

## Programme Outcomes

**On completing the Programme, students will be able**

<b>PO1:</b> to identify, formulate and solve problem in statistics and related areas.
<b>PO2:</b> to apply the knowledge of statistics in various fields.
<b>PO3:</b> to develop statistical models.
<b>PO4:</b> to get exposed and develop technical, analytical and creative skills.
<b>PO5:</b> to promote and uphold self-discipline, leadership qualities, secular outlook, national integration and civic responsibility.
<b>PO6:</b> augment the acquisition of micro and macro skills of Tamil, Malayalam, Hindi and french language usages.
<b>PO7:</b> enhance communicative, linguistic, competency and employability quotient.
<b>PO8:</b> exhibit consistent academic excellence and integrated personality towards lifelong learning.

## Programme Specific Outcomes

**On completion of the Programme the students will**

<b>PSO1:</b> develop the ability to work effectively in broad range of scientific, government, financial, health, technical and other positions.
<b>PSO2:</b> recognize the importance and value of statistical thinking, training and approach to problem solving in various disciplines.
<b>PSO3:</b> accomplish the ability to use various statistical techniques interpret accordingly.

### Programme Educational Objectives

Within few years of graduation the students will attain the following

<b>PEO 1:</b> develop statistical knowledge and analytical thinking in data handling.
<b>PEO 2:</b> work in life and non-life insurance companies, consultancy, government service and also in the stock exchanges.
<b>PEO 3:</b> apply the knowledge of various statistical tools to real life situations.
<b>PEO4:</b> become socially responsible citizens.
<b>PEO5:</b> communicate effectively in various forums.

### Mapping of Programme Outcomes and Programme Specific outcomes to Programme Educational Objectives

	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5
<b>PO 1</b>	M	M	M	M	M
<b>PO 2</b>	M	M	M	M	M
<b>PO 3</b>	H	H	H	H	H
<b>PO 4</b>	H	H	H	H	H
<b>PO 5</b>	H	H	H	H	H
<b>PO 6</b>	H	H	H	H	H
<b>PO 7</b>	M	M	M	M	M
<b>PO 8</b>	M	M	M	M	M
<b>PSO 1</b>	H	H	H	M	M
<b>PSO 2</b>	H	H	H	M	M
<b>PSO 3</b>	H	H	H	M	M

**Curriculum Design**  
**Sri GVG Visalakshi College for Women (Autonomous)**  
Affiliated to Bharathiar University

**B.Sc. Statistics**

Scheme of Examination – CBCS and OBE Pattern

(For the students admitted from the academic year 2021-2022 onwards)

Sem	Course Code	Course Title	Ins. Hrs/ Week	Examination				Credits
				Dur. Hrs	CIA Marks	ESE Marks	Total Marks	
I	121TA1/ 121MY1/ 121HD1/ 121FR1	<b>Part I-</b> Language I	6	3	50	50	100	3
	121EN1	<b>Part II –</b> English I	6	3	50	50	100	3
		<b>Part III</b>						
	121W01	<b>Core I</b> Descriptive Statistics I	4	3	50	50	100	4
	121W02	<b>Core II</b> Applied Statistics	4	3	50	50	100	4
		<b>Core Practical I</b> Statistics Practical I	2	-	-	-	-	-
	121AW1	<b>Allied I</b> Mathematics for Statistics I	6	3	50	50	100	5
	121VEG	<b>Part IV-</b> Value Education Human Values and Gender Equity	2	2	50	-	50	1
II	221TA2/ 221MY2/ 221HD2/ 221FR2	<b>Part I-</b> Language II	6	3	50	50	100	3
	221EN2	<b>Part II -</b> English II	6	3	50	50	100	3
		<b>Part III</b>						
	221W03	<b>Core III</b> Descriptive Statistics II	4	3	50	50	100	4
	221W04	<b>Core IV</b> Probability Distribution I	4	3	50	50	100	4
	221WP1	<b>Core Practical I</b> Statistics Practical I	2	3	30	45	75	2
	221AW2	<b>Allied II</b> Mathematics for Statistics II	6	3	50	50	100	5
	221EVS	<b>Part IV-</b> Environmental Studies	2	2	50	-	50	1
III	321TA3/ 321MY3/ 321HD3/ 321FR3	<b>Part I –</b> Language III	6	3	50	50	100	3

III	321EN3	<b>Part II</b> -English III	6	3	50	50	100	3
		<b>Part III</b>						
	321W05	<b>Core V</b> Probability Distribution II	6	3	50	50	100	6
	321AW3	<b>Allied III</b> Numerical Methods	5	3	50	50	100	5
		<b>Core Practical II</b> Statistics Practical II	2	-	-	-	-	-
	321NSA	<b>Part IV</b> – Non Major Elective - Statistical Analysis	2	2	50	-	50	2
	321WS1	<b>Part IV-</b> Skill Enhancement Course I- Professional English for Statistics	3	3	100	-	100	2
	321NGA	<b>Part IV-</b> General Awareness- Information security	Self Study	2	50	-	50	Grade
IV	421TA4/ 421MY4/ 421HD4/ 421FR4	<b>Part I</b> – Language IV	6	3	50	50	100	3
	421EN4	<b>Part II-</b> English IV	6	3	50	50	100	3
		<b>Part III</b>						
	421W06	<b>Core VI</b> Sampling Theory	5	3	50	50	100	5
	421WP2	<b>Core Practical II</b> Statistics Practical II	2	3	30	45	75	2
	421AW4	<b>Allied IV</b> Principles of Accountancy	6	3	50	50	100	4
	421NGA	<b>Part IV-</b> General Awareness	2	2	50	-	50	2
	421WS2	<b>Part IV-</b> Skill Enhancement Course II- Matrices	3	3	100	-	100	2
421WA1/ 421WA2	<b>Advanced Learners Course I-</b> Indian Official Statistics/ MOOC	-	3	-	100	100	4*	
V		<b>Part III</b>						
	521W07	<b>Core VII</b> Statistical Inference I	5	3	50	50	100	5
	521W08	<b>Core VIII</b> Demographic Methods	5	3	50	50	100	5
	521W09	<b>Core IX</b> Design of Experiments	5	3	50	50	100	5
	521W10	<b>Core X</b> Statistical Quality Control I	5	3	50	50	100	5

V		<b>Core Practical III</b> Statistical Practical III - Using SPSS	2	-	-	-	-	-
	521WE1/ 521WE2	<b>Elective I</b> Elements of Econometrics/ Data Science fundamentals – R Language	5	3	50	50	100	5
	521WS3	<b>Part IV-Skill</b> Enhancement Course III- Actuarial statistics	3	3	100	-	100	2
	521NGA	<b>Part IV-General</b> Awareness- Online MOOC or Swayam Courses/Life Skills	Self Study	2	50	-	50	Grade
VI		<b>Part III</b>						
	621W11	<b>Core XI</b> Statistical Inference II	5	3	50	50	100	5
	621W12	<b>Core XII</b> Statistical Quality Control II	5	3	50	50	100	5
	621WP3	<b>Core Practical III</b> Statistics Practical III - using SPSS	2	3	30	45	75	2
	621WP4	<b>Core Practical IV</b> Statistics Practical IV	4	3	30	45	75	2
	621WE3/ 621WE4	<b>Elective II</b> Operations Research / Real Analysis	6	3	50	50	100	6
	621WE5	<b>Elective III</b> Psychological Statistics	5	3	50	50	100	5
	621WS4	<b>Part IV- Skill</b> Enhancement Course IV – Project and viva voce	3	3	100	-	100	2
	621EX1/ 621EX2/ 621EX3/ 621EX4/ 621EX5	<b>Part V-Extension Activity</b> NCC/NSS/YRC/RRC/ Games	-	-	50	-	50	2
	621WA3/ 621WA4	<b>Advanced Learners</b> <b>Course II</b> Advanced Actuarial Statistics/ MOOC	-	3	-	100	100	4*
621NGA	<b>Part IV- General</b> Awareness- Professional Ethics	Self Study	2	50	-	50	Grade	
Total							3800	140

\*Starred credits are treated as additional credits (Optional)

**Employability:**

**B.Sc. Statistics  
Semester I**

(For the students admitted from the academic year 2021-2022 onwards)

<b>Course: Part III: Core I Descriptive Statistics - I</b>	<b>Course Code: 121W01</b>
<b>Semester: I</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 60 hours</b>	<b>C:T : 52:8</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To impart the basic measures of statistics.
- To provide a strong foundation in basic descriptive measures such as measures of central tendency, dispersion and skewness.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the fundamental concepts of data.	U
CO2	Determine the descriptive measures and its dispersion.	A
CO3	Discuss the concepts of moments and kurtosis.	A
CO4	Determine the curves transformable to the form of least square.	A
CO5	Use statistics topics to demonstrate the real life situations.	A

U –Understanding A-Apply

Syllabus:

Unit I	(11 Hours)
Origin, scope, limitations and misuse of statistics – Collection – Classification – Tabulation of data. Diagrammatic representation of data: one dimensional and two dimensional diagrams – graphic representation: line diagram, frequency polygon, frequency curve, histogram and Ogive curves. Book 1: Chapter 1, Chapter 2 (Sections 2.2 & 2.3).	
Unit II	(11 Hours)
Measures of central tendency: Mean, Median, Mode, Geometric mean and Harmonic mean – Partition values: Quartiles, Deciles and Percentiles – Measures of Dispersion: Mean deviation, Quartile deviation and Standard deviation – Coefficient of variation. Book 1: Chapter 2 (Sections 2.4 – 2.14)	
Unit III	(10 Hours)
Moments – measures of Skewness – Pearson's and Bowley's Coefficient of skewness,	

Coefficient of Skewness based on moments – Kurtosis. Book 1: Chapter 2 (Sections 2.15 – 2.17)	
Unit IV	(10 Hours)
Curve fitting: principle of least squares, fitting of the curves of the form $y = a + bx$ , $y = a + bx + cx^2$ and curves transformable to the above form. Book 2: Chapter 2 (Section 2.4.3)	

Unit V	(10 Hours)
Case study and problems relating to all the above units.	

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – III	Fundamentals of Mathematical Statistics	Gupta. S.C and Kapoor. V.K	Sultan Chand & Sons, 2016 Reprint
IV	Fundamentals of Applied Statistics	Gupta. S.C and Kapoor. V.K	Sultan Chand & Sons, 2018 Reprint

Book for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Methods	Mills. F.C.	Sultan Chand & Sons, 2015 Reprint

E-Resources: (Web resources & E-books)

1. Applied Statistics, Mohammed A.Shayib, First Edition, 2013, bookboon.com

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	M	-	-	L	L	M	M	M	U
CO2	H	H	H	M	-	-	L	L	M	M	M	A
CO3	H	H	H	H	-	-	L	L	H	M	M	A
CO4	H	H	H	-	-	-	L	L	M	M	M	A
CO5	H	H	H	M	-	-	L	L	M	M	M	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester I**

(For the students admitted from the academic year 2021-2022 onwards)

<b>Course: Part III: Core II Applied Statistics</b>	<b>Course Code: 121W02</b>
<b>Semester: I</b>	<b>No. of Credits: 4</b>
<b>No. of hours: 60 hours</b>	<b>C:T : 52:8</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks : 50</b>

(C: Contact hours, T: Tutorial)

Course Objectives:

- ☐ To understand the basic forecasting models of time series data and to acquire practical experience in using the time series data.
- ☐ To impart knowledge on basic concepts of index numbers and national income.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Forecast the time series data using different measurement of trends.	A
CO2	Use the seasonal, cyclic and random methods to analyse the time series data.	A
CO3	Portray the index numbers and the classification of index numbers.	A
CO4	Calculate the chain index number and criteria of good index number using different tests.	A
CO5	Predict the values of business forecasting	A

A-Apply

Syllabus:

Unit I	(11 Hours)
Index Numbers: Introduction –Definition – Characteristics of Index Numbers – Uses of index numbers-Problems in the Construction of index numbers - Types index numbers – Weighted and unweighted index numbers – Methods of Constructing index numbers. Book 1 : Chapter3 (Sections 3.1-3.3)	

Unit II	(11 Hours)
Index Numbers: Tests for ideal Index Number – fixed base and Chain base Index Numbers – Base shifting and deflating the index numbers –Cost of living index Numbers – Indices of industrial production. Book 1: Chapter3 (Sections 3.4-3.10)	

Unit III	( 10Hours)
Analysis of time series: Introduction – Definition –Utility of time series analysis – Components of time series –Preliminary adjustments –Analysis of time series –Methods of Measuring trend: Graphic Method, Method of semi averages Method of Moving Average. Book 1: Chapter2 (Sections 2-2.4.6)	

Unit IV	( 10Hours)
Analysis of time series :Methods of Measuring seasonal variations – Deseasonalisation of data-Measurement of cyclical variations.	



Book 1: Chapter2(Sections 2.5-2.6)

Unit V	( 10Hours)
Business Forecasting : Introduction –Definition –objectives-Steps in business forecasting – Methods of forecasting –forecasting agencies –general assumptions in forecasting –uses, limitation and precautions	
Book 2 : Chapter 28	

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I-IV	Fundamentals of Applied Statistics	Gupta S.C and Kapoor V.K	Sultan Chand & Sons, 2018 Reprint.
V	Fundamentals of Statistics	D.N Elhance, Veena Elhance ,B.M Aggarwal	KitabMahal, 22-A Sarojini Naidu Marg. Allahabad ,LIInd Reprint .Edition 2008

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1	Fundamentals of Statistics(Vol. II)	A. M. Gun, M.K.Gupta& B Dasgupta	World Press, 9 <sup>th</sup> Edition, 2018 Reprint
2	Basic Statistics	Agarwal B.L	New age International Pvt. Ltd 2006 Reprint.

E-Resources : (Web resources & E-books)

1. Applied Business Analysis, Mohammed A.Shayib, 2013, Bookboon.com
2. Demographic Statistics, Nicholas N.N.Nsowah-Nuamah, 2017, Bookboon.com

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	-	-	-	-	M	H	M	A
CO2	H	H	H	H	-	-	-	-	M	H	L	A
CO3	H	H	H	H	-	-	-	-	M	H	M	A
CO4	H	H	H	H	-	-	-	-	M	H	L	A
CO5	H	H	H	H	-	-	-	-	M	H	M	A

Correction Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester II**

**(For the students admitted from the academic year 2021-2022 onwards)**

<b>Course: Part III: Core III Descriptive Statistics – II</b>	<b>Course Code: 221W03</b>
<b>Semester: II</b>	<b>No. of Credits: 4</b>
<b>No. of hours: 60 hours</b>	<b>C:T : 52:8</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks:50</b>

**(C: Contact hours, T: Tutorial)**

**Course Objectives:**

- To enable the students to effectively use bivariate measures such as correlation and regression for data analysis.
- To make the students demonstrate the association of attributes and its measures.
- To provide basic concepts in probability and operations with theorems.

**Course Outcomes:** On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the concepts of correlation and Regression.	U
CO2	Apply the methods of attributes to measure the dependence and independence of data.	A
CO3	Discuss the fundamental concepts of probability.	U
CO4	State the theorems of probability.	A
CO5	Use appropriate statistical tools for determining real life problems.	A

**U –Understanding A-Apply**

**Syllabus:**

<b>Unit I</b>	<b>(10 Hours)</b>
Linear correlation – scatter diagram, Pearson's coefficient of correlation, correlation in a bivariate table, Rank correlation, Coefficient of concurrent deviation – Regression equations – properties of regression coefficients. Chapter 10, Chapter 11 (Section 11.2)	
<b>Unit II</b>	<b>(11 Hours)</b>
Association of attributes: Relation between class frequencies, consistency of data, independence of attributes, criterion of independence, association of attributes: Yule's coefficient of association, Yule's coefficient of colligation. Chapter 13	
<b>Unit III</b>	<b>(11 Hours)</b>
Probability: Sample Space – Concepts of events – Algebraic Operations on events – Definitions of probability. Chapter 3 (Sections 3.2, 3.7 & 3.8)	
<b>Unit IV</b>	<b>(10 Hours)</b>
Generalized addition and compound Theorems of probability – independent events– Conditional probability – Baye's Theorem. Chapter 3 (Sections 3.9.1, 3.12 & 3.13), Chapter 4 (Section 4.2)	
<b>Unit V</b>	<b>(10 Hours)</b>
Case study and problems related to all the above units.	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Fundamentals of Mathematical Statistics	Gupta. S.C and Kapoor V.K	Sultan Chand & Sons, 2016 Reprint

Book for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Methods	S.P.Gupta	Sultan Chand & Sons, 2015 Reprint

E-Resources : (Web resources & E-books)

1. Introduction to Probability, Leif Mejlbro, Ventus Publishing, 2009
2. Probability and Mathematical Statistics, PrasannaSahoo, 2013  
<https://www.researchgate.net/publication/272237355>.

