THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE
B.Sc. STATISTICS
DEGREE COURSE

(With effect from 2020 - 2021)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components / Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		SEMESTER I					CIA	Uni. Exam	Total
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2.	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3.	III	Core Theory	Paper-1	6	4	Descriptive Statistics	25	75	100
	III	Core Practical	Practical-1	4	0	Statistical Practical-I	0	0	0
4.	III	Allied -1	Paper-1	6	3	Mathematics-I	25	75	100
5.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
6.	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		**36**	**20**		**150**	**450**	**600**
		SEMESTER II					CIA	Uni. Exam	Total
7.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
8.	II	English (CE)	Paper-2	6	4	**Communicative English II**	25	75	100
9.	III	Core Theory	Paper-2	5	4	Probability and Random Variables	25	75	100
10.	III	Core Practical	Practical-1	3	2	Statistical Practical-I	25	75	100
11.	III	Allied-1	Paper-2	6	5	Mathematics-II	25	75	100
12.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English II**	25	75	100
13.	IV	Value Education		2	2		25	75	100
14.	IV	Soft Skill		2	1		25	75	100
		Sem. Total		**36**	**25**		**200**	**600**	**800**
		SEMESTER III							
15.	I	Language	Paper-3	6	4	Tamil/Other Lang.	25	75	100
16.	II	English	Paper-3	6	4	English	25	75	100
17.	III	Core Theory	Paper-3	4	4	Distribution Theory	25	75	100
	III	Core Practical	Practical-2	2	-	Statistical Practical-II	-	-	-
18.	III	Allied	Paper-3	4	3	Numerical Methods	25	75	100
		Allied Practical	Practical-1	2	-	Numerical Methods and Programming in C	-	-	-
19.	IV	Skill Based Subject	Paper-1	3	2	Elementary Mathematics	25	75	100
20.	IV	Non-Major Elective	Paper-1	3	2	Statistical Methods-I	25	75	100
		Sem. Total		**30**	**19**		**150**	**450**	**600**

			SEMESTER IV							
21.	I	Language	Paper-4	6	4	Tamil/Other Lang.	25	75	100
22.	II	English	Paper-4	6	4	English	25	75	100
23.	III	Core Theory	Paper-4	4	4	Sampling Theory	25	75	100
24.	III	Core Practical	Practical-2	4	4	Statistical Practical-II	25	75	100
25.	III	Allied	Paper-4	3	3	Programming in C	25	75	100
26.	III	Allied Practical	Practical-1	3	2	Numerical Methods and Programming in C	25	75	100
27.	IV	Skill Based Subject	Practical-1	2	2	Statistical Data Analysis – I (Using R Programming)	25	75	100
28.	IV	Non-Major Elective	Paper-2	2	2	Statistical Methods-II	25	75	100
		Sem. Total		**30**	**25**		**200**	**600**	**800**
		SEMESTER V							
29.	III	Core Theory	Paper-5	6	4	Estimation Theory	25	75	100
30.	III	Core Theory	Paper-6	5	4	Statistical Quality Control	25	75	100
31.	III	Core Theory	Paper-7	5	4	Operations Research	25	75	100
32.	III	Core Theory	Paper-8	5	4	Applied Statistics	25	75	100
	III	Core Practical	Practical-3	3	-	Statistical Practical-III	-	-	-
33.	III	Internal Elective	Paper-1	4	3	(Choose 1 out of 2) A. Demography B. Database Management System	25	75	100
34.	IV	Skill Based Subject	Paper-2	2	2	Indian Official Statistics	25	75	100
		Sem. Total		**30**	**21**		**150**	**450**	**600**
		SEMESTER VI							
35.	III	Core Theory	Paper-9	5	4	Testing Statistical Hypotheses	25	75	100
36.	III	Core Theory	Paper-10	5	4	Design of Experiments	25	75	100
37.	III	Core Theory	Paper-11	5	4	Stochastic Processes	25	75	100
38.	III	Core Practical	Practical-3	4	4	Statistical Practical-III	25	75	100
39.	III	Compulsory Project	Paper-12	5	5	Group / Individual Project	25	75	100
40.	III	Internal Elective	Paper-2	3	3	(Choose 1 out of 2) A. Mathematical Economics B. Real Analysis	25	75	100
41.	III	Internal Elective	Paper-3	3	3	(Choose 1 out of 2) A. Statistical Genetics B. Actuarial Statistics	25	75	100
42.	IV	Skill based Subject	Practical-2	2	2	Statistical Data Analysis – II (Software based)	25	75	100
43.	V	Extension Activities			1		100	0	100
		Sem. Total		**30**	**30**		**300**	**600**	**900**
		Grand Total			**140**				**4300**

