THIRUVALLUVAR UNIVERSITY

Serkkadu

Vellore – 632115

Degree of Bachelor of Science

CHOICE BASED CREDIT SYSTEM

Syllabus for

B.Sc., STATISTICS
(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to Thiruvalluvar University from 2023-2024 onwards)

❖ SCHEME OF EXAMINATIONS

The scheme of examination for different semesters shall be as follows:Course structure under OBE (Semester-wise Details)

Branch: STATISTICS

(For the students admitted from the Academic year 2023-2024 onwards)

PART	COURSE	TITLE OF THE PAPER	HOURS	CREDIT	MARKS		TOTAL
					CIA	UE	
SEMESTER – II							
I	Language	Tamil – II	6	3	25	75	100
II	Language	English – II	6	3	25	75	100
III	Core Theory – III	Matrix and Linear Algebra	4	4	25	75	100
	Core Theory - IV	Distribution Theory	4	4	25	75	100
	Core Practical-1	Practical – I Data Analysis Using MS – Excel)	2	2	25	75	100
	Elective - II	Real Analysis	4	3	25	75	100
	** SEC – 2	Basic Computers(MS Excel)	2	2	25	75	100
IV	** SEC – 3	Quantitative Aptitude	2	2	25	75	100
NO. OF COURSES – 8		**TOTAL**	**30**	**23**	**200**	**600**	**800**

SEMESTER-II

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Matrix and Linear Algebra</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Core III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2"></td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">--</td><td>--</td><td colspan="2">4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic vector and matrix theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:
1. To study the basic operations of transpose and inverse of matrices
. 2. To know the structure of orthogonal and unitary matrices
3. To learn the invariance properties of ranks
4. To know and to apply the concepts of vector space and matrix polynomials.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I Matrices-Transpose-Conjugate transpose- Reversal law for the transpose and conjugate transpose. Ad joint of a matrix, Inverse of a matrix, Singular and Non -Singular matrices,</td></tr>
<tr><td colspan="6">Unit II Reversal law for the inverse of product of two matrices. Commutatively of inverse and transpose of matrix, Commutatively of inverse and conjugate transpose of matrix.</td></tr>
<tr><td colspan="6">Unit III Rank of a matrix, Echelon form, Rank of transpose, Elementary transformations, Elementary matrices, Invariance of rank through elementary transformations, Reduction to Normal form, Equivalent matrices.</td></tr>
<tr><td colspan="6">Unit-IV Vector space – Linear Dependence - Basis of a vector space –Sub-space- Properties of Linearly Independent and dependent system, Row and Column spaces, Equality of Row and Column ranks, Rank of Sum and Product of matrices</td></tr>
<tr><td colspan="6">Unit-V Matrix polynomials, Characteristic roots and vectors, Relation between characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity, Clayey- Hamilton theorem.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Vasishtha.A.R (1972) : Matrices, KrishnaprakashanMandir, Meerut.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. Shanthinarayan, (2012) : A Text Book of Matrices, S.Chand& Co, New Delhi
2. M.L.Khanna (2009), Matrices, Jai PrakashNath& Co</td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="6">e-books, tutorials on MOOC/SWAYAM courses on the subject
https://samples.jbpub.com/9781556229114/chapter7.pdf</td></tr>
</table>

	https://www.vedantu.com/maths/matrix-rank https://textbooks.math.gatech.edu/ila/characteristic-polynomial.html https://www.aitude.com/explain-echelon-form-of-a-matrix/

Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

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

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

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

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

Level of Correlation between PSO's and CO's

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Distribution Theory</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Core IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2"></td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">--</td><td>--</td><td colspan="2">4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Calculus</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:
1.To learn discrete distributions
2. To learn continuous distributions
3. to understand Distributions generated from mathematical functions
4. learn normal distribution and its properties
5. understand about sampling distributions</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I
Binomial distribution – moments, recurrence relation, mean deviation, mode, moment generating function, characteristic function, cumulants. Fitting of Binomial Distribution. Poisson distribution – moments, mode, recurrence relation, moment generating function, characteristic function, cumulants. Fitting of Poisson distribution. Negative binomial distribution – m.g.f., cumulants.</td></tr>
<tr><td colspan="6">Unit II Geometric distribution – lack of memory, moments, m.g.f.- Hyper geometric distribution – mean, variance, approximation to Binomial, recurrence relation – Multinomial distribution – m.g.f., mean and variance.</td></tr>
<tr><td colspan="6">Unit III Normal Distribution – chief characteristics of the normal distribution and normal probability curve, mean, median, mode, m.g.f. characteristic function, moments, points of inflexion, mean deviation, Area property -Importance of Normal Distribution.</td></tr>
<tr><td colspan="6">Unit-IV Exponential distribution – m.g.f., characteristic function, memory less property – Gamma distribution – m.g.f., cumulants and central moments, reproductive property – Beta distribution – First kind and second kind – constants.</td></tr>
<tr><td colspan="6">Unit-V Functions of Normal random variables leading to t, Chi-square and F-distributions (derivations, properties and interrelationship)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Gupta, S.C. Kapoor, V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi
2. Goon, A.M. Gupta M.K. and Das Gupta B (1977) An Outline of Statistical Theory, Vol I, 6/e, World Press, Calcutta.
3. Hogg, R.V. and Graig, A.T. (1978) : Introduction to Mathematical Statistics, A/e, Mc.Graw Hill Publishing Co.Inc., New York.
4.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. Mood, A.D. Graybill, F.A. and Boes, D.C (1974): Introduction to the Theory of Statistics, 3/e, Mc.Graw Hill, New York.</td></tr>
</table>

Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 identify discrete distributions appeared in real life situations
CLO-2 understand some continuous distributions and its applications
CLO-3 connection between some of the real values mathematical functions and its application in distribution theory
CLO-4 understand normal distribution and its properties
CLO-5 understand sampling distributions and its applications in real life
CLO-6 identify probability models in real data and estimate population parameters

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

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

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

Level of Correlation between PSO's and CO's

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Real Analysis</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">Elective – II (Discipline specific)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">-</td><td>--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Number theory and Arithmetic</td></tr>
<tr><td colspan="2">Objectives of theCourse</td><td colspan="7">The main objectives of this course are:
1. To study the basic operations of sets and functions
2. To know the structure of the real sequence and its convergence
3. To learn series and its convergence
4. To learn the limits, continuity and derivative of real valued functions
5. To know and to apply the Riemann integration</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">Unit I
Operations on sets, Functions, Real valued functions, Equivalence, Countability, Real Numbers, Cantor set, Least Upper Bounds, Greatest Lower Bound.</td></tr>
<tr><td colspan="7">Unit II Definition of Sequence, Subsequence, Limit of a sequence, Convergent and Divergent sequences, Oscillating sequence, Bounded and Monotone sequences, Operations on convergent sequences, Limit Infimum, Limit Supremum.</td></tr>
<tr><td colspan="7">Unit III Definition of Series, Convergent and Divergent series, series with nonnegative terms, alternating series, conditional convergence, absolute convergences and test for absolute convergence</td></tr>
<tr><td colspan="7">Unit-IV Limit of a function on the real line, Increasing and Decreasing functions, Continuous function, Derivatives, Derivative and continuity, Rolle’s Theorem, Mean value theorem, Taylor’s theorem</td></tr>
<tr><td colspan="7">Unit-V Concept of Riemann Integral, Upper and Lower sums, Upper integral and Lower Integral Riemann integrability, Necessary and Sufficient condition for Riemann integrable, Properties of Riemann integrals, Fundamental theorem</td></tr>
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<tr><td colspan="2">Reference Books</td><td colspan="7">1. Shanthi narayan, (2012) : Real Analysis, S.Chand& Co, New Delhi
2. Walter Rudin (2017), Principles of Mathematical Analysis, 3rd Edition, McGraw-Hill</td></tr>
</table>

Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject https://tutorial.math.lamar.edu/classes/calci/thelimit.aspx https://www.mathsisfun.com/calculus/derivatives-introduction.html https://www.math.ucdavis.edu/~hunter/m125b/ch1.pdf https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/single-variable-calculus/taylors-theorem/ http://www.ms.uky.edu/~droyster/courses/fall06/PDFs/Chapter06.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO-1 do basic operations of sets and understand set functions
CLO-2 understand sequence and its convergence
CLO-3 understand series and its convergence
CLO-4 identify real valued functions and its discontinuity
CLO-5 understand integration concepts
CLO-6 understand probability functions as set functions and get knowledge on discrete and continuous nature of it

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

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

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CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weight age	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Title of the Course		(Data Analysis Using MS – Excel)					
Paper Number		CORE PARACTICAL-1					
Category	Core	Year	I	Credits	2	Course Code	
		Semester	II				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		-		-		2	2

Objectives:

1. To enable the students to gain computer practical knowledge about the concepts of statistics.
2. To apply the measures of descriptive statistics and probability in real life situations using MSexcel
3. To provide practical knowledge in random variables, probability distributions, expectation,moment generating function, matrices, Rank of matrices.

Practical Exercises:

1. Computation of Measures of Central Tendency for discrete data using MS Excel (Mean,Median, Mode, Geometric Mean, Harmonic Mean)
2. Computation of Measures of Central Tendency for Continuous data using MS Excel (Mean,Median, Mode, Geometric Mean, Harmonic Mean)
3. Computation of Measures of dispersion for discrete data using MS Excel ()
4. Computation of Measures of dispersion for Continuous data using MS Excel ()
5. Graphical Presentation of data (Histogram, Frequency Polygon, Ogives) Using MS Excel.
6. Computation of Co-efficient of Skewness and Kurtosis – Karl Pearson‘s and Bowley‘s datausing MS Excel
7. Fitting of Binomial distribution – Direct Method using MS Excel.
8. Fitting of Poisson distribution – Direct Method using MS Excel.
9. Fitting of Exponential distribution – Direct Method using MS Excel.
10. Problems based on univariate probability distributions.
11. Problems based on probability.
12. Calculating Inverse matrix in Excel.
13. Calculating Transpose matrix in Excel.
14. Calculating Rank matrix in Excel.

Note:

Question Paper Setting:
5 questions are to be set without omitting any unit. All questions carry equal marks.Any 3 questions are to be answered in 3 hours duration out of 5.

Examinations Distribution of Marks

University Examinations (Computer Practical)	60
MarksCIA (Including Practical Record)	40
Marks	
Total	100 Marks