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	-	-	-	-	M	M	L	U
CO2	H	H	H	H	-	-	-	-	L	M	L	A
CO3	H	H	H	H	-	-	-	-	M	M	M	U
CO4	H	H	H	H	-	-	-	-	L	M	M	A
CO5	H	H	H	H	-	-	-	-	M	M	M	A

Correlation Level: H- High, M- Medium, L- Low

### B.Sc. Statistics Semester III

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Allied III Numerical Methods</b>	<b>Course Code: 321AW3</b>
<b>Semester: III</b>	<b>No. of Credits: 5</b>
<b>No. of hours :75 hours</b>	<b>C:T : 65:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

Course Objectives:

- To interpolate the data in real time problems
- To find the derivative at a given point using numerical techniques
- To provide knowledge in numerical integration

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Solve simple problems using different types of difference operator.	U
CO2	Determine unknown values using different types of Interpolation formula.	A
CO3	Determine unknown value in the data with unequal intervals using interpolation techniques.	A
CO4	Find the derivatives of function using interpolation method.	A
CO5	Evaluate single integral using Numerical technique and solve differential equations using iteration methods.	A

U –Understanding A-Apply

Syllabus:

Unit I:	(13 Hours)
Finite differences: First difference-Express any value of $y$ in term of $y_n$ and the backward differences of $y_n$ – Differences of a polynomial – Factorial polynomial. Interpolation (for Equal Intervals): Introduction – Gregory-Newton forward Interpolation formula – Gregory-Newton backward Interpolation Formula – Equidistant terms with one or more missing values. Chapter 5 (Sections 5.1 – 5.4), Chapter 6 (Sections 6.1 – 6.3, 6.7)	
Unit II	(13 Hours)
Central Difference Interpolation formulae (For Equal Intervals): Central differences and central difference table – Central difference interpolation formula – Gauss's forward interpolation formula – Gauss's backward interpolation formula – Stirling's formula – Bessel's formula. Chapter 7 (Sections 7.1 – 7.6)	
Unit III	(13 Hours)
Interpolation With Unequal Intervals: Introduction – Divided differences – Properties of divided differences – Relation between divided differences and forward differences – Theorem: Newton's interpolation formula for unequal intervals – Deduction: Deduce Gregory Newton interpolation forward formula for equal intervals – Lagrange's interpolation formula (for unequal intervals) – Different form of Lagrange's interpolation formula – Inverse Interpolation. Chapter 8 (Sections 8.1 – 8.8)	
Unit IV	(13 Hours)
Numerical differentiation and Integration: Introduction – Newton's forward difference formula to get the derivative – Newton's backward difference formula to compute the derivative – Derivative using Stirling's formula – To find maxima and minima of the function given the tabular values. Chapter 9 (Sections 9.1 – 9.6)	
Unit V	(13 Hours)

Numerical Integration: Introduction – Trapezoidal rule – Simpson’s one-third rule – Simpson’s three-eighths rule. Numerical Solution of Ordinary Differential Equations: Introduction – Solution by Taylor Series (Type I) – Euler’s Series – Runge-Kutta Method.  
Chapter 9 (Sections 9.7, 9.9, 9.13 & 9.14), Chapter 11(Sections 11.5, 11.9, 11.12)

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Numerical Methods	Dr.P.Kandasamy, Dr.K.Thilagavathy and Dr.K.Gunavathi,	S.Chand& Company limited, Reprint 2012,

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1	Numerical Methods in Science and Engineering,	Dr. M.K.Venkataraman	National Publishing company, 5 <sup>th</sup> edition, 1995
2	Finite differences and Numerical Analysis	H.C.Saxena,	S.Chand& Company Ltd., New Delhi, 2001

E-Resources : (Web resources & E-books)

1. Lecture notes on Numerical Analysis by Ruennhwa Ferny
2. Numerical Methods, Babu Ram, Pearson India, 2010.

<https://books.google.co.in>

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	-	-	M	-	-	M	M	M	M	-	U
CO2	H	-	-	M	-	-	M	M	M	M	-	A
CO3	H	-	-	M	-	-	M	M	M	M	-	A
CO4	H	-	-	M	-	-	M	M	M	M	-	A
CO5	H	-	-	M	-	-	M	M	M	M	-	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester III**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part IV – Non-Major Elective Statistical Analysis</b>	<b>Course Code: 321NSA</b>
<b>Semester: III</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 30 hours</b>	<b>C:T : 26:4</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: -</b>

(C: Contact hours, T: Tutorial)

Course Objectives:

- To expose the history of Statistics
- To provide a base in various statistical descriptive measures
- To enable the use of simple statistical tools in analyzing real time data.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain and applications of statistics in various fields.	U
CO2	Examine the ability to apply various statistical tools in data analysis.	A
CO3	Interpret the data using various kinds of charts and diagrams.	A
CO4	Evaluate and analyze methods for examining central tendencies and dispersion.	A
CO5	Predict and forecast the relationship among the variables.	A

U –Understanding A-Apply

Syllabus:

Unit I	(5 Hours)
Origin, Scope, Limitations and Misuse of Statistics – Collection – Classification – Tabulation of data. Chapter 1 (Page No. 2 – 23), Chapter 3(Page No. 40 – 52), Chapter 5(Page No. 92 -126)	

Unit II	(5 Hours)
Diagrammatic representation of data: one dimensional and two dimensional diagrams – graphic representation: line diagram, frequency polygon, frequency curve, histogram and Ogive curves. Chapter 6 (Page No. 128 – 176)	

Unit III	(5 Hours)
Measures of Central Tendency: Mean, Median, Mode, Geometric mean and Harmonic mean – Partition values: Quartiles, Deciles and Percentiles. Chapter 7 (Page No. 178 – 270)	

Unit IV	(5 Hours)
Measures of Dispersion: Mean deviation, Quartile deviation and Standard deviation – Coefficient of variation. Chapter 8 (Page No. 272 – 335)	

Unit V	(6 Hours)
Correlation: Types of correlation – Regression – Properties of regression coefficients. Chapter 10(Page No. 390 – 450), Chapter 11(Page No. 452 – 470)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Statistical Methods	S.P. Gupta	Sultan Chand & Sons, 2016 Reprint

E-Resources : (Web resources & E-books)

1. Descriptive Statistics – The Basis for Biostatistics (Vol. I), Mohammed A.Shayib, 2018, bookboon.com.

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PS2	PSO3	BTL
CO1	M	M	L	M	-	-	H	H	M	M	M	U
CO2	M	M	L	M	-	-	H	H	M	L	M	A
CO3	L	M	L	M	-	-	H	H	L	M	M	A
CO4	M	M	L	M	-	--	H	H	L	M	M	A
CO5	L	M	L	M	-	-	H	H	M	M	M	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester III**

(For students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part IV: Skill Enhancement Course I-Professional English for Statistics</b>	<b>Course Code: 321WS1</b>
<b>Semester: III</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 45 hours</b>	<b>C: T : 39 : 6</b>
<b>CIA Max. Marks: 100</b>	<b>ESE Max. Marks: -</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To nurture the language skills of students in their discipline of study.
- To develop their lexical and grammatical competence in English.
- To guide them in appropriate and comprehensive use of the statistical terms so as improve their employable skills.
- To enhance the creativity of the students, and enable them to think of innovative ways to express their thoughts.
- To imbibe confidence in oral presentations in professional interviews, conferences or meetings.
- To provide training to develop their skills in writing reports and research proposals.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Develop listening skills and comprehend the keywords specific to statistics thereby improving their aural competence.	U
CO2	Exhibit correct usage of words in oral presentations with confidence.	A
CO3	Read and interpret unfamiliar texts and explain/write summary with clarity.	U
CO4	Write reports for simple case studies and data analysis.	A

U –Understanding A-Apply

Syllabus:

Unit I	(7Hours)
<p>Communication:</p> <p>Listening: Listening to Instructions. Effectively understanding and correlating the essentials to respond appropriately and quickly. Listening to TED talks</p> <p>Speaking: Group discussions based on TED talks. Individual oral presentation based on listening to TED talks.</p> <p>Reading: Reading aloud to improve articulation.</p> <p>Writing: Reading diagrammatic information - interpretations maps, graphs and pie charts</p> <p>Vocabulary: Oral and written description of statistical terminology.</p>	
Unit II	(8Hours)
<p>Persuasive Communication:</p> <p>Listening: Listening to advertisements - sensitizing learners to the nuances of persuasive communication – statistical analysis of data – responsiveness after listening</p> <p>Speaking: Debates on statistical interpretations of data–Just-A Minute activities regarding statistical tool usage.</p> <p>Reading: Reading texts on advertisements (on products relevant of the subject areas) and answering inferential questions</p> <p>Writing: Writing an argumentative/persuasive essay on business strategies of industrialists.</p>	
Unit III	(8Hours)
<p>Digital competence:</p> <p>Listening: Listen to audio and video lectures and use technology to appropriately integrate the ideas and create an audio or video file.</p> <p>Speaking : communicate, manage information and collaborate effectively Online. Creating Vlogs.</p> <p>Reading: Reading digital content, interpret the content and prepare and present a comprehensive report orally or in written forms.</p> <p>Writing : Create and share statistical content effectively, appropriately, securely, independently and ethically.</p>	
Unit IV	(8Hours)
<p>Creativity and Innovation</p> <p>Listening: Listening to lectures.</p> <p>Speaking: master the phonetics, the sounds, the rhythm, and to an extent the intonation, modulation and variation in the way to be effective in conveying ideas and information.</p> <p>Reading: Differentiating between facts &amp; opinions, Skimming &amp; Scanning – Reading passages on statistical tools -Understanding text structures: sequencing, comparing and contrasting, relating cause and effect.</p> <p>Writing: Paraphrasing without plagiarism. Note-making and summarizing - Preparing notes from reading texts and Summarize key ideas and information in an organized manner, from the notes prepared.</p>	
Unit V	(8Hours)
<p>Critical Thinking Skills:</p> <p>Listening: Listening to interviews of specialists / Inventors in fields (Subject specific)</p> <p>Speaking: Brain storming sessions on. (Mind mapping). Small group discussions (Subject-Specific) - Framing opinion and judgment on charts, tables and graphs. Group Discussion:</p>	



Discussing survey results in small groups.  
Reading: Book reading – popular Leaders like Steve Jobs, Ratan Tata, Bill gates .  
Writing: Essay Writing based on reading exercises – analysing statistical aspects of big businesses like amazon.

**Books for Reference:**

S.No	Name of the Book	Authors	Publishers with Edition
1	Strategy Rules: Five Timeless Lessons from Bill Gates, Andy Grove and Steve Job	<u>B. David Yoffie</u> , <u>A. Michael Cusumano</u>	Paperback - 2015
2	Critical Thinking, Academic Writing and Presentation Skills:	<u>Marilyn Anderson</u>	Mg University Edition Paperback 2010
3	Critical Thinking: An Introduction	Alec <u>Fisher</u>	South Asian Edition Paperback 2011

**E-Resources:**

1. <https://Voxy.com/Course/Career-aligned/english-for-statistics-for-data-science-bussiness-analysis/>
2. <https://www.onestopenglish.com>
3. <https://iase-web.org>

**Mapping of Course outcome with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	M	H	H	H	-	-	H	-	H	H	H	U
CO2	M	H	H	H	-	-	H	-	M	M	M	A
CO3	M	H	H	H	-	-	H	-	M	M	M	U
CO4	M	H	H	H	-	-	H	-	H	H	H	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester IV**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Core VI Sampling Theory</b>	<b>Course Code: 421W06</b>
<b>Semester: IV</b>	<b>No. of Credits: 5</b>
<b>No. of hours : 75 hours</b>	<b>C:T : 65:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

**Course Objectives:**

- To create awareness on census surveys.
- To introduce various sampling methods and the different types of populations to which the sampling methods are applicable.

- To provide skills to determine the efficiency of the estimators in various sampling methods.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the preliminaries of sampling theory.	U
CO2	Apply simple random sampling technique to select the data for the given research.	A
CO3	Evaluate the sample survey using the stratified random sampling method.	A
CO4	Examine the sample survey using the stratified random sampling method.	A
CO5	Discuss the fundamentals of cluster sampling techniques and ratio estimation.	U

U –Understanding A-Apply

Syllabus:

Unit I	(13 Hours)
Introduction -Survey-Census Method and Sampling Method – Parameter and Statistic - Probability and Non Probability Sampling – The Principal steps in a Sample Survey – Principles of sample survey – Sampling and Non-sampling errors and their sources – Merits of sampling Technique – Limitations of sampling. Book 1: Chapter 7 (Sections 7.1 – 7.7)	
Unit II	(13 Hours)
Types of Sampling – Simple Random Sampling: Selection of simple random sample – Theorems related to Simple random sampling without and with replacement – Estimation of population mean and its Variance – Merits and Demerits of Simple Random Sampling. Book 1: Chapter 7(Sections 7.8, 7.9(7.9.2, 7.9.4, 7.9.5))	
Unit III	(13 Hours)
Stratified Random Sampling: Introduction –Principles of stratification – Advantages and disadvantages of Stratified Random Sampling – Estimation of population mean and variance – Methods for the Allocation of Sample Size– Comparison of Stratified Random Sampling with Simple Random Sampling with and without replacement. Book 1: Chapter 7 (Sections 7.10 (7.10.1 – 7.10.4))	
Unit IV	(13 Hours)
Systematic Sampling – Introduction -Method of selecting systematic sample-circular systematic sample – Estimation of population mean and its variance – Uses of systematic Sampling - Merits and Demerits of systematic Sampling-Systematic sampling versus simple random sampling- Systematic Sampling versus Stratified Random Sampling. Book 1: Chapter 7 (Sections 7.11 (7.11.1 – 7.11.3, 7.11.5, 7.11.6))	

Unit V	(13 Hours)
Cluster sampling -Introduction- Need for Cluster Sampling (clusters of equal sizes) - Single-Stage cluster sampling— Variance in terms of Intraclass Correlation – Ratio estimators: Methods of Estimation – The Ratio Estimator – Estimation of variance from a sample – Comparison of the Ratio Estimate with the Mean per Unit – Bias of the ratio estimate. Book 2: Chapter 9 (Sections 9.1, 9.4), Chapter 6 (Sections 6.1, 6.2, 6.4, 6.6, 6.8)	

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – IV	Fundamentals of Applied Statistics	Gupta S.C and Kapoor V.K	2018 Reprint, Sultan Chand & Sons, New Delhi.
V	Sampling Techniques	Cochran	2015, John Wiley & sons

E-Resources : (Web resources & E-books)

1. Sampling Theory and Methods, S.Sampath, Narosa Publishing, 2001.  
<https://books.google.co.in>
2. Survey Sampling Theory and its Applications, Raghunath Arnab, Academic Press, 2017 <https://books.google.co.in>

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	M	-	-	M	M	H	M	H	U
CO2	H	H	H	M	-	-	M	M	H	L	H	A
CO3	H	H	H	L	-	-	M	M	H	M	H	A
CO4	H	H	H	M	-	-	M	M	H	L	H	A
CO5	H	H	H	M	-	-	M	M	H	M	H	U