Part	Subject	Papers	Credit	Total Credits	Marks	Total Marks
Part I	Languages	4	4	16	100	400
Part II	Communicative English & English	4	4	16	100	400
Part III	Allied (Odd Semester)	2	3	6	100	200
	Allied (Even Semester)	2	5	10	100	200
	Allied Practical	1	2		100	100
	Electives	3	3	9	100	300
	Core	11	(3-5)	44	100	1100
	Core practical	3	(2-3)	10	100	300
	Professional English	2	3	6	100	200
	Compulsory Project (Group/Individual Project)	1	5	5	100	100
Part IV	Environmental Science	1	2	2	100	100
	Soft skill	1	1	1	100	100
	Value Education	1	2	2	100	100
	Lang. & Others /NME	2	2	4	100	200
	Skill Based	4	2	8	100	400
Part V	Extension Activities	1	1	1	100	100
	Total	**43**		**140**		**4300**

THIRUVALLUVAR UNIVERSITY
VELLORE - 632 115

B.Sc. STATISTICS

CBCS Pattern
(With effect from 2020-2021)

List of Core / Allied / Elective / Skill based / Non-Major Elective Subjects

Core Subjects

1. Descriptive Statistics

2. Probability and Random Variables

3. Statistical Practical - I

4. Distribution Theory

5. Sampling Theory

6. Statistical Practical - II

7. Estimation Theory

8. Statistical Quality Control

9. Operations Research

10. Applied Statistics

11. Testing Statistical Hypotheses

12. Design of Experiments

13. Stochastic Processes

14. Statistical Practical – III

15. Project with Viva-voce

Allied Subjects (for students of Statistics)

1. Mathematics - I

2. Mathematics – II

3. Numerical Methods

4. Programming in C

5. Allied Practical – I (Numerical Methods and Programming in C)

Core Elective Subjects (for students of Statistics)

1. Demography

2. Database Management System

3. Statistical Genetics

4. Mathematical Economics

5. Real Analysis

6. Actuarial Statistics

Skill based Subjects (for students of Statistics)

1. Elementary Mathematics

2. Statistical Data Analysis – I (Using R Programming)

3. Indian Official Statistics

4. Statistical Data Analysis – II (Software based)

Non-Major Elective Subjects (for students of other departments)

1. Statistical Methods – I

2. Statistical Methods - II

SEMESTER III
PAPER - 3
DISTRIBUTION THEORY

Course Objective(s)

To enable the students to understand the properties and applications of various probability functions.

UNIT - I

Discrete distributions: Binomial, Trinomial and Multinomial distributions and their properties - Poisson, Negative Binomial and Geometric distributions and their properties.

UNIT - II

Continuous distributions: Normal, Uniform, Exponential, Gamma and Beta distributions and their properties.

UNIT - III

Bivariate Normal Distribution and its properties. Partial and multiple correlation and regression - Concepts and simple problems.

UNIT - IV

Basic Central Limit Theorem (statement only) - Limiting distributions : Poisson distribution as a limiting case of Binomial - Poisson distribution as a limiting case of Negative Binomial distribution - Convergence of Binomial, Poisson, Gamma and Chi-square distribution to Normal distribution using Moment generating function.

