, P. (20)	Agricultural and Social Statistics Agricultural Statistics - Crop forecasting and estimation gs - Support prices - Buffer stocks - Impact of irrig- tries, foreign trade - Balance of payment - Inflation - Soci- Index Numbers Quantity and Value indices. Price Index Numbers: Con- dex numbers, Chain Index Number. Consumer Price In Industrial Production – Construction of index numbers an National Income easures of national income - Income, expenditure as s in various sectors in India. Measurement of income in s, Application of Pareto and Lognormal as income distrib y Issues minars – webinars D. Index Numbers in Theory and Practice, Macmillan. e Statistics Relating to the Indian Economy. ical System in India. e to Official Statistics. 011). Applied Statistics, Second Edition, Books & Alliect Macroeconomics: The Dynamics of Commodity Produce	and and butio	12 roducon pritatisti 12 tatisti 12 ction, Who ses. 12 prod dlity: n. 2 62 I, Ind	hou ctivit ojec cs. hou Use olesa hou ucti Gini hou	rs rs es, ile rs rs rs rs s

- 2 Branson, W. H. (1992). Macroeconomic Theory and Policy, Third Edition, Harper Collins Publishers India (P) Ltd., New Delhi.
- 3 Goon A. M., Gupta M. K., and Dasgupta. B. (2001), Fundamentals of Statistics, Vol. 2, World Press, India.
- 4 Panse, V. G. (1964). Estimation of Crop Yields (FAO), Food and Agriculture Organization of the United Nations.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1 https://www.classcentral.com/course/swayam-macro-economics-19942

2 https://www.classcentral.com/course/swayam-economics-of-health-and-health-care-14023

Course Designed By: Dr. S. Jayalakshmi

Mappi	ng with	Progran	nme Out	comes						
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	L	S	Μ	Μ	L	L	L
CO2	S	S	L	L	S	М	М	L	L	L
CO3	S	S	L	L	S	М	М	L	L	L
CO4	S	S	L	L	S	М	М	L	L	L
CO5	S	S	L	L	S	М	М	L	L	L

Course Code 21S	23A	TITLE OF THE COURSE	L	Т	Р	С
Core		Statistical Estimation Theory	4	1	-	4
Pre-requisite		Knowledge in Probability Theory and	Sylla		202	4-25
Course Objectives		Probability Distributions	Ver	sion		
The main objectives	of this	course are to:				
-		epts of parametric estimation				
		ethods of statistical estimation theory				
3. Study various m	nethod of	of construct confidence intervals				
Expected Course O	utcome	28				
•		on of the course, student will be able to:				
	-	ots and importance of properties of estimators			K	3
-		imator for a given parametric function				6
•		thods of point estimation				3
		d asymptotic behavior of estimators				5
		intervals for population parameters	76	Cuest		6
KI - Kemember; K	2 - Und	erstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; H	<u> </u>	create	3	
Unit:1		Properties of Estimator		12	hou	rs
		ation - Sufficiency – Factorization Theorem – Min				
likelihood equivalen - Blackwell and Lehi		mpleteness – Uniformly minimum variance unbiased	l estii	mator	– R	ao
- Diackwell allu Lelli	mann -	Schene meorems.				
Unit:2		Bounds of Optimal Estimator		12	hou	rs
1	,	er's information measure. Cramer-Rao inequalit	•			•
		bins inequality - Fisher's information matrix- riate and bivariate) distribution.	simul	taneo	us	of
	i (uiiiva					
Unit:3		Methods of Estimation			hou	
		tion-maximum likelihood method (asymptotic properties), method of moments, method of minimum chi-squ				
minimum chi-square		, method of moments, method of minimum em squ	ure u		Juill	cu
T I *4 - 4	C !			10	1	
Unit:4 Consistency and CA		stent Estimators and Asymptotic Properties mators. Asymptotic properties of maximum likeli	hood		hou	
Example of consiste	nt but r	not asymptotic normal estimators from Pitman famil	y. Fis	sher's		
bound for asymptotic	c varian	ce. Asymptotic relative efficiency. Method of least s	quare	s.		
Unit:5		Interval Estimation		12	hou	irs
	Confid	ence level and confidence coefficient. Duality bet	ween			
0		idence interval. Pivotal quantity method. Shortest	U			
		confidence intervals for population proportion population proportions (large samples) - Confide	•			0
		al population, difference between mean and ratio				
populations.						
Unit:6		Contemporary Issues		2	hou	re
Expert lectures, onli	ne semi				nou	15
		Total Lecture He	ours	62	hou	rs
Books for Study						
1 Goon, A. M., Gu World Press, Cal		. K., and Dasgupta, B. (1989). An Outline of Statisti	cal T	heory	-Vo	l.II,
		First Course on Parametric Inference, Narosa Publis	shing	Hous	se, N	lew
3 Rohatgi, V. K. (. ,	Introduction to Probability Theory and Mathematic	al St	atistic	es, J	ohn
Wiley & Sons, N	JY.					
Reference Books1Dudewicz, E. J.	and N	Iishra, S. N. (1988). Modern Mathematical Statisti		hn V	Vila	, <i>Q</i> ,
Sons, NY.	, and N	nsina, 5. iv. (1900). would in wandinatical Statisti	ιs, J(JIII V	v ney	

2	Lehman, E. L., and Cassella, G. (1998). Theory of Point Estimation, Second Edition, Springer,
	NY.
3	Rajagopalan, M., and Dhanavanthan, P. (2012). Statistical Inference, PHI Learning Pvt., Ltd.,
	New Delhi.
4	Rohatgi, V. K., and Saleh, A.K.M.E. (2015), An Introduction to Probability and Statistics,
	Third Edition, John Wiley & Sons, NY.
Re	lated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

https://swayamprabha.gov.in/index.php/Syllabus/detail/10774 https://swayam.gov.in/nd1_noc20_ma19/preview https://nptel.ac.in/courses/111/105/111105043/

Course Designed By: Dr. K. M. Sakthivel

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	Μ	L	S	М	S	М	М	S
CO2	S	Μ	Μ	L	S	М	S	Μ	М	S
CO3	S	Μ	Μ	L	S	М	S	Μ	М	S
CO4	S	S	М	Μ	S	М	S	М	М	S
CO5	S	М	М	Μ	S	М	S	М	М	S

Course Code	21S23B	TITLE OF THE COURSE	L	Т	Р	С
Core		Multivariate Statistical Analysis	4	1	-	4
Pre-requisite		Linear Algebra, Calculus of Several Variables, Probability theory, Sampling theory, Statistical Inference-Estimation theory	Sylla Vers		202	4-25
Course Objec						
The main obje						
2. Develop c methods	clear idea on	edge on various multivariate distribution and multivar when and where to use dependence and interdepende tween multivariate analysis and machine learning and	nce m	ultiv	ariate	e
		fied spectrum of fields.				
Expected Cou	rse Outcom	les				
	1	tion of the course, student will be able to:				
paramete as Chi-So	ers, necessary quare distrib		distrib	outed	K	.1
Hotelling	g T ² distribut	sampling distributions that includes Wishart di ion and Mahalanobis D^2 distribution and its existence	in us	e	K	
		out multivariate statistical methods that includes and Factor Analysis and its application in diversified			K	3
		pt of classification and discriminant function analysis o use statistical software packages to apply mu			K	4
	clear idea a	bout Machine Learning and significance of Mu	ltivar	iate	K	5
		earning,deep learning and reinforcement learning derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; l	K6 – (Create	e	
Unit:1	Mult	ivariate Normal Distribution and Properties		14	hou	rs
Multivariate N	Normal Dist	ributions - Marginal and Conditional Distribution		Chara	cteri	stic
		Distribution of Linear Combinations of Multivariat nd Covariance Matrix of Multivariate Normal Dist				
		e parameters of multivariate normal distribution - Dis				
mean vector -	Necessary a	nd sufficient conditions for a quadratic form to be di	istribu	ited a	s a c	chi-
square distribu known.	ution - Infer	rence concerning the sample mean vector when co	varia	nce n	natri	x is
Unit:2	Sam	pling Distributions in Multivariate Analysis		10	hou	rs
	ibution – C	characteristic function and properties. Hotelling's				
	atio Criterio	ons - Two sample problems with unequal covant of D^2 Distribution - Relationship b problem.				
TL				1.4	1.	
Objectives –	ponents: Ol Estimation of canonica	ctor Analysis and Canonical Correlations opjectives – Extraction of principal components - of factor loadings - Canonical variables and canon al correlation coefficients. Concepts of multidimens	nical	or an corre	latio	is: ns:
Unit:4	•	scriminant Function and Cluster Analysis		12	hou	rs
Discriminant A	Analysis: Ob	jectives and assumptions - Fisher's Discriminant Fun		- Pro	blem	n of
		or More Populations - Cluster Analysis: Objectivition of clusters – Clustering algorithm.	ves, A	Assur	nptic	ons,
Artificial Intel	ligence and I	es of Artificial Intelligence and Machine Learning Machine Learning-Supervised Learning-Classification emi-Supervised Learning-Reinforcement Learning-	n and	Regre		n-
	temporary			2	hou	rs
Expert lectures	s, online sem	inars – webinars				

	Total Lecture Hours62 hours
Bo	ooks for Study
1	Anderson, T.W. (2003). An Introduction to Multivariate Statistical Analysis, Third Edition, Wiley – Interscience, NY.
2	Johnson, R. A., and Wichern, D. W. (2013). Applied Multivariate Statistical Analysis Sixth Edition, Pearson New International Edition.
3	Jambu, M., and Lebeaux, MO. (1983). Cluster Analysis and Data Analysis, North-Holland, NY.
Re	ference Books
1	Kshirsagar, A. M. (1972), Multivariate Analysis, Marcel Decker, Inc., NY.
2	Morrison, D. F. (2004). Multivariate Statistical Methods, Fourth Edition, Duxbury Press, CA
Re	elated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://nptel.ac.in/courses/111/104/111104024/

2 https://nptel.ac.in/courses/111/105/111105091/

3 https://nptel.ac.in/courses/106/106/106106139/

Course Designed By: Dr. K. Pradeepa Veerakumari

Mappi	Mapping with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	М	L	S	Μ	S	S	М	S			
CO2	S	Μ	Μ	L	S	Μ	S	S	Μ	М			
CO3	S	Μ	Μ	Μ	S	Μ	S	S	Μ	М			
CO4	S	М	М	Μ	S	S	S	S	S	М			
CO5	S	S	М	Μ	S	S	S	S	S	S			

Cou	rse Code	21S23C	TITLE OF THE COURSE	L	Т	Р	С
Cor	е		Statistical Quality Control and Reliability Theory	4	1	-	4
Pre-	requisite			Sylla	abus	2024	4-25
Cou	rse Object	tives	Trobability Distributions	vers	51011		
	•		course are to:				
1.	Understan	d the application	ation of statistics in industrial environment.				
2.			manufacturing process changes and process variability	ty.			
3.							
4. 5.		• •					
0.	comprene	ina ano impo					
		rse Outcom					
					r		
1	Construct Paramete		rts for large and smaller shifts in the process		K	1,K3	3
2	Effective	ly interpret t	tatistical Quality Control and Reliability Theory41-4Basics in Descriptive Statistics and ProbabilitySyllabus Version $2024-25$ Durse are to:on of statistics in industrial environment. anufacturing process changes and process variability. cess capability analysis, ice of product control methodology. nnce of reliability theory in industriesn of the course, student will be able to: 				
3	Carry out	t process cap	ability analysis	eory 4 1 Syllabus Version iability. iability. iability. istability. iability. istability. iability of K jate; K6 – Creeters iate; K6 – Creeters iate; K6 – Creeters jate; K6 – Creeters iate; K6 – Creeters jate; Jater jate; Jater jater Jater		K3,1	K5
4	Adopt ap	propriate sai	mpling inspection plans for given conditions		K2,	K3,1	K6
5			•	of	K4,	K5,1	K6
V1	-	nts and syste		V	Croot		
	- Kemennt	ber, K 2 - Un	derstand; KS - Appry; K4 - Anaryze; KS - Evaluate;	<u> </u>	Creat	e	
Unit	:1	Basi	c Control Charts and Capability Analysis		12	hou	rs
		cope of stati	istical quality control - Causes of quality variation -	Cont			
	-	-	-	-	-		-
	pretations.	• •	totting and control chart - 110cess capability	Tatio		lu l	nen
	1						
Unit							
-						<u> </u>	
Unit			ontrol: Attributes and Variables Sampling Plans				
	-	-				-	-
	ations o	f variables	s sampling plan - Derivation of OC curve - dete	ermin	ation	of ₁	olan
para	meters.						
Unit	:4 Pro	oduct Contr	ol: Continuous Sampling and Sequential Samplin	g	12	hou	rs
				-			
				samp	ling I	lans	; by
attin	Juies De						
Unit	::5		Reliability Theory		12	hou	rs
	•						
					-		
	ral compoi	•			•		
T 7 •					-	1.	
Unit Expe		online sem	1 V		2	nou	rs
Елр		, onnie sem		ars	62	hour	`S
Boo	ks for Stu	dv					
		•	Quality Control and Industrial Statistics, Irwin-Illinoi	s, US			
_							