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester IV**

(For students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part IV: Advanced Learners Course I Indian Official Statistics</b>	<b>Course Code: 421WA1</b>
<b>Semester: IV</b>	<b>No. of Credits: 4*</b>
<b>No. of hours: -</b>	<b>C:T : -</b>
<b>CIA Max. Marks: -</b>	<b>ESE Max. Marks: 100</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To understand the scope of statistics in various sectors.
- To impart the importance of statistics and the use of statistics in real world situations.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the importance of Indian official statistics and population statistics.	U
CO2	Discuss the usage of statistics in agriculture, crop production, industry, trade, labour and employment.	U
CO3	Elucidate the scope of statistics in transport and communication.	U
CO4	Classify the importance of statistics in various sectors.	U
CO5	Describe the fundamentals and importance of statistics in miscellaneous, educational, local bodies and election.	U

**U –Understanding**

**Syllabus:**

Unit I
Indian official statistics: Indian statistical system- Statistical organization in the Central and State government and their functions - Population statistics

Unit II
Agricultural statistics : land utilization statistics – crop production statistics – livestock statistics – fishery statistics - industrial statistics – trade statistics – price statistics – statistics of labour and employment

Unit III
Statistics of transport and communications: railway transport –road transport –shipping transport –air transport – communications statistics

Unit IV
Financial and banking statistics : statement of affairs of the reserve bank of India(weekly) – reserve bank of India bulletin(monthly) –report of currency and finance(annual) –statistical tables relating to banks in India (annual) – trend and progress of banking in India (annual)

Unit V
Miscellaneous statistics: Educational statistics –National income statistics –tourism statistics – local bodies statistics – election statistics

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I-V	Fundamentals of Statistics (Vol. II)	A. M. Gun, M.K.Gupta& B Dasgupta	World Press, 9 <sup>th</sup> Edition, 2018 Reprint

**E-Resources: (Web resources & E-books)**

1. English Insurance Contract Law, Malcolm Clarke, 2016, bookboon.com.

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	-	-	-	-	-	H	H	H	M	U
CO2	H	H	M	L	-	-	-	H	H	H	M	U
CO3	H	H	M	L	-	-	-	H	H	H	M	U
CO4	H	H	M	L	-	-	-	H	H	H	M	U
CO5	H	H	M	L	-	-	-	H	H	H	M	U

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester V**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Core VII Statistical Inference - I</b>	<b>Course Code: 521W07</b>
<b>Semester: V</b>	<b>No. of Credits: 5</b>
<b>No. of hours : 75 hours</b>	<b>C:T : 65:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To generate the contingency tables.
- To provide a strong foundation in point estimation and interval estimation and their properties.
- To enable the students to draw conclusions about the populations using the computed value of the parameters.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the concepts and importance of properties of estimators.	U
CO2	Portray the theorems used in the estimation theory.	U
CO3	Calculate the point estimation using different methods.	A
CO4	Construct confidence intervals for population parameters.	A
CO5	Elucidate order statistics and its uses.	U

U –Understanding A-Apply

Syllabus:

Unit I	(13 Hours)
Theory of Estimation: Parameter Space, Statistics, Estimators and Estimate – Characteristics of Estimators – Unbiasedness – Consistency – Invariance Property of Consistent Estimators – Sufficient Conditions for Consistency – Efficient Estimators – Most Efficient Estimator – Minimum Variance Unbiased Estimators – Simple Problems. Chapter 17 (Sections 17.1, 17.2 (17.2.2, 17.2.3))	

Unit II	(13 Hours)
Sufficiency – Neymann Factorization Theorem – Cramer-Rao Inequality – Conditions for the equality sign in Cramer-Rao Inequality – Complete Family of Distributions – MVU and Blackwellisation – Rao-Blackwell Theorem – Simple Problems. Chapter 17 (Sections: 17.2.4, 17.3, 17.4, 17.5)	
Unit III	(13 Hours)
Methods of Estimation: Method of Maximum Likelihood Estimation – Properties of Maximum Likelihood Estimators – Method of Minimum Variance – Method of Moments – Method of Minimum Chi-square Estimation – Simple Problems. Chapter 17 (Section: 17.6)	
Unit IV	(13 Hours)
Interval estimation: Confidence Interval and Confidence Limits – Derivation of Confidence Interval based on Normal, t, Chi-square and F Distributions – Confidence Interval for Large Samples – Simple Problems. Chapter 17 (Section: 17.7)	
Unit V	(13 Hours)
Order Statistics – Cumulative Distribution Function of a Single Order Statistic – Probability Density Function of a Single Order Statistic – Joint p.d.f. of two Order Statistic – Joint p.d.f. of all n order Statistic – Distribution of Range and Other Systematic Statistics. Application of Chi-square Tests: Inferences about a Population Variance, Goodness of Fit, Test of Independence of Attributes- Contingency Tables – Yate’s Correction – Chi-square Test of Homogeneity of Correlation Coefficients. Chapter 9 (Section 9.15), Chapter 15 (Sections 15.6 (15.6.1 – 15.6.4, 15.6.6))	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Fundamentals of Mathematical Statistics	S.C Gupta and V.K. Kapoor	Sultan Chand & Sons, New Delhi, 2016 Reprint.

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Introduction of Mathematical Statistics	Robert V. Hogg and Allen T. Craig	Pearson Education, 2004
2	Statistical Inference	George Casella and Roger L. Berger	Cengage Learning, 2016

**E-Resources : (Web resources & E-books)**

1. Exercises in Statistical Inference, Robert Jonsson, 2014, bookboon.com.
2. Fundamentals of Mathematical Statistics, PavolOrsansky, 2009, bookboon.com

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	L	-	L	M	H	H	H	U
CO2	H	H	H	H	L	-	L	M	L	H	H	U
CO3	H	H	H	H	-	-	L	M	-	H	M	A
CO4	H	H	H	H	L	-	L	M	H	H	H	A
CO5	H	H	H	H	L	-	M	M	H	M	L	U

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester V**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Core X Statistical Quality Control - I</b>	<b>Course Code: 521W10</b>
<b>Semester: V</b>	<b>No. of Credits: 5</b>
<b>No. of hours : 75 hours</b>	<b>C:T : 65:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

Course Objectives:

- To introduce the concept of quality control and its need in real life.
- To impart knowledge of various tools used such as control charts and different sampling plans in quality aspects.
- To enable the students to skillfully handle the tools.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Describe the purpose and functions of Quality control.	U
CO2	Construct the various control charts for variables.	A
CO3	Sketch the different control charts for attributes.	A
CO4	Apply acceptance sampling plans to accept or reject the lot.	A
CO5	Derive the sequential sampling plan and sequential probability Ratio test.	A

U – Understanding A-Apply

Syllabus:

Unit I:	(13 Hours)
Quality Control – Quality characteristics – Cost of Quality – Optimum Cost of Performance – Value of Quality – Balance between the Cost and Value of Quality – Specification of Quality –	

Quality control and Inspection –Quality Policy – Statistical Quality Control – Benefits of SQC – Quality perspective.  
Book 1: Chapter 1 (Sections 1.9 – 1.20)

Unit II (13 Hours)

Introduction-Basis of Statistical Quality Control-Process Control and Product Control-Control Charts- Tools for SQC-Control Chart for Variables –Definition – Objectives – Control Limits  $\bar{X}$ , R and  $\sigma$  Charts – Simple Problems.  
Book 2: Chapter 1 (Sections 1.1-1.8)

Unit III (13 Hours)

Control Chart for Attributes – np, p, c and u Charts –Comparison between Variable and Attribute Charts – Simple Problems.  
Book 2: Chapter 1 (Section 1.9)

Unit IV (13 Hours)

Acceptance Sampling Inspection Plans – Acceptance Sampling for Attributes – Producer’s Risk and Consumer’s Risk – OC, AOQ, ASN, AOQL and ATI curves – Single Sampling Plan – Derivation of OC, ASN and ATI – Double Sampling Plan – Derivation of OC, ASN and ATI – Single Sampling against Double Sampling Plans.  
Book 2: Chapter 1 (Sections 1.11, 1.12(1.12.1 – 1.12.3))

Unit V (13 Hours)

Sequential Sampling Plan – Sequential Probability Ratio Test (SPRT) – Derivation of OC function of SPRT – Derivation of Five Points on OC Curve – Derivation of Five Points on ASN Curve.  
Book 2: Chapter 1(Section 1.12.4)

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I	Statistical Quality Control	M. Mahajan	DhanpatRai& Sons, 2018 Reprint.
II – V	Fundamentals of Applied Statistics	S.C. Gupta and V. K. Kapoor	Sultan Chand & Sons, 2016 Reprint

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Quality Control,	E.L. Grant and R.S. Leavenworth	McGraw Hill (India) Pvt. Ltd., 2014, 22 <sup>nd</sup> Reprint
2	Introduction to Statistical Quality Control,	Douglas C. Montgomery	2008 Reprint, Wiley & Sons.

**E-Resources : (Web resources & E-books)**

1. Acceptance Sampling in Quality Control, Edward G. Schilling and Dean V.



Neubauer, CRC Press, 2009 Reprint.

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	L	-	L	M	H	M	L	U
CO2	H	H	H	H	L	-	L	M	H	M	-	A
CO3	H	H	H	H	L	-	L	M	M	-	-	A
CO4	H	H	H	H	M	-	L	M	M	L	-	A
CO5	H	H	H	H	L	-	L	M	H	H	M	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester V**

(For students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Elective I Data Science Fundamentals- R Language</b>	<b>Course Code: 521WE2</b>
<b>Semester: V</b>	<b>No. of Credits: 5</b>
<b>No. of hours: 75 hours</b>	<b>C:P:T : 45:20:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, P: Practical, T: Tutorial)**

Course Objectives:

- To provide with brief insight of data analytics.
- To familiarize the students with R environment, packages and library.
- To understand the methods of statistical measures for data analytics.
- To provide introduction to exploratory data analytics and visualization of data.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Recall the fundamentals of data analytics	R
CO2	Distinguish between different data types in R	U
CO3	Interpret results based on visual representation	A
CO4	Compute measures of central tendency using R	A
CO5	Visualize data using R and draw inferences	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	(9Hours)
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Data Analytics-An insight: Introduction - Data Evolution-Data Science-Data Analytics -Big Data analytics- Big Data. Understanding Data: Introduction- Data understanding- Data Processing phases-Data measurements-Measures for variable types-Statistical measures.  
 Chapter 1 & 2

<b>Unit II</b>	<b>(9Hours)</b>
Exploring R Basics:- Introduction- Getting started-Rstudio-R basic data types-R operators- R objects-Vectors-list, arrays. Chapter 3	

<b>Unit III</b>	<b>(9Hours)</b>
Exploring R Basics: Matrix- factors- Data frame- Data Visualization in R: Introduction- Exploratory data Analytics- Lattice package- Data sets- Histogram-Density Plot-Box Plot-Bar Chart-Strip Plot-Theoretical Quantile Plot-Dot Plot-Scatter Plot. Chapter 3 & 4.	

<b>Unit IV</b>	<b>(9Hours)</b>
Data Visualization in R: GGplot2-Geoms-Exploring ggplot and qplot-Geom_Points- Geom_line-Geom_histogram-Geom_bar-Geom_Boxplot-Geom_Smooth. Statistical Measures: Introduction- Understanding Data Distribution- Usecase: Central Tendency Measure-Measure of Variability-Range-Inter Quartile Range. Chapter 4 & 5.	

<b>Unit V</b>	<b>(9Hours)</b>
Statistical Measures: Variability Analysis using mean-Median Absolute Deviations-Squared Deviation-Variance-Standard Deviation-Data Standardizing – sampling Distribution- Probability Distributions. Regression Analysis: Introduction- Regression Analysis-Data Types for Regression-Visualization Plots for Linear Regression- Linear Regression. Chapter 5 & 6.	

<b>List of Programs</b>	<b>(20Hours)</b>
1.Creating Vectors, Matrices, Factors and plotting graphs 2. Import Data, copy data from Excel to R 3. Working with variables and Data in R 4. Logic statements 5. Bar charts and pie charts in R 6. Histograms in R 7. Summary statistics in R: Mean, Standard Deviation, Frequencies, t-Test 8. CDF, PDF &Regression for discrete and continuous distributions. Chapter 1 to 6.	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
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I - V	Data Analytics with R Step by Step	V. Bhuvanewari	Published by Department of Computer Applications, BharathiarUnivresity. 2016
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Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Big Data Analytics: A Practitioner's Approach	V. Bhuvanewari, T. Devi	Published by Department of Computer Applications, BharathiarUnivresity. 2016
2	The Art of R Programming	Norman Matloff	No Starch Press,2011.
3	The R Book	Michael J. Crawle	Wiley 2008
4	Statistical Analysis with R.	M. John	Tata McGraw Hill Publishing Co. Ltd October 2010
5	Learning R	Richard Cotton	O'Reilly Media September 2013

E-Resources :

1. [https://cran.r-project.org/doc/contrib/Paradis-rdebuts\\_en.pdf](https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf)
2. <https://www.cs.upc.edu/~robert/teaching/estadistica/rprogramming.pdf>
3. [https://web.itu.edu.tr/~tokerem/The\\_Book\\_of\\_R.pdf](https://web.itu.edu.tr/~tokerem/The_Book_of_R.pdf)
4. [https://www.tutorialspoint.com/r/r\\_tutorial.pdf](https://www.tutorialspoint.com/r/r_tutorial.pdf)
5. [https://d1b10bmlvqabco.cloudfront.net/attach/ighbo26t3ua52t/igp9099yy4v10/igz7vp4w5su9/OReilly\\_HandsOn\\_Programming\\_with\\_R\\_2014.pdf](https://d1b10bmlvqabco.cloudfront.net/attach/ighbo26t3ua52t/igp9099yy4v10/igz7vp4w5su9/OReilly_HandsOn_Programming_with_R_2014.pdf)
6. <https://www.stats.ox.ac.uk/~evans/Rprog/LectureNotes.pdf>

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	-	H	H	H	H	-	M	H	H	H	H	R
CO2	-	H	H	H	H	-	M	H	H	H	H	U
CO3	-	H	H	H	H	-	M	H	H	H	H	A
CO4	-	H	H	H	H	-	M	H	H	H	H	A
CO5	-	H	H	H	H	-	M	H	H	H	H	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester VI**

(For the students admitted from the academic year 2021 – 2022 and onwards)

<b>Course: Part III: Core XI Statistical Inference - II</b>	<b>Course Code: 621W11</b>
<b>Semester: VI</b>	<b>No. of Credits: 5</b>
<b>No. of hours : 75 hours</b>	<b>C:T : 65:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

Course Objectives:

- To impart knowledge on the methods of testing the hypothesis on different distributions.
- To educate the students to identify the areas of application of Neyman-Pearson Lemma.
- To provide a complete knowledge about testing procedures of means and variances
- To teach the fundamentals of sequential analysis.
- To enable the students to distinguish parametric and non-parametric methods

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Construct the hypothesis using the basic terminologies.	A
CO2	Determine the size of critical region and power of test function.	A
CO3	Formulate statistical hypothesis by selecting suitable test procedure.	A
CO4	Examine the sequential probability ratio.	U
CO5	Demonstrate the use of non-parametric statistical methods.	A

U –Understanding A-Apply

Syllabus:

Unit I	(13 Hours)
Testing of statistical Hypothesis – Simple and composite hypothesis null and alternative hypothesis –Critical Region – Types of errors – level of significance – size of the test – power of the test – Steps involved in testing of hypothesis. Chapter 18 (Sections 18.1 – 18.3)	
Unit II	(13 Hours)
Randomized and Non Randomized Test – Most Powerful Test – Neyman-Pearson Lemma and its applications – Unbiased test and unbiased critical Region – Optimum regions and sufficient statistics – Uniformly Most Powerful Critical Region – Simple problems. Chapter 18 (Sections 18.4, 18.5)	
Unit III	(13 Hours)
Test of Significance – Test of significance for Single Proportion, difference of Proportions – Test of Significance for Single Mean, difference of Means – Test of Significance for the difference of Standard Deviation – Bartlett's Test. Chapter 14 (Sections 14.7, 14.8)	
Unit IV	(13 Hours)
Likelihood ratio test – Test Procedure – Properties – Simple Problems – Sequential Analysis: Introduction – Sequential Probability Ratio Test (SPRT)-Operating Characteristic Function of SPRT – Average Sample Number – Simple Problems. Chapter 18 (Sections 18.6(18.6.1), 18.8)	

Unit V	(13 Hours)
Non-Parametric Methods – Comparison between Parametric and Non-Parametric Methods – Run Test, Test for Randomness, Median Test, Sign Test, Mann-Whitney U Test – Kolmogorov-Smirnov Tests – Simple Problems. Chapter 18 (Section 18.7)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Fundamentals of Mathematical Statistics	S.C Gupta and V.K. Kapoor	Sultan Chand & Sons, New Delhi, 2016 Reprint.