UNIT - V

Order statistics - distribution of first, n^{th} and i^{th} order statistics, joint distribution of rth and s^{th} order statistics - distribution of median and range. Simple problems.

Text Books:
1. Gupta, S. C and Kapoor, V. K (2002), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Reference Books:
1. Hogg, R. V and Craig, A. T (2002), Introduction to Mathematical Statistics, Pearson Education Asia, India.

Course Outcomes
1. After studied unit-1, the student will be able to know various discrete distributions
2. After studied unit-2, the student will be able to know various continuous distributions
3. After studied unit-3, the student will be able to know random variables and its properties
4. After studied unit-4, the student will be able to know Limiting distribution and convergence concepts
5. After studied unit-5, the student will be able to know the concept of order statistics

ALLIED - 2

PAPER - 3

NUMERICAL METHODS

Course Objective(s)

To enable the students to establish mathematical functions using numerical data and to estimate functional relationship, interpolate and extrapolate the value of dependent variable, find maxima and minima using differentiation

UNIT - I

Finite differences - forward and backward differences, operators E and Δ, and their basic properties, Interpolation with equal intervals: Newton's forward and backward differences - simple problems.

UNIT - II

Interpolation with unequal intervals: Divided differences and their properties, Newton's divided differences formula and Lagrange's formula for interpolation-simple problems.

UNIT - III

Central difference interpolation formula - gauss forward and backward differences formulae - Stirling, Bessel's Everett's central difference formula.

UNIT - IV

Inverse interpolation - Lagrange's method - iteration of successive approximation method-simple problems. Numerical differentiation - Numerical differentiation upto 2nd order only - simple problems.

UNIT - V

Numerical intergration - Trapezoidal rule - simpson's $1/3^{rd}$ and $3/8^{th}$ rules - Weddle's rule - Euler's summation formula. Numerical method of solution of ordinary differential equations - Taylor's series method - Euler method and Runga Kutta upto second order - simple problems.

Text Books:
1. Numerical Methods by P.Kandasamy,K.Thilagavathy and K.Gunavathi,S.Chand, New Delhi.
2. Numerical methods in Science and Engineering by M.K. Venkataraman, National publishing house, Chennai.

Reference Books:

1. Calculus of finite differences and Numerical analysis by Gupta-Malik, Krishna Prakastan Mandir, Meerut.
2. Numerical methods in Science and Engineering by M.K. Venkataraman, National publishing house, Chennai.
3. Numerical Analysis by B.D. Gupta, Konark publishing.
4. Calculus of finite differences and Numerical Analysis by Saxena, S. Chand & Co.
5. Numerical mathematics by M.M.Ramasamy and Palaniappan.
6. Introductory Methods of Numerical Analysis by S.S.Sastry,Printice Hall of India,New Delhi.

Course Outcomes

1. After studied unit - 1, the student will be able to know how to solve problem of interpolation with equal intervals

2. After studied unit - 2, the student will be able to know how to solve problem of interpolation with unequal intervals

3. After studied unit - 3, the student will be able to know the concept of central differences formula and its usage of solving problem

4. After studied unit - 4, the student will be able to know how to solve problem with inverse interpolation

5. After studied unit - 5, the student will be able to know the concept of numerical differentiation and integration and its usage of real time applications

PAPER - 1

ELEMENTARY MATHEMATICS

Course Objective(s)

The course introduces students to the fundamental principles, concepts and knowledge in the areas of Differential and Integral Calculus.

UNIT - I

Jacobians - Total differential - maxima and minima functions of 2 and 3 independent variable, Lagrange's method (without proof), problems on these concepts.

UNIT - II

Polar coordinates - Angle between radius vector and tangent - Angle between two curves, Curvature, Radius of Curvature in Cartesian and Polar coordinates, p-r equation, Evolutes.

UNIT - III

Asymptotes: Methods (without proof) of finding asymptotes of rational algebraic curves with special cases.

UNIT - IV

Reduction formulae, Beta and Gamma Functions - Properties and Problems.