2	Grant, E. L., and Leavenworth, R. S. (2000). Statistical Quality Control, Seventh Edition,								
	Tata McGraw Hill, New Delhi.								
3	Montgomery, D. C. (2009). Introduction to Statistical Quality Control, Sixth Edition, Wiley India, New Delhi.								
4	Ross, S. M. (2009). Introduction to Probability Models, Tenth Edition, Academic Press, MA, US.								
5	Zacks, S.(1992). Introduction to Reliability Analysis: Probability Models and Statistical Methods, Springer, New York.								
Re	eference Books								
1	Barlow, E.B., and Proschan, F. (1981). Statistical theory of Reliability and Life Testing: Probability Models, Second Edition, Published by Holt, Rinehart & Winston, Inc.								
2	Bowker, A.H., and Lieberman, G.J. (1982). Engineering Statistics, Second Edition, Prentice Hall, New Delhi,								
3	Schilling, E. G., and Nuebauer, D.V. (2009). Acceptance Sampling in Quality Control Second Edition, CRC Press, New York.								
4	Wetherill, G.B. (1977). Sampling Inspection and Quality Control, Second Edition, Chapman and Hall, London.								
D									
	elated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]								
1	http://bmepedia.weebly.com/uploads/2/6/8/26683759/unit_4_quality_control.pdf								
2	http://www2.ing.unipi.it/lanzetta/stat/Chapter20.pdf								
2	1 + t + r + 1/r + r + r + 1/r + 1/r + 1/r + 1/2 + 1/								
3	https://www.win.tue.nl/~adibucch/2WS10/SPClecturenotes.pdf								
4	https://wps.prenhall.com/wps/media/objects/7117/7288732/65767_28_SuppG.pdf								

Course Designed By: Dr. R. Vijayaraghavan

Mappi	Mapping with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	Μ	Μ	S	Μ	S	S	Μ	М			
CO2	S	S	М	Μ	S	Μ	S	S	Μ	М			
CO3	S	Μ	М	Μ	S	S	S	S	Μ	М			
CO4	S	М	М	М	S	М	S	S	Μ	М			
CO5	S	М	М	М	S	S	S	S	Μ	М			

Cou	irse Code	21S33A	TITLE OF THE COURSE L	Т	P	С
Cor	e		Testing Statistical Hypotheses 4	1	1	4
Pre	-requisite			abus sion	⁵ 202	24-25
	rse Objec					
The 1. 2. 3. 4. 5.	Draw infe Impart kn Understar Understar	erence about owledge on nd Neyman-I nd the test pr	course are to: unknown population parameters based on random sample statistical hypothesis Pearson fundamental lemma for testing statistical hypothes ocedures MPT,UMPT,LMPT, LRT and SPRT metric and non-parametric, sequential test procedures			
Fwn	acted Con	ma Autoom	ag			
		sful comple	tion of the course, student will be able to:			
1	Make in random s	ferences ab amples	out statistical unknown population parameters based	on	K1-]	
2		e statistical			K	
3		• •	nesis by selecting suitable test procedure.		K3-1	
4			critical region and power of test function.		K	.5
5	sequentia	al testing pro			K3-1	K6
K1	- Rememt	oer; K2 - Un	derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 –	Crea	ate	
hype rand	damental n othesis, cr lomized an	itical regior	Hypothesis Testing Preliminaries pothesis testing: null and alternative hypothesis, simple a n, type I and type II errors, test function, level o pmised tests, power function, P-value - Neyman-Pearson to standard statistical distributions.	and c f sig	gnifica	osite ance,
	- 1					
mos Inva	notone like t powerful	tests for on	Most Powerful Tests and its variants property - Uniformly most powerful tests - Construction e-parameter and multi-parameter exponential families - est - Applications to standard statistical distribution-	of u Unbi	iased	nly and
Uni	t:3		Likelihood Ratio Tests	1	2 hou	ırs
Like Con	elihood rat		- asymptotic distribution of LR test statistic-consistency or testing mean and variance of normal distributions of	of I	LR te	st -
Uni	t:4		Non-Parametric Tests	1	2 hou	ırs
Smi Koli test	rnov test, mogorov-S - Chi-squa	Problem of mirnov test	- Wald-Wolfowitz runs test - Median test - Mann-Whitr dependence - More than two samples: Kruskal-Wallis tes	ſwo ney-∖	samp Vilco	oles: xon
Uni	t•5		Sequential Probability Ratio Tests	1	2 hou	Ire
Basi erro Prop	c ideas of r probabili perties of S	ties and app	ampling - Wald's equation - sequential probability ratio to proximation of stopping bounds - OC and ASN function lications to standard distributions - statement of Wald's	est (1s of	SPR7 SPR7	Г) - СТ -
Uni	t:6		Contemporary Issues		2 ho	urs
	1	s, online sem	inars – webinars			
			Total Lecture Hours	6	52 hou	ırs

Te	xt Book(s)
1	Rohatgi, V. K. (1976). Introduction to Probability Theory and Mathematical Statistics, John Wiley & Sons, NY. (For units 1,2,3,4,5)
2	Gibbons, J. D. and Chakrabarthi, S. (2010). Nonparametric Statistical Inference, Fifth Edition, Chapman and Hall/CRC Press, FL (For unit 4)
3	Wald, A. (1982). Sequential Analysis. John Wiley & Sons, NY. (For unit 5)
	ference Books
1	Lehmann, E. L. (1986). Testing Statistical Hypotheses, Second Edn., John Wiley & Sons, NY
2	Goon, A. M., Gupta, M. K., Das Gupta. B. (1973). An outline of Statistical Theory, Vol. II, World Press, Calcutta.
3	Rao, C.R. (1973). Linear Statistical Inference and Its Applications, 2nd Edn., Wiley Eastern Ltd.
4	Gupta, S. C., and Kapoor, V. K. (2002), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi
5	Rajagopalan, M., and Dhanavanthan, P. (2012). Statistical Inference, PHI Learning Pvt., Ltd., New Delhi.
6	Conover, W. J. (1980). Practical Nonparametric Statistics, Second Edn., John Wiley & Sons, NY.
7	Rohatgi, V. K., and Saleh, A.K.M.E. (2015), An Introduction to Probability and Statistics, Third Edition, John Wiley & Sons, NY.
Do	lated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=34
1	
	Paper: P-04.Statistical Inference I P-05.Statistical Inference II
2	https://nptel.ac.in/courses/103/106/103106120/
	Introduction to Statistical Hypothesis Testing – IIT Madras
(ourse Designed By: Dr. R. Muthukrishnan

Mappi	Mapping with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	S	Μ	S	Μ	S	S	Μ	М			
CO2	S	S	S	Μ	S	Μ	S	S	Μ	М			
CO3	S	S	Μ	Μ	S	Μ	S	S	Μ	М			
CO4	S	S	Μ	Μ	S	Μ	S	S	Μ	М			
CO5	S	S	Μ	Μ	S	Μ	S	S	Μ	М			

Cou	rse Code	21S33B	TITLE OF THE COURSE	L	Т	Р	С
Core	è.		Linear Models and Design of Experiments	4	1	-	4
Pre-	requisite		Knowledge on Analysis of Variance and Basics of Design of Experiments	Sylla Versi		202	4-25
	rse Object						
	5		course are to:	al 12m		م جا م ا	and
1	its types		ts to understand the theoretical concepts of the gener	ai nne	ear m	odel	and
2	. To mak	e the studen	ts familiar with various experimental designs.				
3			nts understand some advanced concepts of design of	of exp	berim	ents	like
	factoria	l experiment	lS.				
-		rse Outcom					
		Ĩ	ion of the course, student will be able to:	1.1		T 71 T	
1			erstand the theoretical underpinning of the linear r nd design of experiments.	nodel	,	K1,ŀ	\$2
2			of any given experiment and the type of design apt	for its	3	K	2
	analysis.						
3	Apply var its results	0	s of experiments in several practical situations and ev	aluate		K3, I	X5
4	Make fur	ther analyse	s which are specific to the objectives of any experime	nt.		K	4
5		• •	designs as per the requirements and study their beh	aviou	r	K	5
K1	-	ceeding to the tree of the tre	he research. derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; l	K6 - ([¬] reate	<u>م</u>	
			derstand, no rippiy, no rindiyze, ne Evaluate, r			0	
Unit			Linear Models and Basic Designs			hou	
		1	ons on Error Components - Fixed/Mixed and Rando				
			Gauss-Markov setup – Estimation of parameters – Le Iarkov theorem-BLUE – Linear parametric function	-			
			r Linear Hypothesis - Principles of Experimentation				
Desi	gns and CI	RD-RBD-LS	D with their merits and limitations.				
Unit	:2	Compa	rison Tests and Some Special Types of Designs		12	hou	rs
			l Multiple Range Tests: Need – Tukey's Test				
			ethod, Duncan's multiple range test, Neyman-Kauls d two-way - Analysis of Graeco Latin Squares, Cr				
		Strip Plot De		000 0			5115,
	_						
Unit Eact			actorial Experiments and Confounding Advantages and limitations – main effects and in	toract		hou	
	-		n x p Asymmetrical Factorial Experiments – Conce				
and	its advant	ages and li	mitations - Total, partial and balanced Confoundin	ng in			
Facto	orial exper	iments A	nalysis of confounded 2^n and 3^n factorial experiments	•			
Unit	:4	Fracti	onal Factorial and Response Surface Designs		12	hou	rs
		ctional Repl	ication in Symmetrical Factorial experiments - 1/2 a				
			beriments - Construction and Analysis – Concept o Response surface designs – steepest ascent metho				
-		ce designs.	Response surface designs – steepest ascent metho	Ju – 1	Secol	1 u -01	uer
1		U					
Unit			Incomplete Block Designs			hou	
			, Incidence matrix and its properties, C- matrix and and Orthogonality – Balanced Incomplete Block D				
			tra block analyses. Partially Balanced Incomplete Block B				
			Design - Simple and Balanced Lattice Designs.		0	-	
Unit	•6		Contemporary Issues		,	2 ho	IFC
		, online sem	inars – webinars			- 110	u19
1			Total Lecture H	ours	62	hou	rs
Bool	ks for Stud	ły					

1	Montgomory, D.C. (2012). Design and Analysis of Experiments, Eighth Edition, John Wiley & Sons, NY.
2	Das, M. N., and Giri, N. C. (2011). Design and Analysis of Experiments, Second Edition, New Age International Private Ltd., New Delhi
3	Graybill, F.A. (1961): An Introduction to Linear Statistical Models, McGraw Hill Co., London.
4	Graybill, F. A. (2000). Theory and Applications of Linear Models, Duxbury Press, First Edition, MA.
5	Peterson, R. G. (1985). Design and analysis of experiments, Marcel Dekker, NY.
6	Paneerselvam, R. (2012). Design and Analysis of Experiments, PHI Learning Private Ltd., New Delhi.
Re	ference Books
1	Fisher, R.A. (1966). The Design of Experiments, 8th Edition, Oliver and Boyd, London.
2	Federer, W. T. (1967). Experimental Design: Theory and Application, Indian Edition, Oxford and IBH Publishing Co., New Delhi.
3	Kempthorne, O. (1965). The Design and Analysis of Experiments, Wiley Eastern India Limited, New Delhi
4	Cochran, W.G. and Cox, G.M. (1992). Experimental Designs, Second Edition, John Wiley & Sons, New York.
5	Nigam, A. K., Puri, P. D., and Gupta, V. K. (1988). Characterizations and Analysis of Block Designs, John Wiley & Sons, NY.
6	John, P.W.M. (1971). Statistical Design of Experiments, Macmillan Co., NY.
7	Joshi, D.D. (1987). Linear Estimation and Design of Experiments, First Edition, New Age International (P) Ltd, New Delhi.
8	Searle, S.R. and Gruber, M. H. J. (2016). Linear Models, Second Edition, John Wiley & Sons, Inc.,
Re	lated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://nptel.ac.in/courses/110/105/110105087/