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1	Introduction to Mathematical Statistics	Robert V. Hogg and Allen T. Craig	Pearson Education, 5 <sup>th</sup> Edition, 2004
2	Statistical Inference,	George Casella, Roger C. Berger	Cengage Learning India Pvt. Ltd., 2016 Reprint. .

E-Resources : (Web resources & E-books)

1. Introductory Nonparametrics, JCW Rayner, 2016, bookboon.com
2. Inferential Statistics, Mohammed A.Shayib, bookboon.com

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	L	-	M	L	H	H	H	A
CO2	H	H	H	H	L	-	M	L	H	H	M	A
CO3	H	H	H	H	-	-	M	L	H	M	-	A
CO4	H	H	M	H	-	-	M	L	M	L	-	U
CO5	H	H	H	H	L	-	M	L	H	H	H	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester VI**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Core XII Statistical Quality Control -II</b>	<b>Course Code: 621W12</b>
<b>Semester: VI</b>	<b>No. of Credits: 5</b>
<b>No. of hours : 75 hours</b>	<b>C:T : 65:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

Course Objectives:

- To expose the concepts of total quality management used in industries, quality system standards and reliability concepts to control the quality of industrial outputs.
- To create awareness about the ISO quality standards of institutions
- To equip the students with various tools of TQM.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Describe the concept of total quality management system and evaluate the best practice for the attainment of total quality.	U
CO2	Develop various operating cost components and applications of JIT for operation Management.	A
CO3	Elucidate the functioning and application of six-sigma in process control.	U
CO4	Explain how ISO 9000 series is used in attaining quality standards.	U
CO5	Explain the fundamental concepts and methodology used in reliability analysis	U

U –Understanding A-Apply

Syllabus:

Unit I	(13 Hours)
Total Quality Management (TQM) – Need for management of product quality – concept of TQM – TQM philosophies – TQM models – Dimensions of TQM – Elements of TQM. Book 1: Chapter 2(Sections 2.1 – 2.4, 2.12)	
Unit II	(13 Hours)
Waste Control Management – Just-in-time Manufacturing (JIT) – Characteristics, Goals – Elements of JIT – Kanban System – Functions, Rules – Benefits of JIT – Limitations of JIT – Total Quality Management for Excellence. Book 1: Chapter 2(Sections 2.23, 2.25, 2.26)	
Unit III	(13 Hours)
Statistical Process Control (SPC) – Evolution of six sigma quality approach – the mathematics of six sigma – Practical approach to six sigma quality – TQM and six sigma – Six sigma concept of process capability – Six sigma and Indian industries. Book 1: Chapter 3(Section 3.18), Chapter 17	
Unit IV	(13 Hours)
Quality system standards – ISO Standards – Features of ISO: 9000 series standards – Various elements in ISO: 9001 model – ISO implementation – ISO 9001: 2008 – Transition to ISO	

9001:2015 – Introduction – Revision process – user groups – Implementation guidelines.  
 Book 2: Chapter 5( Sections 5.6, 5.8)  
<https:// ISO 9001:2015 implementation guidance>

Unit V	(13 Hours)
Reliability – Quality Control and Reliability – Basic Elements of Reliability – Achievement of Reliability – Designing, Measurement, Cost, Maintenance and Availability – Failure Mode Effect and Criticality Analysis (FMECA) – Failure Rate and Hazard Function – Constant Hazard Mode – Linear Hazard Model – Mean time to failure. Book 1: Chapter 13(Sections 13.1 – 13.6)	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – III & V	Statistical Quality Control	M. Mahajan	DhanpatRai& Sons, 2018 Reprint
IV	Total quality Management	Dr. K. Maran and Dr. K. Raja	Eswar Press, Chennai, 2009 Reprint

**Book for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Quality Control,	E.L. Grant and R.S. Leavenworth,	McGraw Hill (India) Pvt. Ltd., 2014 Reprint

**E-Resources : (Web resources & E-books)**

1. <https:// ISO 9001:2015 implementation guidance>
2. Acceptance Sampling in Quality Control, Edward G. Schilling and Dean V. Neubauer, CRC Press, 2009 Reprint.

**Mapping of Course outcome with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	L	-	L	M	H	H	H	U
CO2	H	M	H	H	-	-	L	M	H	H	H	A
CO3	H	M	H	H	-	-	L	M	H	H	M	U
CO4	H	H	M	H	L	-	L	M	H	H	H	U
CO5	H	H	H	H	L	-	L	M	H	M	-	U

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester V & VI**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Core Practical III Statistics Practical-III Using SPSS</b>	<b>Course Code: 621WP3</b>
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<b>Semester: V &amp; VI</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 60 hours</b>	<b>P:T : 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(P: Practical, T: Tutorial)**

Course Objectives:

- To impart the fundamental features of SPSS
- To secure knowledge in analyzing the data using SPSS software package.
- To train the students to apply the appropriate statistical tools for data analysis.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Interpret results using various types of charts and carryout inferential statistical analysis using SPSS	A
CO2	Test the significant relationship between the variables and interpret the result and test the qualitative data using Non-Parametric test	A

R-Remembrance U –Understanding A-Apply

Syllabus:

List of Programs	(52 Hours)
<ol style="list-style-type: none"> <li>1. Bar Chart, Line Chart, Pie Chart.</li> <li>2. Scatter Plots and Histograms.</li> <li>3. Construction of Frequency Distribution.</li> <li>4. Measures of Central tendency.</li> <li>5. Measures of Dispersion.</li> <li>6. Correlation.</li> <li>7. Linear Regression.</li> <li>8. t-test with one sample.</li> <li>9. Paired t test.</li> <li>10. Independent sample t test.</li> <li>11. ANOVA – One-way.</li> <li>12. ANOVA – Two- way.</li> <li>13. Non-Parametric Analysis: Chi-square test for goodness of fit,</li> <li>14. Spearman's Rank correlation</li> <li>15. Mann-Whitney U test.</li> <li>16. Wilcoxon signed rank test</li> <li>17. Kruskal-Wallis Test.</li> <li>18. Sign Test.</li> <li>19. Median Test.</li> <li>20. Kolmogorov-Smirnov Test.</li> <li>21. Control Charts for Attributes.</li> <li>22. Control Charts for Variables.</li> </ol>	

Books for Reference:



S. No.	Name of the Book	Authors	Publishers with Edition
1	SPSS 17.0 for Researchers	Dr. S. L Gupta and Hitesh Gupta	International Book House Pvt. Ltd., 2011 Reprint
2	Using SPSS-Interactive Hands on Approach	James B. Cunningham, James O.Aldrich	Sage Publications India Pvt. Ltd., 2012 Reprint
3	SPSS for you	A. Rajathi and P. Chandran	MJP Publisher, 2010 Reprint.

**E-Resources : (Web resources & E-books)**

1. SPSS: Stats Practically Short and Simple, Sidney Tyrrell, 2009,  
<https://bookboon.com>

**Mapping of Course outcome with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	L	M	H	H	-	-	M	L	H	H	H	A
CO2	L	M	H	H	-	-	L	L	H	M	L	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester VI**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part IV: Skill Enhancement Course IV Project &amp; Viva voce</b>	<b>Course Code: 621WS4</b>
<b>Semester: VI</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 45 hours</b>	<b>C:T : 39:6</b>
<b>CIA Max. Marks: 100</b>	<b>ESE Max. Marks: -</b>

**(C: Contact hours, T: Tutorial)**

**Preamble:**

This course is offered with an aim of promoting knowledge. It enables the students to communicate and contribute their ability to enhance their skills. A project work has to be carried out individually in an emerging area and a report must be submitted individually. Viva-voce examination will be conducted.

**Course Objectives:**

- To create awareness of applications of statistics in various fields and to interpret the results.
- To enable the students to explore various areas of statistical applications.
- To instill confidence to prepare and submit reports.

**Course Outcomes:** On completion of the Course the student will be able to

CO	Statement	Bloom's
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		Taxonomy level
CO1	Develop, practice and improve technical skills	A
CO2	Apply basic statistical concepts and analytical tools appropriately.	A
CO3	Demonstrate the analyzing skills in exploratory data analysis.	U
CO4	Predict results for a current scenario.	A
CO5	Compare two different sets of samples and interpret the result	U

U –Understanding A-Apply

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	M	M	H	H	L	-	L	M	H	H	H	A
CO2	M	M	H	M	L	-	L	L	H	H	H	A
CO3	M	M	M	L	-	-	L	M	H	H	H	U
CO4	L	L	M	L	M	-	L	H	H	L	-	A
CO5	M	M	M	L	H	-	L	M	H	H	-	U

Correlation level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester VI**

(For the students admitted from the academic year 2021– 2022 onwards)

<b>Course: Part IV: Advanced Learners course II- Advanced Actuarial Statistics</b>	<b>Course Code: 621WA3</b>
<b>Semester: VI</b>	<b>No. of Credits: 4*</b>
<b>No. of hours : -</b>	<b>C:T : -</b>
<b>CIA Max. Marks: -</b>	<b>ESE Max. Marks: 100</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To understand the various concepts relating to marine insurance, policy conditions and payments of marine insurance.
- To possess a sound knowledge about various marine insurance business in India and to utilize the same in their profession.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Compute benefits payable at the moment of death and at the end of year of deaths.	A
CO2	Find the payments for different types of annuities.	A
CO3	Calculate the premium amount.	A

CO4	Determine the expected cash reserves for fully continuous and fully discrete policies.	A
CO5	Determine the joint life status of members in a group and annual premiums.	A

A-Apply

Syllabus:

Unit I
Introduction- Compound Interest and Discount Factor- Benefit- Payable at the Moment of Death- Benefit Payable at the End of Year of Death- Relation Between A and $\bar{A}$ . Book 1: Chapter 5(Sections 5.1-5.5)

Unit II
Introduction- Annuities certain-Continuous Life Annuities- Discrete Life Annuities- Life Annuities with mthly Payments. Book 1: Chapter 6(Sections: 6.1-6.5)

Unit III
Introduction- Loss at Issue Random Variables- Fully Continuous Premiums- Fully Discrete Premiums- True mthly Payment Premiums- Gross Premiums. Book 1: Chapter 7(Sections:7.1-7.6)

Unit IV
Introduction- Fully Continuous Reserves- Fully Discrete Reserves. Book 1: Chapter 8(Sections: 8.1-8.3)

Unit V
Introduction- Joint Life status- Last Survivor status. Book 1: Chapter 9(Sections: 9.1-9.3)

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Actuarial statistics	Shailaja R Deshmukh	Universities Press(India) Private Limited 2009

E-Resources : (Web resources & E-books)

1. English Insurance Contract Law, Malcolm Clarke, 2016, Bookboon.com.

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	-	-	H	H	H	H	H	A
CO2	H	H	H	H	-	-	H	H	H	H	H	A
CO3	H	H	H	H	-	-	H	H	H	H	H	A
CO4	H	H	H	H	-	-	H	H	H	H	H	A
CO5	H	H	H	H	-	-	H	H	H	H	H	A

Correlation Level: H- High, M- Medium, L- Low

Skill Development Courses:

**B.Sc. Statistics  
Semester II**

**(For the students admitted from the academic year 2021-2022 onwards)**

<b>Course: Part III: Core IV Probability Distribution - I</b>	<b>Course Code: 221W04</b>
<b>Semester: II</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 60 hours</b>	<b>C:T : 52:8</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To impart the application of discrete and continuous probability distributions in real life situations.
- To understand the concepts of discrete and continuous distributions and their properties.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy Levels
CO1	Explain the basic concepts and theorems of probability.	U
CO2	Identify the discrete and continuous random variable.	U
CO3	Examine the two dimensional random variable and transformation of variables.	U
CO4	Calculate the Mathematical expectation, conditional expectation and Conditional Variance.	A
CO5	Discuss the concepts of moments, cumulants and characteristic function.	U

U –Understanding A-Apply

Syllabus:

Unit I	(11 Hours)
Random variables – Discrete and Continuous random variables – distribution function – Properties – Probability Mass function and Probability density function – various statistical measures of continuous probability distribution. Book 1: Chapter 5 (Sections 5.1 – 5.4)	
Unit II	(11 Hours)
Marginal and Conditional Distributions: Joint, marginal and conditional distribution functions and density functions – independence of random variables – Transformation of variables (one and two dimensional – concepts only). Book 1: Chapter 5 (Sections 5.5 – 5.7)	
Unit III	(10 Hours)
Mathematical Expectations and Properties: Mathematical Expectation –properties – addition and	

multiplication theorems – Cauchy-Schwartz inequality, conditional expectation and conditional variance.  
Book 1: Chapter 6 (fully)

Unit IV (10 Hours)  
Generating Functions and Characteristic Functions: Moment Generating function, Cumulant Generating function, characteristic function and their properties.  
Book 1: Chapter 7 (Sections 7.1 – 7.3)

Unit V (10 Hours)  
Law of Large Numbers and Central Limit Theorem: Tchebychev’s inequality, convergence in probability, weak law of large numbers and central limit theorem.  
Book 1: Chapter 7 (Sections 7.5 – 7.7)

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Fundamentals of Mathematical Statistics	Gupta.S.C and Kapoor.V.K	Sultan Chand & sons, 2016 Reprint

Book for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1.	Introduction to Mathematical Statistics	Hogg R.V and Craig. A.G.,	Amerind, 2004 Reprint.

E-Resources : (Web resources & E-books)

1. Probability for Finance, Patrick Roger, Ventus Publishing Aps. 2010.

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	M	M	M	-	-	-	H	H	M	M	U
CO2	H	M	M	L	-	-	-	H	H	L	M	U
CO3	H	M	M	H	-	-	-	H	H	L	M	U
CO4	H	M	M	M	-	-	-	H	H	M	M	A
CO5	H	M	M	L	-	-	-	H	H	M	M	U

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester I & II**

(For the students admitted from the academic year 2021-2022 onwards)

<b>Course: Part III: Core Practical I - Statistics Practical I</b>	<b>Course Code: 221WP1</b>
<b>Semester: I &amp; II</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 60 hours</b>	<b>P:T : 52:08</b>
<b>CIA Max. Marks: 30</b>	<b>ESE Max. Marks: 45</b>

**(P: Practical, T: Tutorial)**

Course Objectives:

- To understand the features of Basic Measures of Descriptive Statistics.