UNIT - V

Double Integrals - Change of order of Integration - Triple Integrals - Applications to Area, Surface Area and Volume.

Text Books:
1. S.Narayanan and T.K.Manicavachagom Pillay (2004) *Calculus.* S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.

Reference Books:
1. P.Kandasamy, K.Thilagavathy (2004), Mathematic for B.Sc. Vol.-I, II, III & IV, S.Chand & Company Ltd., New Delhi-55.
2. Shanti Narayan (2001) *Differential Calculus*. Shyamlal Charitable Trust, New Delhi.
3. Shanti Narayan (2001) *Integral Calculus.* S.Chand & Co. New Delhi.

4. S.Sudha (1998) *Calculus.* Emerald Publishers, Chennai.
5. G.B.Thomas and R.L.Finney. (1998) *Calculus and Analytic Geometry*, Addison Wesley (9th Edn.), Mass. (Indian Print)
6. P.R.Vittal. (2004) *Calculus*, Margham Publication, Chennai

Course Outcomes

1. After studied unit - 1, the student will be able to know basics of differential calculus
2. After studied unit - 2, the student will be able to know the various methods solving differential calculus
3. After studied unit - 3, the student will be able to know solving asymptote problems
4. After studied unit - 4, the student will be able to know solving problems using reduction formula
5. After studied unit - 5, the student will be able to know solving double integral problems

PAPER -1

STATISTICAL METHODS - I

Course Objective(s)

To enable students to learn basics of statistics and its applications

UNIT - I

Statistics - Definitions - limitation of statistics - collection of data - primary data - secondary data - Diagrammatic and Graphical representation of data.

UNIT - II

Descriptive Measures - Mean, Median, mode, standard deviation, skewness and kurtosis (ungrouped data only).

UNIT - III

Concept of sample and Population - Preparation of questionnaire and Pre-testing - Simple random, Stratified random and Systematic sampling techniques.

UNIT - IV

Study of relationship between variables: Concept of correlation - Karl Pearson and Spearman rank correlation - simple problems. Qualitative: Contingency tables - Measures of Association. Concept of simple regression - simple problems.

UNIT - V

Elements of Compound interest (nominal and effective rates of interest, annuities certain, present values, accumulated amounts, deferred annuities) - the functions included in compound interest - tables and their uses.

Text Books:
1. Gupta,S.P. (2014): Statistical Methods, Sultan Chand& Sons Pvt Ltd. New Delhi.
2. Federation of Insurance Institutes Study Courses - Mathematical Basis of Life Assurances F1,2.

Reference Books:
1. Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of Applied Statistics, Sultan Chand & Sons.

Course Outcomes

1. After studied unit - 1, the student will be able to know visualization of data
2. After studied unit - 2, the student will be able to know computations of various statistical measures of data

3. After studied unit - 3, the student will be able to know sample selection and various sampling procedures

4. After studied unit - 4, the student will be able to know relationship among variables and fitting of simple regression model

5. After studied unit - 5, the student will be able to know computation of interest calculations

SEMESTER IV

PAPER - 4

SAMPLING THEORY

Course Objective(s)

To enable the students to understand and apply the sampling procedures to different situations.

UNIT - I

Design - Organization and execution of sample surveys - principle steps in sample survey - Pilot survey - principles of sample survey - sampling and non-sampling errors - advantages of sampling over complete census - limitations of sampling.

UNIT - II

Sampling from finite population - simple random sampling with and without replacement - unbiased estimate of the mean, variance of the estimate of the mean finite population correction estimation of standard error from a sample - determination of sample size.

UNIT - III

Stratified random sampling - properties of the estimates - unbiased estimates of the mean and variance of the estimates of the mean - optimum and proportional allocations - relative precision of a stratified sampling and simple random sampling - estimation of gain in precision in stratified sampling.

UNIT - IV

Systematic sampling - estimate of mean and variance of the estimated mean - comparison of simple and stratified with systematic random sampling.