Course Designed By: Dr. R. Jaisankar

Mappi	Mapping with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	М	М	S	Μ	S	М	Μ	М			
CO2	S	S	Μ	Μ	S	Μ	S	Μ	Μ	М			
CO3	S	S	М	Μ	S	М	S	М	М	М			
CO4	S	S	L	Μ	S	М	S	М	М	М			
CO5	S	S	L	Μ	S	М	S	М	М	М			

Course Code	21S33C	TITLE OF THE COURSE L	Т	Р	С
Core		Programming in R 4	1	-	4
Pre-requisite		Knowledge in object oriented language Sylla Versi		202	4-25
 Understar Perform s 	objectives on the operat tatistical ana	f this course are to: ions and functions of R Programming lysis using built-in functions nized program for mathematical and statistical problems			
Expected Cou		es tion of the course, student will be able to:			
	1	cs of R Language		K	2
		ills for performing statistical analysis		K	4
3 Use app	propriate plot	s, charts and diagrams for all kinds of data		K	3
	n parametric			K	
		ne code for multivariate analysis	a	K	6
K1 - Rememb	per; K2 - Un	derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - G	Creat	e	
		Essentials of R Language ssignments, creating vectors, Vectors, vector arithmetic, logets, their modes and attributes, ordered and unordered factor	gical	hou	rs
Unit:2		Basic Operations and functions	12	hou	rs
		and data frames, List and data frames, conditional statemen		1	
runctions – bu	llt-in and use	r defined; Data entry – reading from text file, data editor; e	examp	oles.	
Unit:3	1				
		Basic Statistics and Graphical methods		hou	rs
	atistics and C	Basic Statistics and Graphical methods Braphics: Obtaining summary statistics; generating tables; H gram; exercises.			rs
Pie charts, Box	atistics and C plots, Histo	Braphics: Obtaining summary statistics; generating tables; H	Bar pl		
Pie charts, Box Unit:4 Probability an discrete and distributions;	atistics and C c plots, Histo Proba d Distribution continuous	Braphics: Obtaining summary statistics; generating tables; Egram; exercises.	Bar pl	ots, hou ies f	rs for
Pie charts, Box Unit:4 Probability and discrete and distributions;	atistics and C plots, Histo Proba d Distribution continuous Plotting den	Graphics: Obtaining summary statistics; generating tables; Egram; exercises. bility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and	3ar pl 12 valu con n-par	ots, hou ies f	rs or ous ric
Pie charts, Box Unit:4 Probability an discrete and distributions; methods Unit:5 Correlation: F residuals and f	atistics and C plots, Histo Proba d Distributio continuous Plotting den M Pearson, Spe fitted values;	Graphics: Obtaining summary statistics; generating tables; Figram; exercises. Ibility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and sity and cumulative density curves, parametric and no Model building and Multivariate Analysis Farman and Kendall's correlation; Regression – fitting one and two sample tests for mean and variance – one w	3ar pl 12 valu con n-par 12 g, ob	ots, hou les f tinuc amet hou taini	rs for ous ric rs ng
Pie charts, Box Unit:4 Probability an discrete and distributions; methods Unit:5 Correlation: F residuals and f way ANOVA, Unit:6	atistics and C plots, Histo Proba d Distribution continuous Plotting den M Pearson, Spe Fitted values; Multivariat	Graphics: Obtaining summary statistics; generating tables; Figram; exercises. Ibility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and sity and cumulative density curves, parametric and no Model building and Multivariate Analysis earman and Kendall's correlation; Regression – fitting one and two sample tests for mean and variance – one w e analysis Contemporary Issues	ar pl 12 valu con n-par 12 g, ob vay a	ots, hou les f tinuc amet hou taini	rs for bus ric rs ng vo
Pie charts, Box Unit:4 Probability an discrete and distributions; methods Unit:5 Correlation: F residuals and f way ANOVA, Unit:6	atistics and C plots, Histo Proba d Distribution continuous Plotting den M Pearson, Spe Fitted values; Multivariat	Graphics: Obtaining summary statistics; generating tables; Figram; exercises. bility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and sity and cumulative density curves, parametric and no codel building and Multivariate Analysis earman and Kendall's correlation; Regression – fitting one and two sample tests for mean and variance – one we e analysis Contemporary Issues inars – webinars	3ar pl 12 valu con n-par 12 g, ob vay ar	hou nes f tinuc amet hou taini nd tw	rs for bus ric rs ng vo rs
Pie charts, Box Unit:4 Probability an discrete and distributions; methods Unit:5 Correlation: F residuals and f way ANOVA, Unit:6 Expert lectures	atistics and C plots, Histo Proba d Distribution continuous Plotting den M Pearson, Spe Fitted values; Multivariato s, online sem	Graphics: Obtaining summary statistics; generating tables; Figram; exercises. Ibility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and sity and cumulative density curves, parametric and no Model building and Multivariate Analysis earman and Kendall's correlation; Regression – fitting one and two sample tests for mean and variance – one w e analysis Contemporary Issues	3ar pl 12 valu con n-par 12 g, ob vay ar	hou nes f tinuc amet hou taini nd ty	rs for bus ric rs ng vo rs
Pie charts, Box Unit:4 Probability an discrete and distributions; methods Unit:5 Correlation: F residuals and f way ANOVA, Unit:6 Expert lectures Books for Stu 1 Purohit, S. House, Ne 2 Dalgaard, I	Atistics and C A plots, Histo Proba d Distribution continuous Plotting den Market Plotting den Market Searson, Spe Fitted values; Multivariate S, online sem dy G., Gore, S. w Delhi. P. (2008). In	Graphics: Obtaining summary statistics; generating tables; Figram; exercises. bility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and sity and cumulative density curves, parametric and no codel building and Multivariate Analysis earman and Kendall's correlation; Regression – fitting one and two sample tests for mean and variance – one we e analysis Contemporary Issues inars – webinars	3ar pl 12 valu con n-par 12 g, ob vay ar 2 62	hou les f tinuc amet hou taini nd tw hou hou	rs for bus ric rs ng vo rs rs
Pie charts, Box Unit:4 Probability an discrete and distributions; methods Unit:5 Correlation: F residuals and f way ANOVA, Unit:6 Expert lectures Books for Stu 1 Purohit, S. House, Ne 2 Dalgaard, 1 3 Crawley, M Reference Boo	Atistics and C A plots, Histo Proba d Distribution continuous Plotting den Magearson, Spe Fitted values; Multivariate S, online sem dy G., Gore, S. w Delhi. P. (2008). Inter M. J. (2007). oks A., and Meys	Graphics: Obtaining summary statistics; generating tables; H gram; exercises. bility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and sity and cumulative density curves, parametric and no codel building and Multivariate Analysis earman and Kendall's correlation; Regression – fitting one and two sample tests for mean and variance – one w e analysis Contemporary Issues inars – webinars D., and Deshmukh, S. R. (2009). Statistics Using R, Naros troductory Statistics with R, Second Edition, Springer	ar pl 12 valu con n-par 12 g, ob vay ar 2 62 sa Pul	hou ies f tinuc amet hou taini nd tw hou bolish	rs for bus ric rs ng vo rs rs
Pie charts, Box Unit:4 Probability and discrete and distributions; methods Unit:5 Correlation: F residuals and f way ANOVA, Unit:6 Expert lectures Books for Stu 1 Purohit, S. House, Ne 2 Dalgaard, 1 3 Crawley, M Reference Boo 1 De Vries, A Private Lto	Atistics and C A plots, Histo Proba d Distribution continuous Plotting den Market Plotting den Market Multivariate G, online sem dy G., Gore, S. w Delhi. P. (2008). Ini A, J. (2007). oks A., and Meys I, NY.	Braphics: Obtaining summary statistics; generating tables; I gram; exercises. Ibility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and sity and cumulative density curves, parametric and no Iodel building and Multivariate Analysis carman and Kendall's correlation; Regression – fitting one and two sample tests for mean and variance – one we e analysis Total Lecture Hours D., and Deshmukh, S. R. (2009). Statistics Using R, Naros troductory Statistics with R, Second Edition, Springer The R Book, John Wiley and Sons Private Ltd., NY.	ar pl 12 valu con n-par 12 g, ob vay ar 2 62 sa Pul	hou ies f tinuc amet hou taini nd tw hou bolish	rs for bus ric rs ng vo rs rs
Pie charts, Box Unit:4 Probability an discrete and distributions; methods Unit:5 Correlation: F residuals and f way ANOVA, Unit:6 Expert lectures Books for Stu 1 Purohit, S. House, Ne 2 Dalgaard, I 3 Crawley, M Reference Boo 1 De Vries, A Private Ltd Related Onlin 1 https://swa	Atistics and C A plots, Histo Proba d Distribution continuous Plotting den Market Plotting den Market Multivariate S, online sem dy G., Gore, S. W Delhi. P. (2008). In A, J. (2007). oks A., and Meys I, NY. Market yam.gov.in/10	bility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and sity and cumulative density curves, parametric and no codel building and Multivariate Analysis carman and Kendall's correlation; Regression – fitting one and two sample tests for mean and variance – one we e analysis Total Lecture Hours D., and Deshmukh, S. R. (2009). Statistics Using R, Naros troductory Statistics with R, Second Edition, Springer The R Book, John Wiley and Sons Private Ltd., NY. s, J. (2016). R For Dummies, Second Edition, John Wiley & [MOOC, SWAYAM, NPTEL, Websites etc.] nd1_noc19_ma33/preview	ar pl 12 valu con n-par 12 g, ob vay ar 2 62 sa Pul	hou ies f tinuc amet hou taini nd tw hou bolish	rs for bus ric rs ng vo rs rs
Pie charts, Box Unit:4 Probability an discrete and distributions; methods Unit:5 Correlation: F residuals and f way ANOVA, Unit:6 Expert lectures Books for Stu 1 Purohit, S. House, Ne 2 Dalgaard, I 3 Crawley, M Reference Boo 1 De Vries, A Private Ltc Related Onlin 1 https://swa 2 https://swa	Atistics and C A plots, Histo Proba d Distribution continuous Plotting den Magearson, Spec- Fitted values; Multivariate S, online sem dy G., Gore, S. W Delhi. P. (2008). Inter- A, J. (2007). Dks A., and Meysel, NY. Me Contents yam.gov.in/10 yam.gov.in/10 S.	Braphics: Obtaining summary statistics; generating tables; F gram; exercises. Ibility distributions and Statistical Inference ons: obtaining density, cumulative density and quantile distributions; generating samples from discrete and sity and cumulative density curves, parametric and no Kodel building and Multivariate Analysis carman and Kendall's correlation; Regression – fitting one and two sample tests for mean and variance – one we e analysis Contemporary Issues inars – webinars D., and Deshmukh, S. R. (2009). Statistics Using R, Naros troductory Statistics with R, Second Edition, Springer The R Book, John Wiley and Sons Private Ltd., NY. s, J. (2016). R For Dummies, Second Edition, John Wiley & [MOOC, SWAYAM, NPTEL, Websites etc.]	ar pl 12 valu con n-par 12 g, ob vay ar 2 62 sa Pul	hou ies f tinuc amet hou taini nd tw hou bolish	rs for bus ric rs ng vo rs rs

Mappi	Mapping with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	L	S	S	S	S	М	М	М			
CO2	S	S	L	S	S	S	М	М	М	М			
CO3	S	S	L	S	S	S	М	М	М	М			
CO4	S	S	L	S	S	S	М	М	М	М			
CO5	S	S	L	S	S	S	S	М	М	М			