- To impart the concept of forecasting and its need.
- To compute various measures of probability and to know the concepts of probability distributions.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Calculate various measures of Descriptive Statistics and apply the fundamental concepts in exploratory data analysis	A
CO2	Construct charts and apply the appropriate forecasting techniques to a given data.	A

A-Apply

Syllabus:

List of Programs	(52 Hours)
<p>Syllabus:</p> <p><b>Descriptive Statistics I &amp; II</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Formation of frequency distribution.</li> <li><input type="checkbox"/> Formation of Charts and Diagrams: Histogram, bar diagram, Pie diagram, Frequency curve. Formation of Ogive curves.</li> <li><input type="checkbox"/> Calculation of Arithmetic, Geometric Mean, Median and Mode. Calculation of Percentiles and Quartiles</li> <li><input type="checkbox"/> Calculation of Measures of Dispersion: Range, Standard Deviation, Mean deviation, Quartile Deviation and their coefficients.</li> <li><input type="checkbox"/> Calculation of skewness and kurtosis and their coefficients.</li> <li><input type="checkbox"/> Calculation of Correlation and Regression coefficients and formation of Regression lines.</li> <li><input type="checkbox"/> Calculation of Correlation for bivariate frequency distribution</li> </ul> <p><b>Time Series and Index Numbers</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Calculation of trend values using least square and Moving averages methods.</li> <li><input type="checkbox"/> Calculation of Seasonal variations using method of simple averages ,method of link relative, ratio to trend, ratio to moving average.</li> <li><input type="checkbox"/> Calculation of weighted and unweighted Index Numbers.</li> <li><input type="checkbox"/> Tests for ideal index numbers.</li> <li><input type="checkbox"/> Construction of cost of living index numbers</li> </ul> <p><b>Probability and Random variables</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Simple Problems related to addition and multiplication theorems of probability.</li> <li><input type="checkbox"/> Calculation of expectation, conditional expectation and conditional variance of random variables.</li> </ul>	

Books for Reference:

S.No	Name of the book	Author	Publishers with edition
1	Statistics theory and practice	R.S .N Pillai and Bhagavathi	S.Chan& Company Pvt. Ltd. 2015 Reprint
2	Fundamentals of Applied statistics	S.C.Gupta and V.K	Sultan Chand & Sons,

		Kapoor	Reprint 2017.
3	Statistical Methods	S.P.Gupta	Sultan Chand & Sons, 2016 Reprint

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	-	-	-	-	H	M	H	A
CO2	H	H	H	H	-	-	-	-	H	M	H	A

Correlation level: H- High, M- Medium, L- Low

**B.Sc. Statistics**

**Semester III**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Core V Probability Distribution – II</b>	<b>Course Code: 321W05</b>
<b>Semester: III</b>	<b>No. of Credits: 6</b>
<b>No. of hours : 90 hours</b>	<b>C:T : 75:15</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To impart knowledge about discrete and continuous probability distributions.
- To enable the application of concepts of discrete and continuous probability distributions in real life situations.
- To provide skill in computing probabilities using discrete and continuous distributions.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Examine the binomial, Poisson and negative binomial distributions, moments.	U
CO2	Explain the geometric distribution, hyper-geometric distribution and multinomial distribution.	U
CO3	Explicate the normal distribution and rectangular distribution.	U
CO4	Discuss the Gamma, Beta distributions and Exponential distribution.	U
CO5	Scrutinize the application and derivation of t, F, and $\chi^2$ distributions-relationship between the distributions and their properties.	U

U –Understanding

Syllabus:

Unit I	(15 Hours)
Binomial, Poisson and Negative – Binomial distributions – Moments, m.g.f, cumulants,	

additive property, recurrence relation for the probabilities – simple problems.

Chapter 8 (Sections 8.4 – 8.6)

Unit II

(15 Hours)

Geometric distribution – moments, m.g.f – Hyper - geometric distribution – mean, variance, m.g.f, Binomial as a limiting form of Hyper - geometric distribution – Multinomial distribution – moments.

Chapter 8 (Sections 8.7 – 8.9)

Unit III

(15 Hours)

Normal distribution – limiting form of Binomial distribution, properties, median, mode, moments, m.g.f, cumulants, mean deviation, area property, simple problems – Rectangular distribution – moments, m.g.f. characteristic function, mean deviation – Bivariate normal distribution.

Chapter 9 (Sections 9.2 & 9.3)

Unit IV

(15 Hours)

Gamma, Beta distributions of I kind and II kind – constants – Exponential distribution – additive property.

Chapter 9 (Sections 9.5 – 9.8)

Unit V

(15Hours)

Functions of normal random variable leading to  $\chi^2$ , t and F distributions – inter relationship between the distributions and their properties.

Chapter 15 (Sections 15.2 & 15.3), Chapter 16 (Sections 16.2 – 16.6)

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Fundamentals of mathematical statistics	Gupta. S.C and Kapoor. V.K	Sultan Chand & sons, Reprint 2016

Book for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1.	Introduction to Mathematical Statistics	Hogg R.V and Craig. A.G.,	Amerind, 2004 Reprint.

E-Resources: (Web resources & E-books)

1. Discrete Distributions, Leif Mejlbro, 2009, Ventus Publishing Aps.
2. Continuous Distributions, Leif Mejlbro, 2009, Ventus Publishing Aps.

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	M	-	L	M	M	H	M	M	U
CO2	H	H	H	M	-	L	M	L	H	L	M	U



CO3	H	H	H	M	-	L	M	M	H	M	M	U
CO4	H	H	H	M	-	L	M	L	H	L	M	U
CO5	H	H	H	M	-	L	M	M	H	M	M	U

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester III & IV**

(For students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Core Practical II Statistics Practical II</b>	<b>Course Code: 421WP2</b>
<b>Semester: III &amp; IV</b>	<b>No. of Credits: 2</b>
<b>No. of hours: 60 hours</b>	<b>P:T : 52:08</b>
<b>CIA Max. Marks: 30</b>	<b>ESE Max. Marks: 45</b>

**(P: Practical, T: Tutorial)**

Course Objectives:

- To fit the data using binomial, Poisson and Normal distribution.
- To solve problems based on simple, stratified and systematic random sampling.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Fit binomial, Poisson and Normal distribution.	A
CO2	Estimate mean and variance of the population using simple, stratified and systematic random sampling.	A

A-Apply

Syllabus:

List of Problems	(52 Hours)
<b>Probability Distributions II</b> 1. Estimation of probability in case of binomial , Poisson and Normal distributions 2. Fitting of Binomial distribution. 3. Fitting of Poisson distribution. 4. Fitting of Normal distribution by the method of ordinates. 5. Fitting Normal distribution by area method. <b>Sampling Theory</b> 1. Estimation of mean and variance of the population and the variance of the estimator of the mean using Simple Random Sampling. 2. Stratified Random Sampling – Estimation of mean and variance of the population and of the variance of the estimator of the mean under Proportional and Optimum Allocation. 3. Systematic Sampling– selection and estimation of population mean and its variance	

Books for Reference:

S.No	Name of the book	Author	Publishers with edition
1	Statistics theory and practice	R.S.N Pillai and Bhagavathi	S.Chan& Company Pvt. Ltd. 2015 Reprint
2	Fundamentals of Applied statistics	S.C.Gupta and V.K Kapoor	Sultan Chand & Sons, Reprint 2017.
3	Statistical Methods	S.P.Gupta	Sultan Chand & Sons, 2016 Reprint

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	-	-	-	-	H	M	H	A
CO2	H	H	H	H	-	-	-	-	H	M	H	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester IV**

(For students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part IV: Skill Enhancement Course II Matrices</b>	<b>Course Code: 421WS2</b>
<b>Semester: IV</b>	<b>No. of Credits: 2</b>
<b>No. of hours: 45 hours</b>	<b>C:T : 38: 7</b>
<b>CIA Max. Marks: 100</b>	<b>ESE Max. Marks: -</b>

(C: Contact hours, T: Tutorial)

Course Objectives:

- To identify a system of linear equations and describe its solution set and the elementary operations to reduce matrices to echelon forms.
- To study the properties relating to matrices and determinants.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level

CO1	Perform common matrix operations such as addition, multiplication and transposition.	U
CO2	Identify Hermitian and Skew Hermitian matrices.	U
CO3	Find the cofactor of all elements in a matrix.	U
CO4	Solve a system of linear equations and find out the feasible solution.	A
CO5	Establish a sufficient condition for invertibility in terms of elementary matrices.	A

U – Understanding A – Apply

Syllabus:

Unit I	(6Hours)
Definition of a Matrix – Notations – Difference between a Matrix and a Determinant – Kinds of Matrices – Equality of Matrices – Addition of Matrices – Subtraction of Matrices – Properties of Matrix Addition – Multiplication of Two Matrices – Properties of Matrix Multiplication. Chapter 1 (Page No. 3 –36)	
Unit II	(6Hours)
Matrix Polynomial – Transpose of a Matrix – Symmetric and Skew-Symmetric Matrices – Conjugate of a Matrix – Hermitian Matrix – Skew-Hermitian Matrix – Simple Problems. Chapter 1 (Page No: 36 –66), Chapter 2 (Page No.67-104)	
Unit III	(8Hours)
Determinants – Minor Determinants – Cofactor of an Element – Properties of the Determinants – Notations – Product of two Determinants – Product of Two determinants of different Orders – Adjoint Determinant – Complementary Minor of a Determinant. Chapter 3 (Page No.: 135 – 203)	
Unit IV	(8Hours)
Laplace Expansion of a determinant by the minors of first r columns – Cramer’s Rule – Symmetric and Skew-Symmetric Determinant – Excluding proves of theorems-Simple Problems. Chapter 3 (Page No: 203-228)	
Unit V	(10Hours)
Adjoint of a Matrix – Inverse of a Matrix – Inversion of a Matrix by solving Algebraic Equations – Elementary Operations and Elementary Matrices – Symbols to be used for Elementary Transformations. Chapter 4 (Page No: 229 – 292)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	A Textbook of Matrices	HariKishan,	Atlantic Publishers, NewDelhi,

			2008.
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Book for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1	Matrices	A.R.Vasishtha and A.K.Vasishtha	Krishna PrakashanMedia(P) Ltd., 18 <sup>th</sup> Edition, 2008.

E-Resources : (Web resources & E-books)

1. Matrix Methods and Differential Equations, WynandS.Verwoerd, Bookboon

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	-	M	M	-	-	M	M	H	M	-	U
CO2	H	-	M	M	-	-	M	M	M	M	-	U
CO3	H	-	M	M	-	-	M	M	M	M	-	U
CO4	H	-	M	M	-	-	M	M	H	H	-	A
CO5	H	-	M	M	-	-	M	M	H	H	-	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester IV**

(For the students admitted from the academic year 2021– 2022 onwards)

<b>Course: Part IV: Advanced Learners course I - Online Course (MOOC)</b>	<b>Course Code: 421WA2</b>
<b>Semester: IV</b>	<b>No. of Credits: 4*</b>
<b>No. of hours : -</b>	<b>C:T : -</b>
<b>CIA Max. Marks: -</b>	<b>ESE Max. Marks: 100</b>

(\* Self Study)

Course Objectives:

- To integrate social networking, accessible online resources.
- To self-organize the participation of students according to learning goals, prior knowledge and skills and common interests.

Students eligible for Advanced Learners Course can opt to register for any one Online Course on the basis of self-learning. After obtaining course completion certificate, a viva- voce will be conducted by two Internal Examiners.

**B.Sc. Statistics  
Semester V**

(For students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Core VIII Demographic Methods</b>	<b>Course Code: 521W08</b>
<b>Semester: V</b>	<b>No. of Credits: 5</b>
<b>No. of hours: 75 Hours</b>	<b>C:T : 65:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To impart the concept of social demographic variables such as fertility, mortality, migration.
- To provide skills to construct life tables and to calculate survival rates and to illustrate the influence of the demographic variables on population growth, composition and projection.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain and compare the advantages and disadvantages of different sources of demographic data.	U
CO2	Explain and compare the advantages and disadvantages of different sources of demographic data.	A
CO3	Examine the mortality rate and its comparative study of standardizing from the data.	A
CO4	Construct a simple and abridged life table.	A
CO5	Project a population using appropriate equations and assumptions.	A

U –Understanding A-Apply

Syllabus:

Unit I	(13Hours)
Meaning and Scope of demography : Introduction – Definition of Demography -Scope of Demography -Relation of Demography with other Social Sciences – Important of demography – Source of Demographic Data : Introduction -Populations Census – Methods of population Census – Salient features – uses – Some Problems – Registration Method -Sample surveys – Sources of Demographic Data in India – Census 2011 – Civil Registration system; Demographic Surveys; Exercises. Book 2 : Chapter 1(Page no : 1-9) ,Chapter 4(Page no : 45-49)	
Unit II	(13Hours)
Vital Statistics : Measurement of Mortality :Crude Death Rate – Specific Death Rates -infant Mortality Rate -Standardised Death Rate – Mortality table (or Life Table) : Stationary Population -Stable Population -Central Mortality Rate – Force of Mortality Rate -Assumptions, Descriptions and Construction of Life Table -Uses of life Table.	

Book 2 : Chapter 9 (Page no : 9.9- 9.37)

Unit III	(13Hours)
Vital Statistics :Abridged Life Table : Reed – Merrell Methods- Greville’s Method – King’s Method – Fertility : Crude Birth Rate (C.B.R)-General Fertility Rate (G.F.R) – Specific Fertility Rate (S.F.R) -Total Fertility Rate (T.F.R).	
Book 2: Chapter 9: (Page no: 9.38-9.49 )	

Unit IV	(13Hours)
Vital Statistics: Measurement of Population Growth : Pearl’s Vital index -Gross Reproduction Rate (G.R.R) – Net Reproduction Rate (N.R.R) – Graduation of Mortality Rates : Mekeham’s Graduation formula – GeoperzMakeham formula for mortality.	
Book 2: Chapter 9 (Page no :9.50 -9.63)	

Unit V	(13Hours)
Population Projections: Meaning of population projections – Types of population projections - Methods of population projections -Importance of population projections- limitations of populations projections -Population projection in India – Exercise – Population Growth and Economic Development : Introduction -Effects of population growth on Economic Development – Factors Promoting Economic Development -Factors Retarding Economic Development – Effects of population growth on Indian Economy –Exercises.	
Book 1 : Chapter 3(Page no :35 -44), Chapter 16(Page no :181-188)	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I,V	Demography	M.L Jhigan,Bhatt and J.N Desi	Vrinda publication(P) limited ,3 <sup>rd</sup> Edition
II-IV	Fundamentals of Applied Statistics	Gupta.S.C and Kapoor.V.K,	Sultan Chand & Sons, 2017 Reprint

**Books for Reference:**

S. No.	Name of the Book	Authors	Publishers with Edition
1.	Fundamentals of Statistics	Goon A.M, Gupta.M.K and Das Gupta	World Press, Calcutta, 2018 Reprint
2.	An introduction to the study of population	Bhaskar D. Misra	South Asian Publishers, 1982

**E-Resources : (Web resources & E-books)**

1. Demographic Statistics, Nicholas N.N.Nsowah-Nuamah, 2017, Bookboon.com.

**Mapping of Course outcome with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	M	H	M	M	-	M	M	H	H	H	U
CO2	H	M	H	H	M	-	L	M	L	M	-	A
CO3	H	M	H	H	M	-	M	M	L	-	-	A
CO4	H	H	H	H	M	-	M	M	H	M	-	A

CO5	H	H	H	M	M	-	L	M	H	M	M	A
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Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester V**

(For the students admitted from the academic year 2021– 2022 onwards)

<b>Course: Part III: Core IX Design of experiments</b>	<b>Course Code: 521W09</b>
<b>Semester: V</b>	<b>No. of Credits: 5</b>
<b>No. of hours: 75 Hours</b>	<b>C:T : 65:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

Course Objectives:

- To provide basic principles of experimentation
- To initiate discussions on the analysis of data relating to agriculture, biological sciences and industry.
- To impart the concept of analysis of variance
- To implement comparisons based on F distribution for various designs employed
- To imbibe estimation skills with missing observations and compare the efficiencies of various designs.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Find the linear, fixed, mixed, random effects models and analysis of variance.	A
CO2	Examine the different models of experimental design.	A
CO3	Calculate the one and two missing observation of RBD and CRD using missing plot techniques.	A
CO4	Estimate the interaction using various factorial experiments.	A
CO5	Sketch the outline of analysis of covariance,	A

A-Apply

Syllabus:

Unit I	(13Hours)
Linear Model – Fixed, Mixed and Random Effect Models with examples – Analysis of Variance – Assumptions – ANOVA for One-Way and Two-Way Classifications for Fixed Effect Case – Estimators – Variance of the Estimators – Splitting Sum of Squares – Critical Difference. Book 1: Chapter 5 (Sections 5.1, 5.2(5.2.1,5.2.2), 5.3(5.3.1,5.3.2))	

Unit II	(13Hours)
Experimentation – Terminology – Experimental Error – Principles of design – Uniformity trial – Completely Randomized Design(CRD) – Analysis of CRD – Merits and Demerits – Randomized Block Design(RBD) – Analysis of RBD – Merits and Demerits – Latin Square Design(LSD) – Analysis of LSD – Merits and Demerits.	
Book 1: Chapter 6 (Sections 6.1 – 6.4, 6.5(6.5.1 – 6.5.5), 6.6(6.6.1 – 6.6.5))	

Unit III	(13 Hours)
Efficiency of RBD over CRD – Efficiency of LSD over RBD and CRD – Missing plot techniques in RBD and LSD with one and two missing observations.	
Book 1: Chapter 6 (Sections 6.5(6.5.6, 6.5.7),6.6(6.6.6 – 6.6.8), 6.8)	

Unit IV	(13 Hours)
Factorial Experiments – Advantages of Factorial Experiment over simple Experiment – Symmetrical and Asymmetrical Factorial Experiments – Analysis of 2 <sup>2</sup> , 2 <sup>3</sup> and 3 <sup>2</sup> Factorial Experiments.	
Book 1: Chapter 6 (Section 6.9), Book 2: Chapter 2 (Section 2.12)	

Unit V	(13 Hours)
Analysis of Covariance – ANOCOVA in CRD and RBD with one concomitant variable – Split Plot Design and its Analysis (outline only)	
Book 1: Chapter 6 (Sections 6.7, 6.12)	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I-III	Fundamentals of Applied Statistics	Gupta S.C and Kapoor V.K,	Sultan Chand & sons, 2017 Reprint
IV- V	Fundamentals of Statistics (Vol. II)	A. M. Gun, M.K.Gupta& B Dasgupta	World Press, 9 <sup>th</sup> Edition, 2018 Reprint

**Books for Reference:**

S. No.	Name of the Book	Authors	Publishers with Edition
1	Design and Analysis of Experiments	Das, M.N. and Giri N.L,	Wiley Eastern
2	Design and Analysis of Experiment	Kempthorne,	Wiley Eastern Pvt. Ltd., Reprint 1967

**E-Resources : (Web resources & E-books)**

1. Understanding Statistics, StureHolm, 2016, Bookboon.com
2. Design of Experiments an Introduction Based on Linear Models, Max D. Morris, CRC Press, <https://books.google.co.in>.

**Mapping of Course outcome with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	M	-	L	M	H	H	H	A
CO2	H	H	H	H	M	-	-	M	H	M	M	A



CO3	H	H	H	H	M	-	-	M	H	H	-	A
CO4	H	H	H	H	M	-	L	M	H	L	-	A
CO5	H	H	H	H	M	-	L	M	H	M	-	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics  
Semester V**

(For students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Elective I Elements of Econometrics</b>	<b>Course Code: 521WE1</b>
<b>Semester: V</b>	<b>No. of Credits: 5</b>
<b>No. of hours: 75 hours</b>	<b>C:T : 65:10</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks : 50</b>

(C: Contact hours, T: Tutorial)

Course Objectives:

- To enable the students to effectively use the simple and multiple regression models.
- To provide a complete overview of estimating autocorrelation and to expose the problems of multicollinearity.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the basic principles of the econometric models.	U
CO2	Find the simple regression model using their estimates.	A
CO3	Predict the relationship between two or more variables using multiple correlation.	A
CO4	Discuss the consequences of using OLS in the presence of auto correlation.	U
CO5	Elucidate the policy actions relative to the economic phenomenon of interest.	U

U –Understanding A-Apply

Syllabus:

Unit I	(13Hours)
Definition, Scope, Goals and Divisions of Econometrics – Methodology of Econometric Research. Chapter 1 & 2	

Unit II	(13Hours)
Simple Linear Regression Model – Assumptions – Least Square Criterion and the Normal Equations of OLS – Properties of Least square Estimates – Unbiasedness, Least-Variance, Efficiency, Best Linear Unbiasedness, Least Mean-Square-Error, Sufficiency. Chapter 4 (Sections: 4.1, 4.2, 4.4); Chapter 6 (Sections: 6.1.1)	

Unit III	(13Hours)
Multiple Regression – Model with two explanatory variables – General Linear Regression Model – Linear and Non-linear Relationships. Chapter 7 (Sections: 7.1, 7.2, 7.4)	

Unit IV	(13Hours)
Autocorrelation – Assumptions – Sources – Plausibility – Consequences – Tests for Autocorrelation – The Durbin-Watson Test – Solutions for the case of Autocorrelation – Methods for Estimating Autocorrelation. Chapter 10 (Sections: 10.1 – 10.3, 10.5, 10.6.2, 10.7, 10.8)	

Unit V	(13Hours)
Multicollinearity – Assumptions – Plausibility – Consequences – Tests for Detecting Multicollinearity – Solutions for Multicollinearity – Multicollinearity and Prediction – Multicollinearity and Identification. Chapter 11 (Sections: 11.1 – 11.7)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Theory of Econometrics	A. Koutsoyiannis	Macmillan Press, London, 1999 Reprint

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1	Econometrics	K. Dhanasekaran,	Vrinda Publications (P) Ltd, Delhi, 2011
2	Basic Econometrics	Damodar N. Gujarati	McGraw Hill, Singapore, 2009

E-Resources : (Web resources & E-books)

1. Econometrics, Thomas Andren, 2007, Bookboon.com.
2. Econometrics, BadiH.Baltagi, Springer Science and Business Media, 2011,  
<https://books.google.co.in>

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	L	-	L	M	H	H	M	U
CO2	H	M	H	H	-	-	L	M	H	M	-	A
CO3	H	H	H	H	L	-	L	M	H	H	-	A
CO4	H	H	H	H	L	-	L	M	H	-	M	U
CO5	H	H	H	H	L	-	L	M	H	H	H	U

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester V & VI**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Core Practical IV Statistics Practical-IV</b>	<b>Course Code: 621WP4</b>
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<b>Semester: V &amp; VI</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 60 hours</b>	<b>P:T : 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(P: Practical, T: Tutorial)**

Course Objectives:

- To enable the students to estimate the parameters of distributions.
- To provide skills to analyze data with reference to basic sampling theory
- To teach the nuances of design of experiments
- To instill a complete knowledge of tests of significance
- To equip the students with simple statistical quality control tools.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Estimate the parameters by using different methods practically.	A
CO2	Estimate sample size, mean and variance for different probability sampling methods practically	A
CO3	Test the significance between the variables using various linear model designs and interpret them statistically.	A
CO4	Fit the hypothesis to test the given samples using various statistical tools.	A
CO5	Check whether the product can be accepted or rejected using various quality control methods.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

<b>Unit I</b>	<b>(11 Hours)</b>
<b>Statistical Inference-I</b> 1. Estimation of parameters of the distribution by the methods of maximum likelihood and moments with regard to discrete and continuous distributions. 2. Confidence intervals based on Single mean, Difference of Means (Large Samples and Small Samples), Single Variance and Ratio of Two Variance.	
<b>Unit II</b>	<b>(10 Hours)</b>
<b>Demographic Methods</b> 1. Construction of life table. 2. Determination of mortality, fertility and reproduction rates. 3. Population projection using polynomials and exponential function. 4. Fitting logistic curve to population data by the method of Pearl and Reed.	
<b>Unit III</b>	<b>(11Hours)</b>
<b>Design of Experiments</b>	

1. Analysis RBD and LSD lay outs.
2. Missing plot techniques in RBD and LSD.
3. Analysis of  $2^2, 2^3$  and  $3^2$  factorial designs.

Unit IV (10 Hours)

Statistical Inference-II

1. Standard Normal and Exact tests of significance with regard to proportions, mean, variance.
2. Non-parametric Tests: Run test, test for randomness, median test, sign test, Mann-Whitney U Test.

Unit V (10 Hours)

Statistical quality control

1. Control chart for attributes and variables:  $\bar{X}$ , R, p, np and c charts
2. Single sampling plan and double sampling plan for attributes: OC, AOQ, ASN, ATI curves.

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	M	M	-	-	L	L	H	H	M	A
CO2	H	H	H	M	-	-	L	L	H	H	M	A
CO3	H	M	H	H	-	-	M	M	H	M	M	A
CO4	H	M	H	H	-	-	M	M	H	H	H	A
CO5	H	M	M	H	-	-	L	H	H	-	-	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester VI**

(For students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Elective II Real Analysis</b>	<b>Course Code: 621WE4</b>
<b>Semester: VI</b>	<b>No. of Credits: 5</b>
<b>No. of hours: 90 hours</b>	<b>C:T – 75:15</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks :50</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To apply the concepts of calculus to geometrical and physical problems in higher dimensional spaces.
- To expose the properties of limit and continuity which are indispensable to the study of subjects such as optimization theory.
- To impart adequate knowledge about functional relationships between the variables which have more applications in expressing the laws of physics, chemistry, mechanics etc.

- To impart knowledge and understanding in the advanced topics such as Riemann-Stieltjes integral, functions of bounded variables

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Check for openness, compactness of sets upper and lower limits of sets.	U
CO2	Test for convergent of sequence and obtain their limits.	A
CO3	Determine whether the given function is continuity or not.	A
CO4	Identify the points at Which the function is differentiate and the applicability of Rolle's theorem.	A
CO5	Test Whether the given function is Riemann integral, compute upper and lower Riemann integral.	A

U –Understanding A-Apply

Syllabus:

Unit I	(15Hours)
Real Numbers: Introduction- Finite and Infinite sets-Order structure of the set of real numbers- Algebraic structure of the set R-Closed intervals, open intervals. Semi-closed or semi-open intervals-Sets bounded above and sets bounded below , Bounded sets-Limits points of a set- Closed sets- Compact sets, Heine Borel Theorem. Chapter 1: Page no(3-5, 12-17) Chapter 2: Page no(37-55)	

Unit II	(15Hours)
Real Numbers: Domain and Range of a function- Bounded sequences – Convergent sequences- Non-convergent sequences- Algebraic operations and limits-Sub-sequences of a sequence- Theorem on nested intervals-Infinite series: its convergence and sum- The meaning of $a^x$ when $a > 0$ , and $x$ is any rational number. Chapter 3: Page no(56-100)	

Unit III	(15Hours)
Real valued Functions of a Single Real Variable. Limit and Continuity: Introduction- Real valued functions of a single real variable-limits-Continuity, Uniform continuity, Properties of functions continuity in closed intervals-Monotone functions-Functions of bounded variation. Chapter 4: Page no(101-149)	

Unit IV	(15Hours)
Real valued Functions of a Single Real Variable. Derivability: Derivability- Meaning of the sign of derivative at a point-Darboux's Theorem-Rolle's Theorem-Higher Derivatives- Young's form of Taylor's theorem-Applications of Taylor's theorem-The Indeterminate form 0/0- The Indeterminate form $\infty/\infty$ . Chapter 5: 150-194	

Unit V	(15Hours)
Real Valued Functions of a Single Real Variable. Riemann Integrability: Introduction- Riemann integrability and integral of a bounded functions over finite domain- Darboux's theorem- Another equivalent definition of integrability and integral- Conditions for integrability-Particular classes of bounded integrable functions- Properties of integrable functions. Chapter 6: 195-216.	

Book for study:

Unit	Name of the Book	Authors	Publisher with Edition
I-V	A course of Mathematical Analysis	Shanti Narayan	S.chand&Company.Pvt, 1987.

Books for Reference:

S.No.	Name of the Book	Authors	Publishers with Edition
1.	Principles of Mathematical Analysis	Walter Rudin	McGraw Hill, Third Edition, 1976.
2.	Source book on Real Analysis part I	M.S.Rangachari	New Century Book House (P) Ltd, 1996
3.	Modern Analysis	Arumugam, Isaac	New Gamma Publishing House, 1994

E-Resources : (Web resources & E-books)

1. Introduction to Real Analysis, Robert G.Bartle, Donald R. Sherbert, Third Edition, John Wiley &Son's, Inc.

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	-	-	M	-	-	M	H	-	-	-	U
CO2	H	-	-	M	-	-	M	H	-	-	-	A
CO3	H	-	-	M	-	-	M	H	-	-	-	A
CO4	H	-	-	M	-	-	M	H	-	-	-	A
CO5	H	-	-	M	-	-		H	-	-	-	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester VI**

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Elective III Psychological Statistics</b>	<b>Course Code: 621WE5</b>
<b>Semester: VI</b>	<b>No. of Credits: 5</b>
<b>No. of hours : 75 hours</b>	<b>C:T : 65:10</b>

**CIA Max. Marks: 50**

**ESE Max. Marks: 50**

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To gain knowledge in the application of scaling procedure and different types of Rank correlation.
- To demonstrate the kinds of evidence that would be relevant to assessing the reliability and validity of a particular measure.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Determine the degree of similarity between the variables by using different ranking techniques.	A
CO2	Identify the consistency of a measure using reliability techniques.	A
CO3	Examine station to involve in developing and validating the multi-item Self report scales.	A
CO4	Predict the relationship between the variables using correlation ratio	A
CO5	Classify the research methods used in psychology and apply the statistical techniques used in psychological research.	A

A-Apply

Syllabus:

Unit I	(13 Hours)
Introduction – Some Scaling Procedures – Scaling Individual Test Items in Terms of Difficulty – Scaling of scores on a test – z or $\sigma$ Scores, Standard Scores, Normalized Scores, T-Score, Percentile Scores – Scaling of Ranking in terms of Normal probability curve – scaling of ratings in terms of Normal probability curve. Book 1: Chapter 8(Sections 8.1, 8.2)	
Unit II	(13 Hours)
Reliability of Test Scores – Definition of Reliability – Index of Reliability – Methods of Determining Test Reliability – The Test-Retest Methods – Alternate or Parallel form Method – Split-half method – The Rulon Method – Method of Rational Equivalence. Book 1: Chapter 8(Sections 8.3 – 8.3.4)	
Unit III	(13 Hours)

Validity of Test Scores – Estimation of Validity – Types of Validity – Validity and Test Length – Comparison between reliability and validity – Intelligence tests and Intelligence Quotient.  
 Book 1: Chapter 8( Sections 8.4, 8.5)

Unit IV (13 Hours)

Correlation Ratio – Intra-Class Correlation – Multiple and Partial Correlation – Coefficient of Partial Correlation – Coefficient of Multiple Correlation – Simple Problem.  
 Book 3: Chapter 12 (Sections 12.1, 12.2, 12.4, 12.7, 12.8)

Unit V (13 Hours)

Correlation from Ranks –Biserial Correlation –Correlation from four-fold table – The Contingency Coefficient – Curvilinear or Non-linear Relationship.  
 Book 2: Chapter 14

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I-III	Fundamental of Applied Statistics	S.C. Gupta and V.K. Kapoor	Sultan Chand & Sons, 2017 Reprint
IV,V	Statistics in psychology and Education	Henry E Garrett	2014 Reprint, Paragon International publisher

**E-Resources : (Web resources & E-books)**

1. Statistics in Psychology and Education, S.K.Mangal, PHI Learning Pvt. Ltd., 2010.
2. Statistics for Research in Psychology, Rick Gurnsey, Sage Publications, 2018,  
<https://books.google.co.in>

**Mapping of Course outcome with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	L	M	H	M	H	-	H	H	H	M	L	A
CO2	L	M	H	M	H	-	H	H	H	-	-	A
CO3	L	M	H	L	M	-	H	H	H	-	M	A
CO4	L	M	H	H	H	-	H	H	H	H	M	A
CO5	L	M	H	H	L	-	H	H	H	M	-	A

Correlation Level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester VI**

**(For the students admitted from the academic year 2021– 2022 onwards)**

<b>Course: Part IV: Advanced Learners course II- Online Course (MOOC)</b>	<b>Course Code: 621WA4</b>
<b>Semester: VI</b>	<b>No. of Credits: 4*</b>
<b>No. of hours : -</b>	<b>C:T : -</b>



<b>CIA Max. Marks: -</b> (* Self Study)	<b>ESE Max. Marks: 100</b>
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Course Objectives:

- To integrate social networking, accessible online resources.
- To self-organize the participation of students according to learning goals, prior knowledge and skills and common interests.