UNIT - V

Ratio estimators: Ratio estimates, variance of the ratio estimates - Bias of the ratio estimates. Regression estimators: Linear regression estimate regression estimates with pre-assigned b-regression estimates when b is computed from the sample.

Text Books:
1. William, G. Cochran (1984): Sampling techniques, Wiley Eastern.

Reference Books:
1. Des Raj (1976): Sampling theory, Tata McGraw Hill.

2. Daroga Singh & Chaudhary, F.S. (1986): Theory and Analysis of Sample Survey

Designs. Wiley Eastern.

3. Sukhatme P.V. et al (1984): Sample survey methods and its applications, Indian Society of Agricultural Statistics, New Delhi.

4. Murthy, M.N. (1967): Sampling theory and methods, Statistical Publishing Society, Calcutta.

5. Sampath S. (1999): Sampling theory and methods. New Age International Ltd.

6. Engineering Updates.

7. Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons.

Course Outcomes

1. After studied unit-1, the student will be able to know the concept of sample survey and its features

2. After studied unit-2, the student will be able to know simple random sampling procedure

3. After studied unit-3, the student will be able to know stratified random sampling procedures

4. After studied unit-4, the student will be able to know systematic sampling procedure

5. After studied unit-5, the student will be able to know ratio and regression estimators

CORE **PRACTICAL II**

STATISTICAL PRACTICAL-II

Course Objective(s)

To enable students to solve problems related to estimation and hypothesis testing, statistical quality control techniques and design and analysis of experiments

Problems relating to the following topics which are covered in Semester III and Semester IV shall form the basis for practical:

1. Distribution Theory (problems related to fitting of various distributions such as binomial, poison, normal, computation of correlation, partial and multiple correlation coefficients)
2. Sampling Theory (problems related to estimates of population mean and variances, under simple random sampling, stratified random sampling, systematic random sampling, ration and regression estimators)

Text Books

Books prescribed in the respective core papers shall be used.

Note

The maximum marks for continuous internal assessment and end semester University examination for Statistical Practical-II shall be fixed as 40 and 60, respectively. The continuous internal assessment shall involve test (25 marks) and record work (15 marks). 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.

ALLIED -2

PAPER - 4

PROGRAMMING IN 'C'

Course Objective(s)

To enable the students to understand and develop programs in C.

UNIT - I

Introduction to "C", variables, data types-declarations, type conversions, increment and decrement, Bitwise, Logical and Assignment operators.

UNIT - II

Expression and conditional expressions, control structures, If-Else, SWITCH, WHILE, FOR and DO WHILE loop structures. Break continue, GO and Label statements. Function, function returning, Non-integers, Function arguments -Static and register variables.

UNIT - III

Arrays and Strings - Array Declaration, Multi dimensional Arrays Strings/Character Arrays, Array initialization-Pointers and addresses. Pointers and Arrays-Pointer to function.

UNIT - IV

Structures and functions, Array of structures Fields, Unions-type definition standard input and output - formatted output - output - Access to the standard library.

UNIT - V

File Access, File handling in C - File descriptions - Error handling - 'Low level i/o-Read and Write'. Open, Create, Close, Unlike-Random Access - seek and I seek.

Text Books:
1. Balagurusamy, E. (1997): ANSI 'C' Programming, Tata-McGraw Hill Publishers Ltd.

Reference Books:
1. Yaswant Kanetkar (1997): Let Us 'C',BPB Publications, New Delhi.
2. Bruce,H.Hunter: Introduction to 'C'

Course Outcomes

1. After studied unit - 1, the student will be able to know the basic data types of programming in c

2. After studied unit - 2, the student will be able to know the various control structures and its usage

3. After studied unit - 3, the student will be able to know the concept of arrays and pointers

4. After studied unit - 4, the student will be able to know the concept of structures and unions.

5. After studied unit - 5, the student will be able to know to file structures and its manipulations

ALLIED PRACTICAL
NUMERICAL METHODS AND PROGRAMMING IN C

Course Objective(s)

To enable students to solve problems related to numerical methods using programming in C

Problems relating to the following topics which are covered in Semester III and Semester IV shall form the basis for practical:

Problems relating to the following topics shall form the basis for the practical.