Course Code 21S43A TITLE OF THE COURSE	Code21S43ATITLE OF THE COURSELT								
Core Stochastic Processes	4	1	1 4						
	Sylla Vers		202	4-25					
Course Objectives	V CI D	1011							
The main objectives of this course are to:									
1. Understand the fundamental concept of random process and its variants.									
2. Understand the Chapman-Kolmogorov equation and its applications.									
 Compute transition probability matrix and its long run distribution. Inculcate various models of stochastic process and its applications. 									
4. Inculcate various models of stochastic process and its applications.5. Impart knowledge on various stationary time series modeling techniques									
5. Input knowledge on various stationary time series modernig teeningtees									
Expected Course Outcomes									
On the successful completion of the course, student will be able to:									
1 Compute n-step transition probability matrix and its long run.									
2 Classify the states of Markov chain		ŀ	K1-K	2					
3 Know the concept of branching process and to compute extinction probabilit	ties	ŀ	К2-К	[4					
4 Know the concept of renewal process and its applications		ŀ	К2-К	[4					
5 Forecast using various stationary time series techniques.		ŀ	K1-K	6					
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6	6 – 0	reate)						
Unit:1 Stochastic Processes Preliminaries			hou						
Random variables – Generating Function – Probability generating function – generating	<u> </u>								
bivariate distribution – Concept of Laplace and inverse Laplace transform – Lapla									
probability distribution - Introduction to Stochastic Processes - Classification									
Processes - Markov Chain - Transition Probability Matrix, Transition grap Kolmogorov Equation -Calculation of n-step transition probability and its limit.	<u>эп</u> -	Cha	ipma	un-					
Komogorov Equation -Calculation of n-step transition probability and its mint.									
Unit:2 Markov Process		12	hou	rs					
Classification of states and chains: communication relation, periodicity, irreduc									
persistent, ergodic states - limit theorems - Random Walk and Gambler's Ruin Pre-									
process with discrete state space: Poisson process - postulates and properti		-							
process - birth and death process - Kolmogorov differential equations - Marke	-	roces	SS W	ıth					
continuous state space: Wiener process - differential equations for a Wiener proce	288.								
Unit:3 Renewal Process		12	hou	rs					
Renewal Processes - Renewal Process in Discrete and Continuous Time - Ren	newa	Inte	erval	_					
Renewal Function and Renewal Density - Renewal Equation - Wald's equa									
theorems: Elementary Renewal Theorem - Probability Generating Function	on c	of R	enev	val					
Processes.									
Unit:4 Branching Process		12	hou	rc					
Branching Processes – Properties of generating function of branching pro	oces								
Watson process) – Probability of ultimate extinction - Distribution of total number									
conditional limit laws - Concept of Bellman-Harris process.		1 0							
Unit:5 Stationary Process			hou						
Stationary Processes – Gaussian process - application to Time Series: auto-covar									
correlation functions and their properties - Pure random process – first order M		-							
Moving Average - Autoregressive, Autoregressive Moving Average - Autoregre									
Moving Average Processes - Box-Jenkins Methodology: Model building strategy residual analysis, diagnostic checking, forecasting.	y, 02	SIC 10	Jeas	01					
Unit:6 Contemporary Issues		2	hou	rs					
Expert lectures, online seminars – webinars									
Total Lecture Hour	1								
	rs	62	hour	:s					
Text Book(s)									
Text Book(s)1Karlin, S. and Taylor, H.M. (1975): A First Course in Stochastic Processes, Academic Press, Inc., NY (For units 1,2,3,4,5)									

3	Hanke, J.E and Wichern, D.W. (2009). Business Forecasting, PHI Learning Pvt Limited, 8 th edition,
	New Delhi. (For unit 5)
Re	ference Books
1	Granger, C. W. J., and Newbold, P. (1984): Forecasting Econometric Time Series, Second Edition, Academic Press Inc., NY.
2	Anderson, T.W., (1971): The Statistical Analysis of Time Series, John Wiley & Sons, NY. (Latest Edition: 1994: Wiley Interscience)
3	Adke, S. R., and Manjunath, S. A. (1984): An Introduction to Finite Markov Processes, Wiley Eastern, New Delhi.
4	Parzen, E. (1962): Stochastic Processes, Holden-Day, Oakland, CA. (Latest Edition: 2015: Dover Books on Mathematics, Dover Publications).
5	Box, G.E.P., Jenkins, G.M., Reinsel, G.C and Ljung, G.M. (2015). Time Series Analysis: Forecasting and Control, 5 th edition, John-Wiley & Sons, New Jersey
Re	lated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=34
	Paper: P-10. Stochastic Processes and Time Series Analysis - ISI, Kolkata
2	https://nptel.ac.in/courses/111/103/111103022/
	Stochastic Processes – IIT Guwahati
3	https://nptel.ac.in/courses/111/102/111102098/
	Introduction and Motivation for studying Stochastic Processes – IIT Delhi
4	https://ocw.mit.edu/courses/mathematics/18-445-introduction-to-stochastic-processes-spring-
	2015/lecture-notes/
5	https://www.stat.auckland.ac.nz/~fewster/325/notes/325book.pdf
C	ourse Designed By: Dr. R. Muthukrishnan

Mapping with Programme Outcomes											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	S	S	Μ	L	S	Μ	S	L	Μ	М	
CO2	S	S	Μ	L	S	Μ	S	L	Μ	М	
CO3	S	S	Μ	L	S	Μ	S	L	Μ	М	
CO4	S	S	Μ	L	S	S	S	L	S	S	
CO5	S	S	М	L	S	S	S	L	S	S	

Core Pre-requisite		TITLE OF THE COURSE	L	Τ	P	C
-		Biostatistics and Survival Analysis	4	1	-	4
		Basics of distribution theory and regression analysis	ibus sion	2024	1-25	
Course Object						
The main objec						
		ss of Biostatistics and its need.				
		nave a clear understanding of special kinds of vari	lous s	statist	ical t	ools
	biostatistics.	bout the potential applications of these tools.				
J. DC KIOV	vicugeable a	bout the potential applications of these tools.				
Expected Cour	rse Outcom	es				
On the success	sful complet	ion of the course, student will be able to:				
1 Understa	and the conc	epts and statistical tools used in Biostatistics.			K2	2
2 Effective	ely apply the	ese tools on solving the biological problems occurring	ng in		K	3
real life.						
		ostatistical data as per the objectives of the problem	1.		K∠	ŀ
1		es of the analyses meaningfully.			K5	
	-	lems of his own and able to proceed with them.			Ke	5
K1 - Rememb	er; K2 - Unc	lerstand; K3 - Apply; K4 - Analyze; K5 - Evaluate;	K6 -	- Crea	ate	
Unit:1	D ' ((' ('	Clinical Trials	1.		hour	
		s – Various types of studies - Ethics - Measures of				
and disease bu	urden. Clinio	cal Trials - Goals of Clinical Trials - Phases o	f Cli	nical	Tria	ls -
		rials - Randomization: Fixed Allocation, Simple, I				
-		ponse Adaptive - Blinding: Single, Double and T	-		-	for
Clinical Trials:	Parallel Gro	ups Design, Cluster Randomization Designs, Crosse	over]	Desig	ns.	
Unit:2	Mu	tiple Regression and Logistic Regression		12	hour	S
Multiple Regre		sumptions – uses – Estimation and interpretation	of	coeffi	cient	s –
Testing the reg	pression coe	fficients – Coefficient of determination – Testing	g mo	del a	deau	
		ction – Logistic regression model – relative risk –			ucqui	acy.
			logit			
properties of o	dds ratio – t			- ode	ls rat	io –
		he relationship between the odds ratio and relativ	e risł	- odo x - N	ds rat Iaxin	io – ium
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	Methodologies, Second Edition, Wiley – Interscience, John Wiley & Sons, NJ.
2	Friedman, I. M., Furberg, C. D., and DeMets, D. L. (2010), Fundamentals of Clinical Trials,
	Fourth edition, Springer – Verlag, NY.
3	Van Belle, G., Fisher, L. D., Heagerty, P. J., and Lumley, T. (2004). Bio-Statistics - A
	Methodology for the Health Science, Second Edition, Wiley, NY.
4	Daniel, W. W. and Chad L. Cross(2018). Bio-Statistics: A foundation for analysis in the
	Health Sciences, Eleventh Edition, John Wiley & Sons, NY.
5	Kleinbaum, D. G., and Klein, M. (2012): Logistic regression: A Self-Learning Text, Third
	Edition, Springer – Verlag, NY.
6	Kleinbaum, D. G., and Klein, M. (2012): Survival Analysis: A Self-Learning Text, Third
	Edition, Springer – Verlag, NY.
Ref	erence Books
1	Hosmer, Jr. D. W., Lemeshow, S., and Sturdivant, R. X. (2013). Applied Logistic Regression,
	Third Edition, John Wiley & Sons, Inc., NY.
2	Lee, E. T., and Wang, J. W. (2013). Statistical Methods for Survival Data Analysis, Fourth
	Edition, Wiley, NY.

- 3 Rossi, R. J. (2010). Applied Biostatistics for Health Sciences, John Wiley & Sons, Inc., NY
- 4 Klein, J. P. and Moeschberger, M. L. (2003). Survival Analysis: Techniques for Censored and Truncated Data, Second Edition, Springer – Verlag, NY.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

- Prof.Shamik Sen, Department of Bioscience and Bioengineering, IIT Bombay, "Introduction to Biostatistics", NPTEL. [https://swayam.gov.in/nd1_noc20_bt28/preview]
 Dr.Felix Bast, Central University of Punjab, Bathinda, 2020, "Biostatistics and
- Dr.Felix Bast, Central University of Punjab, Bathinda, 2020, "Biostatistics and Mathematical Biology", (NPTEL). [https://swayam.gov.in/nd2_cec20_ma05/preview]
 www.healthknowledge.org.uk
- Course Designed By: Dr. R. Jaisankar

Mapping with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
CO1	S	S	L	Μ	S	S	S	S	Μ	L		
CO2	S	S	L	М	S	S	S	S	Μ	L		
CO3	S	S	L	S	S	S	S	S	S	L		
CO4	S	S	L	S	S	S	S	S	S	L		
CO5	S	S	L	Μ	S	S	S	S	Μ	L		

Course Code	ourse Code21S23E_TITLE OF THE COURSELT							
Elective		Operations Research	4	1	-	4		
Pre-requisite		Basic knowledge in operations research	Sylla Vers		202	4-2		
Course Object			V CI S.	IOII				
The main objec	tives of this of	course are to:						
		ance and concepts of optimization						
		ation for both linear and non-linear problem tion to any real time optimization problem						
Expected Cour								
•		on of the course, student will be able to:						
1 Form and	Solve the lin	near programming problem			K	(4		
2 Solve the	integer prog	ramming problem			K	3		
3 Understar	nd and evalua	ate the non-linear programming problem			K	5		
		ventory problem				6		
_		ne queueing problem				(4		
K1 - Rememb	er; K2 - Und	lerstand; K3 - Apply; K4 - Analyze; K5 - Evaluate;	K6 – (Creat	e			
Unit:1		Linear Programming		12	hou	rs		
	ar programmi	ing problems – Simplex algorithm – Use of artificial	l varia					
		ethod - Degeneracy in LPP. Duality – Interpretation	of du	ality	- Dı	Jal		
Simplex Method	d - Simple pro	oblems.						
Unit:2		Integer and Dynamic Programming		12	hou	rs		
		m (IPP) – Pure and mixed integer programming prol	blems					
		he algorithm - Mixed IPP - Branch and Bound tee						
	roblem (DPP)) - Principle of optimality – Recursive equation approa	ach Cl	naract	erist	ics		
of DPP.								
Unit:3		Non-linear Programming			hou			
		NLPP): Formulation of NLPP - Constrained optimiz acker conditions. Quadratic Programming: Wolf's and						
Unit:4		Inventory Control		12	hou	rs		
	ure of Inven	tory Problems, Concept of economic order quanti	ity, it					
		allowing quantity discounts and shortages, I						
probabilistic in deterministic in		els - Models with random demand, and static risk m	odels	- Mu	lti-it	em		
deterministic m	iventory prob	Jenis.						
Unit:5	Q	ueueing Theory and Network Analysis		12	hou	rs		
- 0.	· •	ng models, classification of models - M/M/1, M						
		tate solutions, Waiting Time Distributions for M						
Models. Netwo and critical path		ng by PERT/CPM, PERT: Basic components, deter	mınat	10n 0	of flo	WS		
and critical pau	1.							
Unit:6		Contemporary Issues		2	2 hou	irs		
Expert lectures,	, online semi	nars – webinars		()	1.			
Deal C. Ct.	1	Total Lecture H	ours	62	hou	ГS		
Books for Stud		man, G. J. (1990). Introduction to Operations Resear	ch Fi	fth F	ditio	n		
McGraw-H		man, O. J. (1990). Infoldetion to Operations Resear	CII, 11		unio	п,		
2 Kanti Swar	up, Gupta, P.	. K., and Man Mohan. (2017). Operations Research, & Sons, New Delhi.	Ninet	eenth	1			
3 Taha, H. A.		erations Research: An Introduction, Third Edition, M	[cMill	an				
4 Sharma, S.	D. (2017). O	Operations Research: Theory, Methods and Applicati	ons, H	Kedar	Nat	h, R		
Nath and C	o, Meerut.							
Reference Boo	ks							
		nents of Queuing Theory, McGraw-Hill Co., NY.						
1 Duuty, 1. L.								