Students eligible for Advanced Learners Course can opt to register for any one Online Course on the basis of self-learning. After obtaining course completion certificate, a viva- voce will be conducted by two Internal Examiners.

### Entrepreneurship Development

#### B.Sc. Statistics Semester V

(For the students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part IV: Skill Enhancement Course III Actuarial Statistics</b>	<b>Course Code: 521WS3</b>
<b>Semester: V</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 45 hours</b>	<b>C:T : 39:6</b>
<b>CIA Max. Marks: 100</b>	<b>ESE Max. Marks: -</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To expose the major life insurance policies covered in Indian life insurance.
- To enable a good choice of investments and to make appropriate decision regarding policies.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the involved in Insurance business	U
CO2	Use discrete and continuous distributions in actuarial statistics.	A
CO3	Identify various risk models for short term.	A
CO4	Determine survival functions, median future life time and force of mortality.	A
CO5	Find expected number of survivals, construct life tables.	A

U –Understanding A-Apply

Syllabus:

Unit I	(7 Hours)
Insurance Business: Introduction- What is an Actuarial Science- Insurance Companies as Business Organizations- Concept of Risk- How does the Insurance Business operate- Role of Statistics in Insurance – Insurance Business in India.	
Book1 : Chapter1 (Sections 1.1-1.7)	

Unit II	(8 Hours)
Introductory Statistics: Introduction- Some Important- Discrete Distributions- Some Important Continuous Distributions- Multivariate Distributions.	
Book 1 : Chapter 2(Sections 2.1-2.4)	

Unit III	(8 Hours)
Feasibility of Insurance Business and risk Models for Short t Term: Introduction- Expected Value Principle- Notion of Validity- Risk Models for Short Term.	
Book 1 : Chapter 3(Sections 3.1-3.4)	

Unit IV	(8 Hours)
Future Lifetime Distribution and Life Tables: Introduction- Future Life time Random Variable- Curate Future- Lifetime.	
Book 1: Chapter 4(Sections 4.1-4.3)	

Unit V	(8 Hours)
Future Lifetime Distribution and Life Tables: Life Tables- Assumptions of Fractional ages- Select and Ultimate Life Tables.	
Book 1: Chapter 4(Sections 4.4-4.4.6)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Actuarial statistics	Shailaja R Deshmukh	Universities Press(India) Private Limited 2009

E-Resources : (Web resources & E-books)

1. Actuarial Mathematics and Life-Table Statistics, Eric V.Slud, 2001, bookboon.com
2. Principles of Actuarial Science, Michael Sherris, 2011, Bookboon.com

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	-	-	H	M	H	H	H	U
CO2	H	H	H	-	-	-	H	M	H	H	H	A
CO3	H	H	H	H	-	-	H	M	H	H	H	A
CO4	H	H	H	H	-	-	H	M	H	H	H	A
CO5	H	H	H	H	-	-	H	M	H	H	H	A

Correlation level: H- High, M- Medium, L- Low

**B.Sc. Statistics**  
**Semester VI**  
(For students admitted from the academic year 2021 – 2022 onwards)

<b>Course: Part III: Elective II Operations Research</b>	<b>Course Code: 621WE3</b>
<b>Semester: VI</b>	<b>No. of Credits: 6</b>
<b>No. of hours: 90 hours</b>	<b>C:T : 75:15</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks :50</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To understand the fundamentals of optimization techniques and to formulate a real life problem into a linear programming model.
- To impart the application of optimization in inventory control and to expose the networking techniques to the students

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Solve LPP problems using linear programming methods.	A
CO2	Minimize the cost using transportation techniques.	A
CO3	Compute optimum strategies in game theory.	A
CO4	Optimize various costs indulged with inventories.	A
CO5	Apply optimization in networks.	A

A-Apply

Syllabus:

Unit I	(15 Hours)
Linear Programming: Introduction – Linear Programming Problem. Graphical Solution and Extension: Introduction - Graphical solution method – some exceptional cases-General Linear Programming Problem – Canonical and Standard forms of LPP – Simplex method: Introduction – computational Procedure – Use of Artificial Variables (Big M method only). Chapter 2(Section 2.1,2.2), Chapter 3(3.1-3.5), Chapter 4(Sections 4.1 ,4.3, 4.4)	
Unit II	(15 Hours)
Transportation Problem : Introduction – LP formulation of the transportation Problem – The transportation table – Loops in transportation tables – Finding an initial basis feasible solution: North west corner method – least-cost method – Vogel's Approximation method – Test for Optimality – Transportation Algorithm (MODI METHOD).Decision Analysis : Decision under uncertainty. Chapter 10 (Sections 10.1,10.2, 10.5 , 10.6, 10.9,10.10,10.12,10.13), Chapter 11 (Sections 11.1 – 11.3), Chapter 16 (Section 16.5)	

Unit III	(15 Hours)
Games and Strategies: Introduction – Two- Person Zero-sum game – some basic terms – The Maximin- Minimax Principle – Games without Saddle point – mixed strategies -Graphical Solution of 2xn and mx2 games. Chapter 17 (Sections 17.1 – 17.6)	

Unit IV	(15 Hours)
Inventory Control I: Introduction – Types of inventories – Reasons for carrying inventories – The inventory decisions – Objectives of scientific inventory control – Costs associated with inventories – Factors affecting inventory control – An inventory control problem – The concept of EOQ – Deterministic inventory problems with no shortages – Deterministic inventory problems with shortages – Problems of EOQ with price breaks. Chapter 19 (Sections 19.1 – 19.12)	

Unit V	(15Hours)
Network scheduling by PERT/CPM: Introduction – Network: Basic Components – Logical Sequencing –Rules of Network Construction – concurrent Activities – Critical Path Analysis – Probability Considerations in PERT – Distinction between PERT and CPM . Chapter 25 (Sections 25.1 – 25.8)	

Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I –V	Operations Research,	Kantiswarup, P.K. Gupta and Manmohan	Sultan Chand and Sons, New Delhi, 18 <sup>th</sup> Edition, 2015 Reprint

Books for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1	Operations Research – Theory and Applications	J.K.Sharma,	Macmillan India Ltd, 4 <sup>th</sup> edition, 2012.
2	Operations Research: An Introduction	Hamdy A. Taha	Pearson India Education Pvt. Ltd., 2016 Reprint

E-Resources : (Web resources & E-books)

- 1.Introduction to Operations Research, Frederick S. Hillier and Gerald J.Lieberman, 9<sup>th</sup> Edition
- 2.Problems in Operations Research, Er.Prem Kumar Gupta and Dr.D.S.Hira, S.Chand& Sons, 4<sup>th</sup> Edition, 2015, <https://books.google.co.in>

Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	M	H	H	L	-	L	M	H	M	-	A
CO2	H	L	H	H	L	-	L	M	H	-	-	A
CO3	H	H	H	H	-	-	L	M	H	M	-	A
CO4	H	H	H	H	L	-	L	M	H	M	M	A
CO5	H	H	H	H	-	-	L	M	H	H	H	A

Correlation Level: H- High, M- Medium, L- Low



**Curriculum Design**  
**Sri G.V.G Visalakshi College for Women (Autonomous)**  
 Affiliated to Bharathiar University  
 B.Sc. Statistics  
 Scheme of Examination – CBCS Pattern  
 (For the students admitted during the academic year 2020-2021 Only)

Sem	Course Code	Course Title	Ins. Hrs/ Week	Examination				Credits
				Dur. Hrs	CIA Marks	ESE Marks	Total Marks	
I	119TA1/ 119MY1/ 119HD1/ 119FR1	Part I Language I	6	3	25	75	100	4
	119EN1	Part II English I	6	3	25	75	100	4
		Part III						
	117W01	Core I Descriptive Statistics - I	4	3	25	75	100	4
	117W02	Core II Descriptive Statistics - II	4	3	25	75	100	4
	217WP1	Core Practical I Statistical Practical I	2	-	-	-	-	-
	117AW1	Allied I Mathematics for Statistics I	6	3	25	75	100	4
	119VEC	Part IV-Value Education	2	2	50	-	50	2
II	219TA2/ 219MY2/ 219HD2/ 219FR2	Part I Language II	6	3	25	75	100	4
	219EN2	Part II English II	6	3	25	75	100	4
		Part III						
	217W03	Core III Applied Statistics	6	3	25	75	100	4
	217WP1	Core Practical I Statistical Practical I	4	3	25	50	75	3
	217AW2	Allied II Mathematics for Statistics II	6	3	25	75	100	4
	219EVS	Part IV- Environmental Studies	2	2	50	-	50	2
III	<b>320TA3/ 319MY3/ 319HD3/ 319FR3</b>	<b>Part I Language III</b>	<b>6</b>	<b>3</b>	<b>25</b>	<b>75</b>	<b>100</b>	<b>4</b>

	319EN3	Part II English III	6	3	25	75	100	4
		Part III						
	317W04	Core IV Demographic methods	3	3	25	75	100	4
	317W05	Core V Probability Distribution I	3	3	25	75	100	4
	317AW3	Allied III Computer programming for Statistical Analysis I	5	3	25	50	75	3
	317AWP	Allied Practical C& C++ programming	2	-	-	-	-	-
	317NSA	Part IV – Non Major Elective Statistical Analysis	2	2	50	-	50	2
	320WS1	Part IV- Skill Enhancement Course I Professional English for Statistics	3	3	75	-	75	3
IV	420TA4/ 419MY4/ 419HD4/ 419FR4	Part I Language IV	6	3	25	75	100	4
	419EN4	Part II English IV	6	3	25	75	100	4
		Part III						
	417W06	Core VI Probability Distribution II	4	3	25	75	100	4
	417WP2	Core Practical II Statistical Practical II	2	3	25	50	75	1
	417AW4	Allied IV Computer programming for Statistical Analysis II	5	3	25	50	75	3
	417AWP	Allied Practical C & C++ programming	2	3	20	30	50	2
	417NGA	Part IV- General Awareness and Information Security	2	1	50	-	50	2
	420WS2	Part IV- Skill Enhancement Course - II Actuarial Statistics	3	3	75	-	75	3
V	517W07	Part III						
		Core VII Statistical	5	3	25	75	100	4

		Inference I						
	517W08	Core VIII Sampling theory	5	3	25	75	100	4
	517W09	Core IX Design of Experiments	5	3	25	75	100	4
	517W10	Core X Statistical Quality Control I	5	3	25	75	100	4
	617WP3	Core Practical III Statistical Practical III	2	-	-	-	-	-
	517WE1/ 517WE2	Elective I	5	3	25	50	75	4
	517WS3	Part IV- Skill Enhancement Course – III Elements of Econometrics	3	3	75	-	75	3
VI	617W11	Part III Core XI Statistical Inference II	5	3	25	75	100	4
	617W12	Core XII Statistical Quality Control II	5	3	25	75	100	4
	617WP3	Core Practical III Statistical Practical III – Using SPSS	2	3	25	50	75	2
	617WP4	Core Practical IV Statistical Practical IV	5	3	40	60	100	3
	617WE3/ 617WE4	Elective II	5	3	25	50	75	4
	617WE5	Elective III Psychological Statistics	5	3	25	50	75	3
	617WS4	Part IV- Skill Enhancement Course - IV Project	3	3	75	-	75	3
	617EX1/ 617EX2/ 617EX3/ 617EX4/ 617EX5	Part V- Extension activities	-	-	50	-	50	2
		Total					3500	140

## List of Electives:

Semester V – Elective - I

**517WE1** - Numerical Methods**517ME2** - Biostatistics

Semester VI – Elective - II

**617ME3** - Operations Research**617ME4** - Matrices



**Syllabus having direct bearing on Employability****B.Sc. Statistics****Semester I****(For the students admitted during the academic year 2017 – 2018 and onwards)**

<b>Course: Part III: Core I Descriptive Statistics - I</b>	<b>Course Code: 117W01</b>
<b>Semester: I</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 60 (Total hours)</b>	<b>C:T: 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

**(C: Contact hours, T: Tutorial)****Course Objectives:**

- to impart the basic measures of statistics
- to provide a strong foundation in basic descriptive measures such as measures of central tendency, dispersion and skewness.

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Demonstrate the ability to apply fundamental concepts in exploratory data analysis.	<b>U</b>
<b>CO2</b>	Classify and present the data	<b>R</b>
<b>CO3</b>	Interpret examples of methods for summarizing data set which are most appropriate to highlight interesting features of the data.	<b>U</b>
<b>CO4</b>	Construct and interpret graphical summaries of data.	<b>A</b>
<b>CO5</b>	Compute the descriptive measures and its dispersion	<b>U</b>
<b>CO6</b>	Fit curves transformable to the form of least square.	<b>A</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I</b>	<b>(11 Hours)</b>
Origin, scope, limitations and misuse of Statistics – Collection – Classification – Tabulation of data. Diagrammatic representation of data: one dimensional and two dimensional diagrams – graphic representation: line diagram, frequency polygon, frequency curve, histogram and Ogive curves. Book 1: Chapter 1, Chapter 2: (Sections 2.2 & 2.3).	
<b>Unit II</b>	<b>(11 Hours)</b>

Measures of central tendency: Mean, Median, Mode, Geometric mean and Harmonic mean – Partition values: Quartiles, Deciles and Percentiles – Measures of Dispersion: Mean deviation, Quartile deviation and Standard deviation – Coefficient of variation.

Book 1: Chapter 2: (Sections 2.4 – 2.14)

**Unit III** (10 Hours)

Moments – measures of Skewness – Pearson’s and Bowley’s Coefficient of skewness, Coefficient of Skewness based on moments – Kurtosis.

Book 1: Chapter 2: (Sections 2.15 – 2.17)

**Unit IV** (10 Hours)

Curve fitting: principle of least squares, fitting of the curves of the form  $y = a + bx$ ,  $y = a + bx + cx^2$  and curves transformable to the above form.

Book 2: Chapter 2: (Section 2.4.3)

**Unit V** (10 Hours)

Case study and problems relating to all the above units.

#### Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – III	Fundamentals of Mathematical Statistics	Gupta. S.C and Kapoor. V.K	Sultan Chand & Sons, 2016 Reprint
IV	Fundamentals of Applied Statistics	Gupta. S.C and Kapoor. V.K	Sultan Chand & Sons, 2017 Reprint

#### Book for Reference:

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Methods – Part I	Mills. F.C.	Pitman Publishing, 1965

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G.Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics****Semester I**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III: Core II: Descriptive Statistics – II</b>	<b>Course Code: 117W02</b>
<b>Semester: I</b>	<b>No. of Credits: 4</b>
<b>No. of hours :60 (Total hours)</b>	<b>C:T: 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks:75</b>

**(C: Contact hours, T: Tutorial)****Course Objectives:**

- to enable the students to effectively use bivariate measures such as correlation and regression for data analysis.
- to make the students demonstrate the association of attributes and its measures.
- to provide basic concepts in probability and operations with theorems.