1. Summation of Series: Sin(x), Cos(x), Exp(x), (Comparison with built in functions)
2. String Manipulation: Counting the no. of vowels, consonants, words, white spaces in a line of text and array of lines. Reverse a string & check for palindrome. Substring detection, count and removal - Finding and replacing substrings
3. Solution of polynomial equation - Newton Raphson method
4. Solution of system of simultaneous equation - Gauss elimination method.
5. Interpolation - Lagrange interpolation.
6. Numerical integration by Trapezoidal, Simpson's and Weddle's rules - Calculate the value of π (up to five decimal places).
7. Check the accuracy of the built in functions Sin(x), Cos(x),(x in radians) e^x, e^{-x} Generation of Fibonacci Sequence.
8. Matrix addition, multiplication, inverse, transpose, determinant of square matrix. Solution of simultaneous equations by Iterative methods and by using inverse.

Text Books

Books as prescribed in Allied papers in the semester III and IV.

Note

The maximum marks for continuous internal assessment and end semester University examination for Allied 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.

SKILL BASED SUBJECT
PAPER - 2 (PRACTICAL-I)

STATISTICAL DATA ANALYSIS-I (USING R PROGRAMMING)

Course Objective(s)

To enable students to utilize the theoretical knowledge gained in the core papers and to develop computational and technical skills for real life applications emphasizing the importance of R programming.

Problems relating to the following topics shall form the basis for the practical.

1. Using R command-Operations on vectors and matrices. Creating and Manipulation of data frames - user-defined functions.
2. Matrix addition, multiplication, inverse, transpose, determinant and trace of matrix.
3. Construction of table with one or more variables. Graphical procedures– Pie chart, Bar chart, Histograms and Boxplots.
4. Computation of various descriptive measures such as Measures of central tendency, measures of dispersion, skewness and kurtosis. Computation of correlations and regression co-efficient.

Text Books

Purohit, S. G., Gore, S. D., and Deshmukh, S. R. (2009). Statistics Using R, Narosa Publishing House, NewDelhi.

E-Resources
www.r-project.org
Note

The maximum marks for continuous internal assessment and end semester University examination for Statistical Data Analysis-I(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.

NON-MAJOR ELECTIVE
PAPER 2
STATISTICAL METHODS - II

Course Objective(s)

To enable students to learn the concept of estimation of unknown parameters of the population and hypothesis testing problem.

UNIT - I

Population growth and change - arithmetic, geometric and exponential growth rates - Population estimation and projection.

UNIT - II

Measures of mortality - Crude and Specific rates- Infant mortality rate - direct and indirect standardization of death rates - Complete life table.

UNIT - III

Estimation - Point estimation - interval estimation - mean - variance - proportions - simple problems.

UNIT - IV

Parametric Tests - Testing of significance of small and large sample tests - t-test, chi-square test - F test - z-test.

UNIT - V

Non- Parametric tests - Sign test, Wilcoxon test, Mann-Whitney U Test. Median test, Run test, Kolmogorov - Smirnov One Sample test. Chi- Square Tests - Goodness of fit - Test of independence of attributes.

Text Books:
1. Gupta,S.P (2014): Statistical Methods, Sultan Chand & Sons .
2**.** Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of Applied Statistics, Sultan Chand & Sons.

Reference Books:
1. Rohatgi, V.K. (1984) An introduction to probability theory and Mathematical Statistics, Wiley Eastern.

Course Outcomes

1. After studied unit - 1, the student will be able to know computation of population growth rate
2. After studied unit - 2, the student will be able to know the concept of mortality and its calculations
3. After studied unit - 3, the student will be able to know the concept of estimation of parameter
4. After studied unit - 4, the student will be able to know various parametric testing procedures
5. After studied unit - 5, the student will be able to know various non-parametric testing procedures