2 Wagner, H. M. (1980). Principles of Operations Research with Application to Managerial Decisions, Second Edition, Prentice Hall India Learning Private Limited, New Delhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1 https://swayam.gov.in/nd2_cec20_ma10/preview

2 https://swayam.gov.in/nd1_noc19_ma29/preview

3 https://nptel.ac.in/courses/112/106/112106131/

4 https://nptel.ac.in/courses/112/106/112106134/

Course Designed By: Dr. K. M. Sakthivel / Dr. S. Jayalakshmi

Mapping with Programme Outcomes											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	S	S	Μ	L	S	Μ	S	L	L	Μ	
CO2	S	S	Μ	L	S	Μ	S	L	L	М	
CO3	S	S	L	L	S	Μ	S	L	L	М	
CO4	S	S	Μ	L	S	Μ	S	L	L	Μ	
CO5	S	S	S	L	S	Μ	S	L	L	Μ	

Course Code 21S33E	TITLE OF THE COURSE	L	Т	P	С
Elective	Econometrics	4	1	-	4
Pre-requisite	Basic knowledge in linear models	Sylla Vers	bus	202	4-25
	and their properties	Vers	ion		
Course Objectives The main objectives of the	his course are to:				
5	on concepts of methodology, nature and scope of Econo	matri	o and	1.001	c
1 0	of applications of econometrics	meun		uysi	3
	lore the concepts of linear models				
	estimation methods for linear regression model and simu	ltanec	ous e	quat	ion
models					
Expected Course Outco	letion of the course, student will be able to:				
	sic concepts of Econometrics, methodology and limit	otions	of	V 1	,K2
using Econometric		ations	01	КI	, К 2
	Least square estimators and its properties			K	3
	n of violation of basic assumptions of GLS			K	Χ5
1	or structural and reduced form models				ζ4
5 Obtain viable, relia	ble and optimal solution under simultaneous equation mo	odels		K	ζ6
· · · · ·	Jnderstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K		reate		
Unit:1	Preliminaries on Econometrics		12	hou	rs
	trics- Meaning and Scope - Methodology of Econometr	ics - 1	Natu	re a	nd
Sources of Data for Ecor	ometric analysis – Types of Econometrics				
Unit:2	Conceptized Logar Squares and Properties		10	hou	
	Generalized Least Squares and Properties east Squares(GLS) Estimator - Heteroscedasticity, A				
	s of Auto-correlation, Multicollinearity, Tools	for		ndli	
Multicollinearity					C
Unit:3	Model Building and Lag Models	1 T		hou	
	Stochastic Regressors, Errors in Variable Models a ndependent Stochastic linear Regression, Auto reg				
regression, Lag Models	ndependent Stochastic Inical Regression, Ruto reg	,103510	<i>,</i> 1		ai
Unit:4	Simultaneous Linear Equations Models			hou	
	tions Model, Identification Problem- Conditions for Iden				
	Single Equation and Simultaneous Equations, Methods	s of E	estim	atio	n-
	east Variance Ratio and Two-Stage Least Square				
Unit:5 Statist	ical Inference on Simultaneous Equations Models		12	hou	rs
	f Two-Stage Least Squares Estimator, Limited Inform	ation			
	Estimators, Methods of Three- Stage Least Squares.				
	~ ~ ~				
Unit:6	Contemporary Issues		21	hou	rs
Expert lectures, online se	Total Lecture Ho		62	hou	rc
Dealer for Study	Total Lecture no	u15	04	nou	15
Books for Study	997). Theory of Econometrics, Second Edition, Macmilla	an			
	conometric Methods, Fourth Edition, McGraw Hill				
	ter, D. (2008). Basic Econometrics, Fifth Edition, McGraw	-Hill			
Reference Books					
	ciples of Econometrics, John Wiley.				
2 Walters, A. (1970). A	n Introduction to Econometrics, McMillan and Co.				
Related Online Conton	s [MOOC, SWAYAM, NPTEL, Websites etc.]				
	n/nd2_cec20_hs14/preview				
	urses/111/104/111104072/				
3 https://nptel.ac.in/cou	urses/110/105/110105053/				

4 https://nptel.ac.in/courses/111/104/111104098/ 5 https://nptel.ac.in/courses/110/105/110105030/ Course Designed By: Dr. K. M. Sakthivel / Dr. K. Pradeepa Veerakumari

Mappi	Mapping with Programme Outcomes												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	М	L	S	М	S	М	М	М			
CO2	S	S	Μ	L	S	М	S	Μ	Μ	М			
CO3	S	S	Μ	L	S	М	S	Μ	Μ	М			
CO4	S	S	Μ	L	S	М	S	Μ	Μ	М			
CO5	S	S	М	L	S	М	S	М	М	М			

Course Code 21S43E_	TITLE OF THE COURSE	L	<u>T</u>	Р	<u>C</u>
Elective	Data Mining and Big Data	4 Svlla	1 bus	-	4
Pre-requisite	Data Data Nitucuire and Data Nource	Vers		2024	4-25
Course Objectives					
The main objectives of this					
	of separate database for decision making.				
	s of data mining techniques in different case studies.				
5. Incurcate the concep	pt learning and Machine learning theory.				
Expected Course Outcom	es				
On the successful complet	ion of the course, student will be able to:				
	database and their structure in social media			K	1
	the importance of KDD and Data Mining				2
	chniques in real world scenario.				3
1 1	f computational aspects in KDD Environment.			K4	
	es on a different applications of data mining and Big dat				6
K1 - Remember; K2 - Une	derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6	6 – 0	Create	e	
TT \$4.1	Detahase and Date Visualization		10	b	• ~
Unit:1 Introduction to Data - G	Database and Data Visualization rowth in Data - Database - Data understanding and	d pr		hou tion	
	and Unstructured data - Data Models - Data Warehous				
	Visualization - Structure Query Language - Application		•		
			1		
Unit:2	Knowledge Discovery Process			hou	
Introduction to Data Minin	g – Definition - An expanding universe of data product				ata
	data mining in manhating anaptical analizations	Inc			
mining verses query tools	- data mining in marketing - practical applications.		-	-	self
mining verses query tools learning – machine learning	ng- concept learning - decision support system - integration	grati	ion w	-	self
mining verses query tools learning – machine learning		grati	ion w	-	self
mining verses query tools learning – machine learnin mining – client / server data	ng– concept learning - decision support system – integra warehousing – multi processing machine – cost justifi	grati	on won.	vith o	self lata
mining verses query tools learning – machine learnin mining – client / server data Unit:3	ng– concept learning - decision support system – integ a warehousing – multi processing machine – cost justifi Knowledge Discovery Environment	grati	ion woon.	hou	self lata
mining verses query tools learning – machine learnin mining – client / server data Unit:3 Knowledge discovery proc	ng– concept learning - decision support system – integra warehousing – multi processing machine – cost justifi	grati icatio	ion woon.	hou	self lata
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Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

- https://swayam.gov.in/nd1_noc20_cs92/preview 1
- 2 3 https://swayam.gov.in/nd2_cec19_cs01/preview
- https://nptel.ac.in/courses/106/105/106105174/

Course Designed By: Dr. V. Kaviyarasu

Mappi	Mapping with Programme Outcomes												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	L	S	S	S	S	S	S	S			
CO2	S	S	L	S	S	S	S	S	S	S			
CO3	S	S	L	S	М	S	S	S	М	М			
CO4	S	S	L	S	М	М	S	S	М	М			
CO5	S	S	L	S	М	S	S	S	М	М			

Course Code21S23E_Elective	TITLE OF THE COURSE Robust Statistics	L 4	Т 1	P -	C 4
Pre-requisite	Sampling, Distribution, Estimation, Testing of Hypotheses, Design of Experiments, Multivariate Statistics	Sylla Vers	ibus	202	24-25
Course Objectives: The main objectives of this	course are to				
	tions and limitations of existing statistical procedures				
	normality assumption and outlier detection		1		
	of robust statistics in the context of measures of location st statistics under univariate, multivariate and regression				
5. Impart basic knowledg		i più		05	
Expected Course Outcom	les:				
*	tion of the course, student will be able to:				
	conventional and modern methods			1-K	
1	istical measures by using robust methods			1-K	
	ng suitable conventional / robust procedures			1-K	
	at population parameters based on random samples.			3-K	
5 Solve real life proble procedures.	ms by applying suitable conventional / robust statistical		K	3-K	.6
1	derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6	o – Cr	eate		
Unit:1	Introduction		12 k	loui	rs
	ution - Normal curve - problems with assuming norm				
	ust statistics - tools for judging robustness –qualitative,			ve,	and
infinitesimal robust ness - i	nfluence function, breakdown point, maximum asympto	otic bi	las.		
location - dispersion estir M-estimates – influence	scale – quantiles - trimmed means – winsorized mean nates – median absolute deviation - M-estimates of sca function, breakdown point, maximum bias, and asymp - concept of L-estimates and R-estimates. Statistical Inference	le – j	prope	ertie nalit	s of ty –
	tests - student's t and non-normality - basic boot tstrap t method — inferences about the population				
Unit:4	Linear Regression		12 h		re
Review of Least Square Regression M-estimates	e method – Least Median of Squares – Least Trin – robust tests for linear hypothesis – robust test usin variance property of regression estimate.	nmed	Squ	iare	s -
Unit:5	Multivariate Statistics		12 h	loui	rs
vector and scatter matrix estimators of multivaria Minimum Covariance D	iate data – Outlier detection methods – Robust meas – Multivariate M-estimators of location and scatter – te location and scatter - Minimum Volume Ellip Determinant estimator – affine equivariance property distance – Robust distance - Concept of data depth.	High soid	h brea estin	akdo nato	own or –
Unit:6	Contemporary Issues		2	ho	urs
Expert lectures, online ser	ninars – webinars				
	Total Lecture Hou	rs	62	ho	urs
Text Book(s)	Statistics Wiley				
1Huber (1981). Robust2Jana Jureckova and JaHall/CRC	n Picek (2006). Robust Statistical Methods with R, Chap	oman	&		
	ndamentals of Modern Statistical Methods, Springer.				
4 Wilcox, R.R. (2017). Int	roduction to Robust Estimation and Hypothesis Testing, Else	vier.			

Re	eference Books
1	Wilcox(2009). Basic Statistics, Oxford University Press.
2	Rohatgi, V. K. (1976). Introduction to Probability Theory and Mathematical Statistics, John Wiley & Sons, NY.
3	Montgomery, D.C., Peck, E.A. and Vining, G.G. (2011). Introduction to linear regression analysis, Wiley
4	Shevylyakov, G.L.and H.Oja (2016). Robust Correlation: Theory and Applications, Wiley
5	Tiku, M.L. and Akkaya, A.D. (2004). Robust estimation and hypothesis testing, New Age International (P) Limited.
Re	elated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	http://www.stat.rutgers.edu/home/dtyler/ShortCourse.pdf
2	http://cmstatistics.org/CMStatistics2015/docs/WinterCourseAR_Regression.pdf?20180201194816
3	https://cseweb.ucsd.edu/~slovett/workshops/robust-statistics-2019/slides/donoho-univariate.pdf
4	https://cseweb.ucsd.edu/~slovett/workshops/robust-statistics-2019/slides/donoho-multivariate.pdf
5	https://cseweb.ucsd.edu/~slovett/workshops/robust-statistics-2019/slides/donoho-regression.pdf

Course Designed By: Dr. R. Muthukrishnan

Mappi	Mapping with Programme Outcomes													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10				
CO1	S	S	Μ	М	S	Μ	S	S	М	S				
CO2	S	S	Μ	S	S	Μ	S	S	М	S				
CO3	S	S	Μ	S	S	Μ	S	S	М	S				
CO4	S	S	М	М	S	Μ	S	S	М	S				
CO5	S	S	М	S	S	Μ	S	S	М	S				

Course code 21S33E	TITLE OF THE COURSE	L	Т	P	С
Elective	Machine Learning using Python	4	1	-	4
Pre-requisite	Knowledge in Basic Programming and	Sylla	ibus	2024	1 25
-	Multivariate Analysis	Vers	sion	202	+-23
Course Objectives:	1.				
The main objectives of the					
-	n basics operations in Python				
2. Understand machine		D 1			
3. Explore and execute	the machine learning concepts for real time data using	Pyth	on		
Expected Course Outcon	mes				
A	etion of the course, student will be able to:				
	ations and concepts in Python			K	3
=	e the essential modules in Python			K	3
3 Evaluate the scope	and opportunities of machine learning			K	5
	nd hands-on training in machine learning techniques			K	5
	kills for machine learning techniques			K	6
	nderstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; I	X6 - (Create	е	
,					
Unit: 1	Basics of Python		12	hour	•6
	bes, lists, control statements, functions, classes, files and exce	eption		noui	0
		puon			
Unit:2	Essential Modules in Python		12	hour	•S
Jupyter Notebook, Num	py, Scipy, Matplotlib, Pandas, mglearn				
			10		
Unit:3	Supervised Learning ssion, k-Nearest Neighbors, k-Nearest Neighbors, Deci	cion ^r		hour	S
Neural Networks	ssion, k-mearest merghoors, k-mearest merghoors, Deer	SIOI	lices,	,	
Unit:4	Unsupervised Learning -1		12	hour	.s
Preprocessing and Scalin	ng, Scaling training, Dimensionality Reduction, Featur	e Ext			
Manifold Learning	6,			,	
Unit:5	Unsupervised Learning -2		12	hour	.s
Clustering: k- Means clu	stering, Agglomerative Clustering, DBSCAN				
Unit:6	Contemporary Issues		2	hour	•S
Expert lectures, online se	eminars – webinars				
	Total Lecture Ho	urs	62	hour	'S
Text Book(s)		1			
1 Introduction to Mach Muller & Sarah Guid	ine Learning with Python $-$ A Guide for Data Scientist	s by A	Andre	as C	•
	n Python : Essential Techniques for Predictive Ana	alvsis	hv]	Mick	veal
Bowles (2015), Wile		11y 515	Uyı	.viici	icai
	e : A hands-on, Project- Based Introduction to Prog	gramn	ning	by F	Eric
Matthes(2016), no sta				-	
Reference Books			-		
	y, Statistics and Machine Learning (second edition) (20)19) t	y Jos	e	
Unpingco, Springer 2 Practical Statistics fo	or Data Scientists(second edition)(2020) by Peter Bruc	$-\Delta n$	drew	Bru	<u></u>
& Peter Gedeck, O'R		e, All	uiew	Diu	LE
	j				
Related Online Conten	ts [MOOC, SWAYAM, NPTEL, Websites etc.]				
1 https://swayam.gov.	in/nd1_noc20_cs29/preview				
2 https://swayam.gov.	in/nd1_noc19_cs59/preview				
3 https://nptel.ac.in/co	ourses/106/106/106106202/				
Course Designed By: Dr	. K.M.Sakthivel				
U V					

Mappi	Mapping with Programme Outcomes												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	М	S	М	S	S	S	М	М			
CO2	S	S	М	S	М	S	S	S	М	Μ			
CO3	S	S	Μ	S	М	S	S	S	М	М			
CO4	S	S	Μ	S	М	S	S	S	М	М			
CO5	S	S	М	S	М	S	S	S	М	М			

Course Code	21S43E_	TITLE OF THE COURSE	L	Т	P	С
Elective		Demography and Vital Statistics	4	1	-	4
Pre-requisite		EUDOADEDIAIS OF GATA AND GATA SOUTCE	Sylla Vers		202	1-2
Course Objecti The main object			VCIS			
5						
2. Acquire the	e knowledge o	emographic and Vital Statistical data. of Mortality and Fertility Rate in India.				
Expected Cour		Life Table, Population projection and Migration.				
		on of the course, student will be able to:				
	-	h, Death and other vital statistics.			K	1
		ledge in Measurements of Population.			K	
		of life table and its types.			K	3
*	1	f Migration and its importance.			K	
-	-	ea of population projection and their estimation.			K	5
		erstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K	X6 – (Create		_
Unit:1		Demographic Data			hou	
	Demography eories: Erro	and vital statistics - Sources Uses and Methods of dependence of the demographic data, uses of Balancing	-	-		
1		formula - Adjustment of age data - use of Myer	0	-		
Population comp						
Unit:2		Measurement of Mortality		12	hou	•6
	population -	Rates and Ratios of vital events - Measurements of	Mor			
Death Rate (CD	DR), Specific	Death Rate (SDR), Infant Mortality, Rate (IMR)				
Death Rates - D	irect and Indi	rect method of Standardization.				
Douin Mailes - D	neet and mar					
				10	b	
Unit:3		Life Tables	Dete		hou	
Unit:3 Stationary and S	stable populat	Life Tables tion - Lotka and Dublin's Model - Central Mortality		s - Fo	orce	of
Unit:3 Stationary and S Mortality. Life	stable populat Tables: Assu	Life Tables tion - Lotka and Dublin's Model - Central Mortality Imption, description, construction of Life Tables a	and U	s - Fo Jses	orce of L	of fe
Unit:3 Stationary and S Mortality. Life	stable populat Tables: Assu	Life Tables tion - Lotka and Dublin's Model - Central Mortality	and U	s - Fo Jses	orce of L	of fe
Unit:3 Stationary and S Mortality. Life Tables - Make table.	stable populat Tables: Assu	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a ompertz Curve - National and UN Model life table	and U	s - Fo Jses bridg	orce of L ged 1	of fe fe
Unit:3 Stationary and S Mortality. Life Tables - Make table. Unit:4	table populat Tables: Assu hams and Go	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a ompertz Curve - National and UN Model life table Measurement of Fertility	and U e - A	s - Fo Jses bridg	orce of L ged 1 hou	of fe fe s
Unit:3Stationary and SMortality. LifeTables - Maketable.Unit:4Measurements ofRate (GFR) - SPopulation Grow	Stable popular Tables: Assu hams and Go of Fertility: N Specific Fert wth: Crude r	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a ompertz Curve - National and UN Model life table	and U e - A Gen	s - Fo Jses bridg 12 eral l asure	orce of L ged 1 houn Ferti ment	of fe fe 's ity
Unit:3 Stationary and S Mortality. Life Tables - Make table. Unit:4 Measurements of Rate (GFR) - S Population Grov Rate (GRR) and	Stable populat Tables: Assu hams and Go of Fertility: N Specific Fert wth: Crude r Net Reprodu	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a compertz Curve - National and UN Model life table Measurement of Fertility Nuptiality and Fertility - Crude Birth Rate (CBR) - tility Rate (SFR) and Total Fertility Rate (TFR). rates of natural increase - Pearl's Vital Index - Gruction Rate (NRR).	and U e - A Gen	s - Fo Jses bridg 12 eral l asure Repro	orce of L ged 1 houn Ferti- ment oduc	of fe fe ife s ity of ior
Unit:3 Stationary and S Mortality. Life Tables - Make table. Unit:4 Measurements of Rate (GFR) - S Population Grow Rate (GRR) and Unit:5	Stable populat Tables: Assu hams and Go of Fertility: N Specific Fert wth: Crude r Net Reprodu	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a compertz Curve - National and UN Model life table Measurement of Fertility Nuptiality and Fertility - Crude Birth Rate (CBR) - tility Rate (SFR) and Total Fertility Rate (TFR). rates of natural increase - Pearl's Vital Index - Gr iction Rate (NRR). Population Projection and Migration	Gen Gen	s - Fo Jses bridg 12 eral l asure Repro	brce of L ged 1 hour Ferti ment oduc	of fe fe ife s ity o tion
Unit:3Stationary and SMortality. LifeTables - Maketable.Unit:4Measurements ofRate (GFR) - SPopulation GrowRate (GRR) andUnit:5Population estir	Stable populat Tables: Assu hams and Go of Fertility: N Specific Fert wth: Crude r Net Reprodu P nation and F	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a compertz Curve - National and UN Model life table Measurement of Fertility Nuptiality and Fertility - Crude Birth Rate (CBR) - tility Rate (SFR) and Total Fertility Rate (TFR). rates of natural increase - Pearl's Vital Index - Grates inction Rate (NRR). Population Projection and Migration Projection – Basic concepts – Growth and Change	Gen Gen ross e – 1	s - Fo Jses bridg eral l asure Repro	hour prce of L ged 1 hour Ferti ment oduc	of fe fe ife s ity o tion s
Unit:3Stationary and SMortality. LifeTables - Maketable.Unit:4Measurements ofRate (GFR) - SPopulation GrowRate (GRR) andUnit:5Population estirProjection -Exp	Stable populat Tables: Assu hams and Go of Fertility: N Specific Fert wth: Crude r Net Reprodu P nation and F onential and	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a compertz Curve - National and UN Model life table Measurement of Fertility Nuptiality and Fertility - Crude Birth Rate (CBR) - tility Rate (SFR) and Total Fertility Rate (TFR). rates of natural increase - Pearl's Vital Index - Gr iction Rate (NRR). Population Projection and Migration	Gen Gen Meaross I e – I Mig	s - Fo Jses bridg eral l asure Repro	hour prce of L ged 1 hour Ferti ment oduc	of fe fe ife ity of tion
Unit:3 Stationary and S Mortality. Life Tables - Make table. Unit:4 Measurements of Rate (GFR) - S Population Grow Rate (GRR) and Unit:5 Population estir Projection –Exp migration, Intern Unit:6	Stable populat Tables: Assu hams and Go of Fertility: N Specific Fert wth: Crude r Net Reprodu P nation and F onential and national and F	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a compertz Curve - National and UN Model life table Measurement of Fertility Nuptiality and Fertility - Crude Birth Rate (CBR) - tility Rate (SFR) and Total Fertility Rate (TFR). ates of natural increase - Pearl's Vital Index - Gruction Rate (NRR). Population Projection and Migration Projection – Basic concepts – Growth and Change Logistic curve. Migration: Internal and International Postcensal estimates - Decennial population Census i Contemporary Issues	Gen Gen Meaross I e – I Mig	s - Fo Jses bridg eral l asure Repro 12 Methoration lia.	hour prce of L ged 1 hour Ferti ment oduc	of fe fe ife ity o tion rs of et
Unit:3 Stationary and S Mortality. Life Tables - Make table. Unit:4 Measurements of Rate (GFR) - S Population Grow Rate (GRR) and Unit:5 Population estir Projection –Exp migration, Intern	Stable populat Tables: Assu hams and Go of Fertility: N Specific Fert wth: Crude r Net Reprodu P nation and F onential and national and F	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a compertz Curve - National and UN Model life table Measurement of Fertility Nuptiality and Fertility - Crude Birth Rate (CBR) - tility Rate (SFR) and Total Fertility Rate (TFR). ates of natural increase - Pearl's Vital Index - Gruction Rate (NRR). Population Projection and Migration Projection – Basic concepts – Growth and Change Logistic curve. Migration: Internal and International Postcensal estimates - Decennial population Census i Contemporary Issues	e – I Mig in Inc	s - Fo Jses o bridg eral l asure Repro 12 Methoria. 2	hour prce of L ged 1 hour Ferti ment oduc hour ods 1 - N	of ife ife ify otion rs of et
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Unit:3 Stationary and S Mortality. Life Tables - Make table. Unit:4 Measurements of Rate (GFR) - S Population Grow Rate (GRR) and Unit:5 Population estir Projection – Exp migration, Intern Unit:6 Expert lectures, Books for Stud 1 Goon, A. M Ninth Editio 2 Gupta, S. C. Sons Private 3 Mishra, B. I Ltd., New D	Stable populat Tables: Assu hams and Go of Fertility: N Specific Fert wth: Crude r Net Reprodu P nation and F onential and national and H online semin online semin y 1., Gupta, M n, World Pre ., and Kapoor Limited, Ne D. (1980). An yelhi.	Life Tables tion - Lotka and Dublin's Model - Central Mortality imption, description, construction of Life Tables a compertz Curve - National and UN Model life table Measurement of Fertility Nuptiality and Fertility - Crude Birth Rate (CBR) - tility Rate (SFR) and Total Fertility Rate (TFR). ates of natural increase - Pearl's Vital Index - Gruction Rate (NRR). Population Projection and Migration Projection – Basic concepts – Growth and Change Logistic curve. Migration: Internal and International Postcensal estimates - Decennial population Census i Contemporary Issues ars – webinars Total Lecture ho . K., and Dasgupta, B. (2008). Fundamentals of S ss, India. r, V. K. (2016). Fundamentals of Applied Statistics, w Delhi. Introduction to the Study of Population, South Asia	Gen Gen Mea ross Mea ross Mea ross Mea ross Statis	s - Fo Jses o bridg eral l asure Repro 12 Methoration lia. 2 62 tics, tan C	hour Ferti ment oduc hour oduc hour hour vol. hour hour hour hour coluct hour hour coluct hour hour coluct hour coluct hour hour coluct hour coluct hour coluct hour coluct hour coluct hour coluct hour coluct hour coluct hour coluct hour coluct hour coluct hour coluct hour coluct hour hour coluct hour hour hour hour coluct hour hou	rs ity of ife ife ife ife ife ife ife if
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2 Biswas, S. (1988). Stochastic Processes in Demography & Application, Wiley Eastern Ltd., India

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1 https://nptel.ac.in/courses/109/104/109104045/

2 https://swayam.gov.in/nd1_noc19_hs39/preview

3 https://nptel.ac.in/courses/109/104/109104150/

Course Designed By: Dr. V. Kaviyarasu

Mappi	Mapping with Programme Outcomes												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	Μ	М	L	S	М	S	Μ	L	L			
CO2	S	Μ	Μ	Μ	S	М	S	Μ	Μ	М			
CO3	S	Μ	Μ	Μ	S	М	S	Μ	Μ	М			
CO4	S	Μ	Μ	L	S	М	S	Μ	L	L			
CO5	S	Μ	Μ	L	S	М	S	Μ	L	L			

Ele	urse Code 21S43E_ ctive	TITLE OF THE COURSELApplied Regression Analysis4Fundamentals of Linear Regression, CorrelationSylla	T P C 1 - 4 bus
Pre	-requisite	and their Properties Versi	
	urse Objectives		
1 he 1. 2. 3.	Impart application of 1	course are to: s of regression model building. regression models in various domains. ogy to test assumptions and conditions involved in regression	on models
	pected Course Outcom	tion of the course, student will be able to:	
1	Identify mature of reg		K1,K2
2		non-linear regression models	K1,K2 K2,K3
3	Test model assumption		K3,K4
4	=	est statistic and carryout tests of significance	K3.K5
5	Build logistic regress	ion and generalized linear models	K2,K6
K	I - Remember; K2 - Un	derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – G	Create
T T 1			101
Uni		imple Regression Models and Properties with one independent variable, assumptions, estimation of	12 hours
star pre	idard error of estimator diction. Testing of h	r, testing the significance of regression coefficients, stand ypotheses about parallelism, equality of intercepts, ice of independent variable.	lard error of
hon X. I	gnostic checks and co noscedasticity, lack of t Inverse regression.	Tests for Assumptions rrection: graphical techniques, tests for normality, uncor fit, modifications like polynomial regression, transformatio	ons on Y or
Uni		ultiple Regression Models and Properties	12 hours
esti wit	mation spaces. Variance	lard Gauss Markov Setup. Least square (LS) estimation ce - Covariance of LS estimators. Estimation of error va ons. LS estimation with restriction on parameters. S etric functions.	riance, case
line des	n-linear regression: Lin arity initial estimates, cent, Marquardt's meth	Non-linear Regression Models nearization transforms, their use & limitations, examinati iterative procedures for NLS grid search, Newton-Raphs nods. Logistic Regression: Logic transform, ML estimation test, score test, test for overall regression.	son, steepest
Uni	it:5	Logistic Regression and GLM	12 hours
Mu wit	ltiple logistic regressio h categorical data ana	ns, forward, backward method. Interpretation of paramet lysis. Generalized Linear model: link functions such , inverse Gaussian and gamma.	ters relation
Uni	it:6	Contemporary Issues	2 hours
Exp	pert lectures, online sem		
D	lea for Stand-	Total Lecture hours	62 hours
1	bks for Study Draper, N. R. and Smi and Sons.	th, H. (1998). Applied Regression Analysis, Third Edition	, John Wiley
2	•	eck, E. A., and Vining, G. G. (2012). Introduction to Linea , John Wiley & Sons, NY.	r Regression
Ref	erence Books		
1	Third Edition, John Wi	•	
23		, C.J. (2003). Nonlinear Regression, John Wiley & Sons, N W., and Kutner, M.H. (1989). Applied Linear Statist	

Second Edition, Irwin, IL.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1 https://ncss-wpengine.netdna-ssl.com/wp-content/themes/ncss/pdf/Procedures/NCSS/ Multiple_Regression.pdf

- 2 https://nptel.ac.in/courses/111/104/111104098/
- 3 http://people.sabanciuniv.edu/berrin/cs512/lectures/10x-logistic-regression-new.pdf
- 4 https://nhorton.people.amherst.edu/ips9/IPS_09_Ch14.pdf
- 5 https://online.stat.psu.edu/stat504/node/149/
- 6 https://online.stat.psu.edu/stat504/node/171/

Course Designed By: Dr. R. Vijayaraghavan

Mappi	Mapping with Programme Outcomes												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	М	S	М	Μ	S	S	М	М			
CO2	S	S	Μ	S	Μ	Μ	S	S	Μ	М			
CO3	S	S	Μ	S	Μ	L	S	S	Μ	М			
CO4	S	S	Μ	S	Μ	L	S	S	Μ	М			
CO5	S	S	Μ	S	Μ	L	S	S	Μ	М			

	le 21S2P1	TITLE OF THE COURSE	L	Т	P	С
Core: Prac	ical	Statistical Practical I	-	1	4	4
Pre-requis		Knowledge in Statistical Methods	Sylla Vers		202	4-25
Course Ob	*	• .				
	v	is course are to:				
-	-	n statistical computation using real data sets				
	0	apply theory into practice ry through practical oriented training				
	Course Outcon					
-		of the course, student will be able to:				
	1	mples and study the properties of estimators			K1 -	K4
		statistical measures			K2 -	
-		cance tests based on multivariate data			K2 -	
2	U	eters of the population based on random samples			K1 -	
	ruct process co				K1 -	
	1	nderstand; K3 - Apply; K4 - Analyze; K5 - Evaluate;	K6 _			110
			110 -			
Unit: 1	1 0 1	Sampling Methods	,		hou	
-		g – Stratified Random Sampling – Systematic Sampli mpling – Ratio and Regression estimates.	ing –	Sing	le-sta	ige
Unit: 2	age Cluster Sa	Multivariate Analysis		15	hou	rc
	likelihood esti	mation of population mean vector and covariance ma	atrix			
		alanobis D^2 Statistics - Principal component analysis				
		Discriminant Function.			J	
Unit: 3		Statistical Inference			hou	
		ods of Maximum Likelihood, Moments, Minimum Chi	-Squ	are -	Inter	val
		ance, ratio of variances and proportions.		15		
Unit: 4		istical Quality Control and Reliability Theory		12	b hou	
		range traction detective number of detective num	nher		fects	
Single, dou		, range, fraction defective, number of defective, num ntial sampling plans – Problems on reliability.	nber		efects	
Single, dou Unit: 5		ntial sampling plans – Problems on reliability.	nber	of de		5 –
Unit: 5	ble and sequer	•	nber	of de	efects 2 hou	5 –
Unit: 5	ble and sequer	ntial sampling plans – Problems on reliability. Contemporary Issues		of de		5 – I rs
Unit: 5 Expert lect	ble and sequer	ntial sampling plans – Problems on reliability. Contemporary Issues minars – webinars Total lecture h		of de	2 hou	5 – I rs
Unit: 5 Expert lect Text and I 1 Singh	ble and sequer ares, online ser Reference Boo D., and Chowo	ntial sampling plans – Problems on reliability. Contemporary Issues minars – webinars Total lecture h ks dhary, F. S. (2018). Theory and Analysis of Sample Su	ours	of de 2 62	2 hou 2 hou	s – Irs rs
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Unit: 5 Expert lect Text and I 1 Singh Age Ir 2 Johnso Editio 3 Goon, World 4 Montg India, Related O 1 <u>https://</u>	ble and sequer ares, online ser Reference Boo D., and Chowc ternational Pri on, R. A., and V n, Pearson New A. M., Gupta, Press, Calcutta omery, D. C. (New Delhi. hline Contents (nptel.ac.in/cor www.nptelvide	ntial sampling plans – Problems on reliability. Contemporary Issues minars – webinars Total lecture h ks dhary, F. S. (2018). Theory and Analysis of Sample So vate Ltd., New Delhi. Wichern, D. W. (2013). Applied Multivariate Statistica v International Edition. M. K., and Dasgupta, B. (1989). An Outline of Statist a. (2009). Introduction to Statistical Quality Control, Si s [MOOC, SWAYAM, NPTEL, Websites etc.] ntent/syllabus_pdf/111104073.pdf cos.in/2012/12/applied-multivariate-analysis.html	ours urvey 11 Ana tical 7	of de 62 Desi alysis	2 hou 2 hou .gn, N Sixt	nrs rs New h
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The maximum marks for continuous internal assessment and end semester University examination for Statistics Practical I shall be fixed as 40 and 60, respectively. The continuous internal assessment shall involve test and record work. The question paper at the end semester examination shall consist of four questions with internal choice. A candidate shall attend all the four questions, each of which shall carry 15 marks. The examination shall be conducted at the end of Semester II. Problems relating to the above topics which are covered in Semester I and Semester II shall form the basis for setting the question paper.

Mappi	Mapping with Programme Outcomes													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10				
CO1	S	S	L	S	S	S	S	S	М	М				
CO2	S	S	L	S	S	S	S	S	М	Μ				
CO3	S	S	L	S	S	S	S	S	М	М				
CO4	S	S	L	S	S	S	S	S	М	М				
CO5	S	S	L	S	S	S	S	S	М	М				

Course code 21S3P2	TITLE OF THE COURSE L	Т	P	C
Core: Practical	Statistical Software Practical using SPSS and MINITAB	1	4	4
Pre-requisite		abus sion	202	4-25
Course Objectives				
The main objectives of thi				
	ning in statistical computation using software			
	handling statistical data for analysis			
	familiarize with the application of statistical tools			
Expected Course Outcom				
	ion of the course, student will be able to:		17.1	17.6
1 Use the software for	**		K1-	
	hs, charts and diagrams		K1-	
3 Compute statistical n	neasures using software		K1-	K6
4 Perform statistical da	ata analysis		K1-	K6
K1 - Remember; K2 - Uno	derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – C	Create		
	otive Statistics and Generating Random Samples		hou	
	graphical representation of data and descriptive statistic			
Calculation of probabiliti	ies under various distributions and generating random s	sampl	es f	rom
probability distributions				
Unit: 2RegressionCorrelation and regression	Analysis, Interval Estimation and Parametric Tests a: Simple, partial and multiple correlation coefficients, simple fitting, time series and forecasting models. Confidence	ple lir		and
Unit: 2RegressionCorrelation and regressionmultiple regression, curvemean, variance and propertaitistics.	n: Simple, partial and multiple correlation coefficients, simple fitting, time series and forecasting models. Confidence ortions, tests of significance based on normal, t, chi-squ	ple lin inte iare,	near rvals Far	and for id Z
Unit: 2RegressionCorrelation and regressionmultiple regression, curvemean, variance and propertiesstatistics.Unit: 3Non-	n: Simple, partial and multiple correlation coefficients, simple fitting, time series and forecasting models. Confidence ortions, tests of significance based on normal, t, chi-squ- parametric Tests and Design of Experiments	ple lin e inte are, 15	near rvals Far hou	and for id Z rs
Unit: 2RegressionCorrelation and regressionmultiple regression, curvemean, variance and propostatistics.Unit: 3Non-Run, sign and median test	n: Simple, partial and multiple correlation coefficients, simple fitting, time series and forecasting models. Confidence ortions, tests of significance based on normal, t, chi-squ- parametric Tests and Design of Experiments ts, test based on Kruskal – Wallis statistics, Freedman's t	ple lin e inte are, 15	near rvals Far hou	and for id Z rs
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Unit: 2RegressionCorrelation and regressionmultiple regression, curvemean, variance and propertiesstatistics.Unit: 3Non-Run, sign and median tesANOVA-two way ANOVUnit: 4MultivPrincipal component analyquality control charts – D	n: Simple, partial and multiple correlation coefficients, simple, fitting, time series and forecasting models. Confidence ortions, tests of significance based on normal, t, chi-sque- parametric Tests and Design of Experiments ts, test based on Kruskal – Wallis statistics, Freedman's t A-factorial designs– Multiple comparison tests variate Analysis and Statistical Quality Control ysis, factor analysis, cluster analysis and discriminant analysis Determination of parameters for constructing basic control	ple lin e inter iare, 15 est. C 15 sis. St	near rvals F an hou Dne v hou tatist	and for d Z rs way rs ical
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The maximum marks for continuous internal assessment and end semester University examination for Statistical Software Practical using SPSS and MINITAB shall be fixed as 40 and 60, respectively. The continuous internal assessment shall involve test and record work. The question paper at the end semester examination shall consist of the four units with internal choice A candidate shall attend all the four questions, each of which shall carry 15 marks. The examination shall be conducted at the end of Semester II. Problems relating to the topics taught using statistical software namely SPSS and MINITAB shall form the basis for setting the question paper.

Mappi	Mapping with Programme Outcomes													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10				
CO1	S	S	L	S	S	М	S	S	М	М				
CO2	S	S	L	S	S	М	S	S	М	М				
CO3	S	S	L	S	S	М	S	S	Μ	М				
CO4	S	S	L	S	S	М	S	S	М	М				
CO5	S	S	L	S	S	М	S	S	М	М				

Course code 21S4P3	TITLE OF THE COURSE	L	Τ	P	C
Core: Practical	Statistics Practical II	-	1	4	4
Pre-requisite	Knowledge in Statistical Methods		abus sion	2024	1-25
Course Objectives					
The main objectives of the	is course are to:				
1. Impart knowledge or	n statistical computation using real data sets				
	apply theory into practice				
3. Understand the theor	ry through practical oriented training				
Expected Course Outcon					
*	n of the course, the student will be able to:				
1 Attempt to classify t	the sample space as acceptance and rejection regions		K	[1 - I	ζ4
2 Compute test function	ons for testing the hypotheses		K	12 - I	ζ4
3 Carry out analysis of	f experimental designs		K	[2 - I	ζ4
4 Solve the manageria	al decision making problem		K	(1 - I	ζ3
5 Apply the theoretica	al knowledge in statistics to the problems in life science	es	K	[1 - I	Κ6
K1 - Remember; K2 - U	Inderstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; I	K6 – (Create	e	
	Statistical inference				
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The maximum marks for continuous internal assessment and end semester University examination for Statistics Practical II shall be fixed as 40 and 60, respectively. The continuous internal assessment shall involve test and record work. The question paper at the end semester examination shall consist of four questions with internal choice. A candidate shall attend all the four questions, each of which shall carry 15 marks. The examination shall be conducted at the end of Semester IV. Problems relating to the above topics which are covered in Semester III shall form the basis for setting the question paper.

Mappi	Mapping with Programme Outcomes												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	L	S	S	S	S	S	М	S			
CO2	S	S	L	S	S	S	S	S	Μ	S			
CO3	S	S	L	S	S	S	S	S	М	S			
CO4	S	S	L	S	S	S	S	S	М	S			
CO5	S	S	L	S	S	S	S	S	Μ	S			

	TITLE OF THE COURSE	L	Т	P	С
Core: Practical	Statistical Software Practical using R	-	1	4	4
Pre-requisite		Sylla Vers		202	4-2
Course Objectives					
The main objectives of thi	s course are to:				
1. Perform basic operati	ions and functions in R Programming				
	tistical methods using build-in functions				
A	ogram for mathematical and statistical problems				
Expected Course Outcon	nes ion of the course, student will be able to:				
1				V	2
-	erations of R Language			K	
	s, Charts and diagrams for all kinds of statistical data			K	
	est procedures using R software			K	
	codes for the methods in Statistical quality control			K	
1	rogramming codes for multivariate analysis		a	K	3
K1 - Remember; K2 - Ur	nderstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K	(6 – (Create	e	
Unit: 1 B	Desis On susting and Descripting Statistics		15	ham	
	Basic Operations and Descriptive Statistics nd matrices, Creating and manipulating data frame	. (hou	
	escriptive Statistics, Correlation coefficient – Pearson				
	ple linear and multiple linear regressions	5, 5	peum	inun	
Unit: 2	Parametric Tests		14	hou	rs
	lependent t test, F test, Chi- Square test, One way and tw	wo w	ay A	NOV	/A
Unit: 3	Non-Parametric Tests			hou	
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chi square test					
chi square test Unit: 4 Statist	cical Quality Control and Multivariate Analysis		17	hou	rs
chi square test Unit: 4 Statist X bar Chart and R – Cha	ical Quality Control and Multivariate Analysis art, X bar Chart and S – Chart, C Chart, P Chart, np		17	hou	rs
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The maximum marks for continuous internal assessment and end semester University examination for Statistical Software Practical using R shall be fixed as 40 and 60, respectively. The continuous internal assessment shall involve test and record work. The question paper at the end semester examination shall consist of four questions with internal choice. A candidate shall attend all the four questions, each of which shall carry 15 marks. The examination shall be conducted at the end of Semester IV. The aim of this paper is to utilize theoretical knowledge gained and to develop computational and technical skills for real life applications emphasizing the importance of R programming. Problems relating to the topics specified in Units I to IV shall form the basis for setting the question paper:

Mappi	Mapping with Programme Outcomes												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	L	S	S	S	S	S	М	М			
CO2	S	S	L	S	S	S	S	S	М	М			
CO3	S	S	L	S	S	S	S	S	М	М			
CO4	S	S	L	S	S	S	S	S	М	М			
CO5	S	S	L	S	S	S	S	S	М	М			

Course code	21S4PV	TITLE OF THE COURSE	L	Т	Р	С
Core		Project and Viva - Voce	4	1	-	-
Pre-requisite		Knowledge in statistical theory methods	Sylla Vers		2024	1-25

All the admitted candidates shall have to carry out a project/dissertation work during the fourth semester under the supervision of the faculty of the Department of Statistics in the University. Candidates shall have to submit three copies of the report of the project/dissertation work at the end of the fourth semester at least two weeks before the last working day and shall have to appear for a viva-voce examination. The report shall be evaluated and viva-voce examination shall be conducted jointly by an External Examiner and the Project Guide. The maximum marks for the project/dissertation report and viva – voce examination shall be fixed as 100, which is split with the following components:

Internal Assessment Marks by the Project/Dissertation Guide	:	25 marks
Evaluation of Project/Dissertation Report jointly by the External Examiner and the Guide	:	50 marks
Conduct of Viva-Voce Examination jointly by the External Examiner and the Guide	:	25 marks

а <i>и</i>		TITLE OF THE COURSE L	T	P	C
Supportive		Descriptive Statistics 2 Series Series	<u> 1</u>	-	2
Pre-requisite			labus rsion	202	4-2
Course Object The main object		course are to:			
Ŭ					
	the basics of	statistics mpute statistical measures for analysing data			
	0	y and applications of probability			
Expected Cour					
On the success	sful completi	ion of the course, student will be able to:			
1 Understar	nd the theory	and applications of basic statistics]	K1-K	6
2 Compute	statistical m	easures for decision making]	K1-K	6
3 Solve pro	blems on ba	sic probability]	К2-К	6
4 Perform c	orrelation ar	nd regression analysis]	K1-K	6
5 Make inte	erpretations of	of results from the derived results]	K1-K	6
K1 - Rememb	er; K2 - Unc	lerstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 -	Creat	e	
Unit:1		Statistics and Statistical Data		hou	
		nitations, uses and Misuses of statistics. Classification ar	d Tab	ulatio	on
of data, Diagrai	nmatic and g	graphic representation of data.			
Unit:2		Basic Statistical Measures	6	hou	rs
	ntral tendenc	cy–Measures of Dispersion-relative measures of dispersi			
and Kurtosis-Lo					
Unit:3		Basic Notions of Probability		hou	
		ce-Statistical probability Axiomatic approach to probab	\1 1fv_F	inite	117
additive and a	ountable of	ditive probability functions Addition and multiplication			
		ditive probability functions-Addition and multiplication were theorem-Simple problems			
		ditive probability functions-Addition and multiplication and multiplic			
	bability-Bay		on the		IS-
Conditional pro Unit:4 Random varia	bability-Bay Ran bles-Discret	yes theorem-Simple problems. dom Variables and Probability Functions re and continuous random variables-Distribution f	on the 6 unctio	orem hou	rs nd
Conditional pro Unit:4 Random varia probability den	bability-Bay Ran bles-Discret sity function	dom Variables and Probability Functions and continuous random variables-Distribution for a random variable-Expectation of a random variable	on the 6 unctio Addit	orem hou n an ion a	rs nd nd
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Mapping with Programme Outcomes													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	М	L	М	М	М	М	L	L			
CO2	S	S	М	L	М	М	М	М	L	L			
CO3	S	S	М	L	М	М	М	М	L	L			
CO4	S	S	М	L	М	М	М	М	L	L			
CO5	S	S	М	L	М	М	М	М	L	L			

Course Code	TITLE OF THE COURSE I	T	P	С			
Supportive	Statistical Methods for Biologists 2		-	2			
Pre-requisite							
Course Objectives The main objectives of	this course are to:						
5							
	o compute statistical measures for analysing data						
3. Instruct the applica	ations of statistical methods for biological problems						
Expected Course Outo	comes						
On the successful com	pletion of the course, student will be able to:						
1 Understand the th	neory and applications of basic statistics	ŀ	K1-K	6			
1	al measures for decision making		K2-K	-			
	neses and perform statistical analysis for biological problems		K1-K				
	of variance for experimental designs		K1-K				
	ons of results from the derived results		K1-K	6			
K1 - Remember; K2 -	Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 -	– Create	e				
Unit:1	Statistical Data, Classification and Tabulation	6	hou	rs			
	and Clinical experiments of data-Classification and tabul						
	tation of data- Histogram and frequency curves						
Unit:2	Basic Measures of Statistics		hou				
Measures of Central ter	ndency-Mean, Median, Mode, Geometric mean, Harmonic M	Iean- M	leasu	res			
of deviation – Range, J and Kurtosis.	Mean deviation, Quartile and standard deviation - Measure	es of Sk	tewn	ess			
and Kurtosis.							
Unit:3	Correlation and Regression		hou				
Correlation : Rank Co equations for biological	orrelation – Multiple and Partial Correlation – Regression l problems.	ı – Reş	gressi	ion			
Unit:4	Basic Sampling Methods	6	hou	rs			
	pling – Simple random sample – Stratified sample – system						
cluster sample. Test of	significance based on large sample – Mean, Variance and Pro	oportion	is.				
Linite5 Ano	lugic of Vaniance and Pagie Experimental Degigns	6	how	10			
	alysis of Variance and Basic Experimental Designs One way and Two way classifications – Completely Randon		hou lock				
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Analysis of variance – Randomized Block desi Unit:6	One way and Two way classifications – Completely Randor ign and Latin Square Design (Simple problems based on biol Contemporary Issues	mized b logical d	lock	s –			
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Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	М	L	М	М	М	М	М	S
CO2	S	S	М	L	М	М	М	М	М	S
CO3	S	S	Μ	L	М	М	М	М	М	S
CO4	S	S	Μ	L	М	М	М	М	М	S
CO5	S	S	Μ	L	М	М	М	М	М	S

Course Code Supportive	TITLE OF THE COURSE Elements of Operations Research	L T 2 1	P C - 2
Pre-requisite	Basic understanding of computations	Syllabus Version	2024-25
Course Objectives		· cr sion	
The main objectives of this	course are to:		
2. Inculcate knowledge i	rial decision making methods n formulating optimization problems ing optimization problems		
Expected Course Outcom	tion of the course, student will be able to:		
1	y of elements of operations research		K2
	cchniques for solving decision making problems		K2
3 Formulate the optimized		ŀ	K1-K6,
1	agement through problems		K2-K6
	agram and perform network analysis		K2-K6
	derstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K 6		
, -			
Unit:1	Linear Programming		hours
	em – Graphical Method – General Problem of Linear and Phase II Problems – Transportation and Assignmer		
	Replacement Theoryy acement of Items that deteriorate – Replacement of d group replacement policy.		hours hat fail
Unit:3	Sequencing Problems		hours
machines – Processing 'n'	cessing 'n' jobs through 2 machines – Processing 'n jobs through 'm' machines.	jobs th	
Unit:4	Network Analysis		hours
•	ction to Network – Determination and flow for Critica Techniques and its differences.	al Path M	ethod –
Unit:5	Basics of Inventory Theory	6	hours
Inventory Theory – Meani with and without shortages	ing of Inventory - Factors involved in Inventory - E	conomic	Models
Unit:6ContemporaryExpert lectures, online sem		2	hours
	Total Lecture hou	rs 32	hours
Books for Study1Kanti Swarup, Gupta, Edition, Sultan Chand de	P. K., and Man Mohan. (2017). Operations Resea	arch, Nir	neteenth
2 Sharma, S. D. (2017). Ram Nath and Co, Mee	Operations Research: Theory, Methods and Applicationerut.	ons, Keda	ar Nath,
Reference Books			
1 Taha, H. A. (1982). Op Co., Inc., London.	perations Research: An Introduction, 3rd Edition, McM	/lillan Pu	blishing
Related Online Contents	[MOOC, SWAYAM, NPTEL, Websites etc.]		
	ses/111/107/111107128/		
	ses/112/106/112106134/		
	vayam2.ac.in/cec20_ma10/preview		
Course designed by: Dr. I	K. Pradeepa Veerakumari		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	М	L	М	М	М	L	М	М
CO2	S	S	М	L	М	М	М	L	М	М
CO3	S	S	М	L	М	М	М	L	М	М
CO4	S	S	М	L	М	М	М	L	М	М
CO5	S	S	М	L	М	М	М	L	М	М