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Associate the data and find its measure.	<b>U</b>
<b>CO2</b>	Fit the line of best fit and its coefficient.	<b>A</b>
<b>CO3</b>	Measure the dependence and independence of data by method of attributes.	<b>U</b>
<b>CO4</b>	Recognize the degree of uncertainty that is involved before making important decisions.	<b>R</b>
<b>CO5</b>	Interpret the success or failure in terms of probability conditions.	<b>U</b>
<b>CO6</b>	Use an appropriate statistical tool for data summary and exploratory data analysis	<b>A</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I</b>	<b>(10 Hours)</b>
Linear correlation – scatter diagram, Pearson's coefficient of correlation, correlation in a bivariate table, Rank correlation, Coefficient of concurrent deviation – Regression equations – properties of regression coefficients. Chapter 10, Chapter 11: (Section 11.2)	
<b>Unit II</b>	<b>(11 Hours)</b>
Association of attributes: Relation between class frequencies, consistency of data, independence of attributes, criterion of independence, association of attributes: Yule's coefficient of association, Yule's coefficient of colligation. Chapter 13	

<b>Unit III</b>	<b>(11 Hours)</b>
Probability: Sample Space – Concepts of events – Algebraic Operations on events – Definitions of probability. Chapter 3: (Sections 3.2, 3.7 & 3.8)	

<b>Unit IV</b>	<b>(10 Hours)</b>
Generalized addition and compound Theorems of probability – independent events – Conditional probability – Baye’s Theorem. Chapter: 3 (Sections 3.9.1, 3.12 & 3.13) Chapter 4 (Section 4.2)	

<b>Unit V</b>	<b>(10 Hours)</b>
Case study and problems related to all the above units.	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Fundamentals of Mathematical Statistics	Gupta. S.C and Kapoor V.K	Sultan Chand & Sons, 2017 Reprint

**Book for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Methods – Part I	Mills. F.C.	Pitman Publishing, 1965

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

## B.Sc. Statistics Semester II

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III: Core III: Applied Statistics</b>	<b>Course Code: 217W03</b>
<b>Semester: II</b>	<b>No. of Credits: 4</b>
<b>No. of hours :90 (Total hours)</b>	<b>C:T: 75:15</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to introduce time series to enable the students to forecast the data relating to economics and business.
- to demonstrate the use of index numbers in solving problems.
- to provide a strong foundation in basic demographic measures.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Formulate methods for using time series analysis for addressing business problems.	A
CO2	Define price and quality indices and construct price, quantity and value indexes.	R
CO3	Predict future values for the present data by various techniques of time series analysis.	A
CO4	Identify and compare the advantages and disadvantages of the different sources of Demographic data.	R
CO5	Describe the distribution of a population using various demographic characteristics.	R
CO6	Present appropriate techniques to ensure comparability of the measures across the birth population	A

**R-Remembrance U –Understanding A-Apply****Syllabus:****Unit I : Time series (15 Hours)**

Concept – components of time series – additive and multiplicative models – Resolving components of a time series – measuring trend: Graphic, semi – averages, moving average and principle of least squares methods.  
Chapter 2: (Sections 2.1 - 2.4.6)

**Unit II Time series (15 Hours)**

Seasonal variation – measuring seasonal variation: method of simple averages, ratio to trend method, ratio to moving average method and link relative method – Cyclical and Random fluctuations – variate difference method.  
Chapter 2: (Sections 2.5, 2.6 & 2.9)

**Unit III Index Numbers (15 Hours)**

Index numbers and their definitions – construction and uses of fixed and chain based index numbers – simple and weighted index numbers – Laspeyre's, Paache's, Fisher's, and Marshall- Edgeworth index numbers – optimum tests for index numbers – Cost of living index numbers.  
Chapter 3: (Sections 3.1 – 3.5)

**Unit IV Demographic methods (15 Hours)**

Demography – definition – sources of demographic data: vital registration – population census – population register – demographic surveys – population data as aid to social, economic and healthy planning – process of Indian Civil registration and census.  
Chapter 9: (Sections 9.1 – 9.3)

<b>Unit V Demographic methods</b>	<b>(15 Hours)</b>
Fertility measurements: Fertility as a component of population change – crude birth rate – general, specific and total fertility rates – gross and net reproduction rates and their interpretation.	
Chapter 9: (Sections 9.7 & 9.8)	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Fundamentals of Applied Statistics	Gupta S.C and Kapoor, V.K,	Sultan Chand & Sons, 2017 Reprint.

**Books for Reference:**

S.No.	Name of the Book	Authors	Publishers with Edition
1	Applied General Statistics	Croxton, F.E and Cowden, D.J	Prentice Hall, 3 <sup>rd</sup> Edition, 1967.
2	Fundamentals of Applied Statistics	Gun.A.M, Gupta.M.K and Das Gupta	World Press, 2018 Reprint.
3	The Advanced Theory of Statistics - Vol.III	Kendall.M.G and Alan Stuart.	Macmillan Pub Co, 4th Edition, 1983

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

### B.Sc. Statistics Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core IV Demographic Methods</b>	<b>Course Code: 317W04</b>
<b>Semester: III</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 45 (Total hours)</b>	<b>C:T: 39:6</b>
<b>CIA Max. Marks: 25 Marks</b>	<b>ESE Max. Marks: 75 Marks</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to create awareness about the core social demographic variables such as mortality, migration.
- to provide skills to construct life tables and to calculate survival rates.
- to illustrate the influence of the demographic variables on population growth, composition and projection.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Construct and analyze simple and abridged life tables.	A
CO2	Project a population using appropriate equations and assumptions.	A
CO3	Recognize and analyze typical demographic patterns arising from the data.	R
CO4	Describe basic demographic indicators and elaborate on their computation and interpretation	R
CO5	Interpret the data base on which are built population projections and work force projections.	U
CO6	Estimate the rate of change in a population.	U

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I</b>	<b>(8 Hours)</b>
<b>Mortality Measurements:</b> Crude Death Rate – Specific Death Rates – Standardized Death Rates – direct and indirect methods. Book 1: Chapter 9: (Sections 9.4.1 – 9.4.3)	
<b>Unit II</b>	<b>(8 Hours)</b>
Comparative Mortality Index – Infant Mortality Rate – Maternal Mortality Rate – cause – of – Death Rate – case fatality rate – force of mortality – graduation of mortality rates – Gompertz and Makeham's laws. Book 1: Chapter9: (Sections 9.4.3, 9.5.4 & 9.9)	
<b>Unit III</b>	<b>(7 Hours)</b>
Assumptions, Description and Construction of Various columns of a life table and their Relationships – Uses of a life table – Age pyramid. Book 1: Chapter 9: (Sections 9.5, 9.5.5 & 9.5.6)	
<b>Unit IV</b>	<b>(8 Hours)</b>
Construction of an Abridged life table – Reid and Merrell Method – Greville's Method – Migration – Factors Effecting Migration – Gross and Net Migration Rates. Book 1 Chapter 9: (Sections 9.6, 9.6.1 & 9.6.2) Book 2: Chapter 10 (fully)	
<b>Unit V</b>	<b>(8 Hours)</b>
Population Projection – Population Estimates and Projection – Arithmetic, Geometric and Exponential growth rates – Logistics curves – Pearl and Reed method – method of Rhodes – Basic ideas of stationary and stable population. Book 1: Chapter9: (Sections 9.5.1 & 9.5.2)	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I - III, IV & V	Fundamentals of Applied Statistics	Gupta.S.C and Kapoor.V.K,	Sultan Chand & Sons, 2017 Reprint
IV	Principles of Population Studies	Asha A.Bende and Tara Karitkar	Himalaya publishing, 2006 Reprint.

**Books for Reference:**

S. No.	Name of the Book	Authors	Publisherswith Edition
1.	Fundamentals of Statistics	Gun A.M, Gupta.M.K and Das Gupta	World Press, Calcutta, 2018 Reprint
2.	An introduction to the study of population	Bhaskar D. Misra	South Asian Publishers, 1982

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

### B.Sc. Statistics Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Non-Major Elective Statistical Analysis</b>	<b>Course Code: 317NSA</b>
<b>Semester: III</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 30 (Total hours)</b>	<b>C:T: 26:4</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: -</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to expose the history of Statistics
- to provide a base in various statistical descriptive measures
- to enable the use of simple statistical tools in analyzing real time data.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Identify the history and applications of statistics in various fields.	R
CO2	Demonstrate the ability to apply various statistical tools in data analysis.	U



<b>CO3</b>	Interpret the data using various kinds of charts and diagrams.	<b>U</b>
<b>CO4</b>	Evaluate and analyze methods for examining central tendencies and dispersion.	<b>A</b>
<b>CO5</b>	Measure the degree of relationship between the variables.	<b>U</b>
<b>CO6</b>	Predict and forecast the relationship among the variables.	<b>A</b>

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I:</b>	<b>(8 Hours)</b>
Origin, Scope, Limitations and Misuse of Statistics – Collection – Classification – Tabulation of data. Chapter 1 (Page No. 2 – 23), Chapter 3(Page No. 40 – 52), Chapter 5(Page No. 92 -126)	

<b>Unit II</b>	<b>(7 Hours)</b>
<b>Diagrammatic representation of data:</b> one dimensional and two dimensional diagrams – graphic representation: line diagram, frequency polygon, frequency curve, histogram and Ogive curves. Chapter 6(Page No. 128 – 176)	

<b>Unit III</b>	<b>(6 Hours)</b>
<b>Measures of Central Tendency:</b> Mean, Median, Mode, Geometric mean and Harmonic mean – Partition values: Quartiles, Deciles and Percentiles Chapter 7(Page No. 178 – 270)	

<b>Unit IV</b>	<b>(7 Hours)</b>
<b>Measures of Dispersion:</b> Mean deviation, Quartile deviation and Standard deviation – Coefficient of variation. Chapter 8(Page No. 272 – 335)	

<b>Unit V</b>	<b>(7 Hours)</b>
<b>Correlation:</b> Types of correlation – Regression – Properties of regression coefficients. Chapter 10(Page No. 390 – 450), Chapter 11(Page No. 452 – 470)	

**Books for study:**

<b>Unit</b>	<b>Name of the Book</b>	<b>Authors</b>	<b>Publishers with Edition</b>
<b>I – V</b>	Statistical Methods	S.P. Gupta	Sultan Chand & Sons, 2016 Reprint

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

## B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core VII Statistical Inference - I</b>	<b>Course Code: 517W07</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

### Course Objectives:

- to generate the contingency tables.
- to provide a strong foundation in point estimation and interval estimation, and their properties.
- to enable the students to draw conclusions about the populations using the computed value of the parameters.

### Course Outcomes: On completion of the Course the student will be able to

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Construct contingency tables to test independence and homogeneity of the samples	<b>A</b>
<b>CO2</b>	Demonstrate approaches to include a measure of accuracy for estimation procedures.	<b>U</b>
<b>CO3</b>	Formulate estimators and test procedures based on point estimation.	<b>A</b>
<b>CO4</b>	Find the Cramer-Rao lower bound for the variances of unbiased estimators.	<b>U</b>
<b>CO5</b>	Compute confidence interval and confidence limit for a population parameter.	<b>U</b>
<b>CO6</b>	Analyze and interpret real time empirical data.	<b>A</b>

### R-Remembrance U –Understanding A-Apply

**Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
<p>Order Statistics – Cumulative Distribution Function of a Single Order Statistic – Probability Density Function of a Single Order Statistic – Joint p.d.f. of two Order Statistic – Joint p.d.f. of all n order Statistic – Distribution of Range and Other Systematic Statistics. Application of Chi-square Tests: Inferences about a Population Variance, Goodness of Fit, Test of Independence of Attributes- Contingency Tables – Yate’s Correction – Chi-square Test of Homogeneity of Correlation Coefficients.</p> <p>Chapter 9: Section 9.15; Chapter 15: Section 15.6 (15.6.1 – 15.6.4, 15.6.6)</p>	
<b>Unit II</b>	<b>(13 Hours)</b>
<p>Theory of Estimation: Parameter Space, Statistics, Estimators and Estimate – Characteristics of Estimators – Unbiasedness – Consistency – Invariance Property of Consistent Estimators – Sufficient Conditions for Consistency – Efficient Estimators – Most Efficient Estimator – Minimum Variance Unbiased Estimators – Simple Problems.</p> <p>Chapter 17: Sections: 17.1, 17.2 (17.2.2, 17.2.3)</p>	
<b>Unit III</b>	<b>(13 Hours)</b>
<p>Sufficiency – Neymann Factorization Theorem – Cramer-Rao Inequality – Conditions for the equality sign in Cramer-Rao Inequality – Complete Family of Distributions – MVU and Blackwellisation – Rao-Blackwell Theorem – Simple Problems.</p> <p>Chapter 17: Sections: 17.2.4, 17.3, 17.4, 17.5</p>	
<b>Unit IV</b>	<b>(13 Hours)</b>
<p>Methods of Estimation: Method of Maximum Likelihood Estimation – Properties of Maximum Likelihood Estimators – Method of Minimum Variance – Method of Moments – Method of Minimum Chi-square Estimation – Simple Problems.</p> <p>Chapter 17: Sections: 17.6</p>	
<b>Unit V</b>	<b>(13 Hours)</b>
<p>Interval estimation: Confidence Interval and Confidence Limits – Derivation of Confidence Interval based on Normal, t, Chi-square and F Distributions – Confidence Interval for Large Samples – Simple Problems.</p> <p>Chapter 17: Section: 17.7</p>	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Fundamentals of Mathematical Statistics	S.C Gupta and V.K. Kapoor	Sultan Chand & Sons, New Delhi, 2016 Reprint.

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Introduction of Mathematical Statistics	Robert V. Hogg and Allen T. Craig	Pearson Education, 2004
2	Statistical Inference	George Casella and Roger L. Berger	Cengage Learning, 2016

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics**  
**Semester V**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course Part III – Core VIII Sampling Theory</b>	<b>Course Code: 517W08</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks 75</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to create awareness on census surveys
- to introduce various sampling methods and the different types of populations to which the sampling methods are applicable.
- to provide skills to determine the efficiency of the estimators in various sampling methods.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Estimate the sample size for a research or a study.	U
CO2	Demonstrate the optimum results with the available sources at the disposal by studying the sample values.	U
CO3	Develop an understanding about different sampling methods based on probability and non-probability sampling	A
CO4	Obtain best possible estimates of the population parameters.	U
CO5	Increase the level of efficiency and cost reduction of sampling.	A
CO6	Evaluate mean and variance of the parameter based on different sampling methods.	A

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I</b>	<b>(13 Hours)</b>
Introduction – Parameter and Statistic – The Principal steps in a Sample Survey – Principles of sample survey – Sampling and Non-sampling errors – Merits of sampling Technique – Limitations of sampling. Book 1: Chapter 7 (Sections 7.1 – 7.7)	
<b>Unit II</b>	<b>(13 Hours)</b>
Types of Sampling – Simple Random Sampling: Selection of simple random sample – Notations and Terminology of SRS – Theorems related to Simple random sampling without and with replacement – Estimation of population mean and Variance – Merits and Demerits of Simple Random Sampling. Book 1: Chapter 7: Sections: 7.8, 7.9(7.9.2, 7.9.4, 7.9.5)	
<b>Unit III</b>	<b>(13 Hours)</b>
Stratified Random Sampling: Introduction – Advantages of Stratified Random Sampling – Notations and Terminology – Theorems related to Estimate of population mean and variance – Allocation of Sample Size – Comparison a Stratified Random Sampling with Simple Random Sampling without Stratification. Book 1: Chapter 7: Sections: 7.10 (7.10.1 – 7.10.4)	
<b>Unit IV</b>	<b>(13 Hours)</b>
Systematic Sampling – Notations and terminology – Variance of the estimated mean – Systematic Sampling versus Stratified Random Sampling – Merits and Demerits of systematic Sampling- Circular Systematic Sampling. Book 1: Chapter 7: Sections: 7.11 (7.11.1 – 7.11.3, 7.11.5, 7.11.6)	
<b>Unit V</b>	<b>(13 Hours)</b>
Single-Stage cluster sampling (clusters of equal sizes) – Reasons for Cluster Sampling – Variance in terms of Intracluster Correlation – Ratio estimators: Methods of Estimation – The Ratio Estimator – Estimation of variance from a sample – Comparison of the Ratio Estimate with the Mean per Unit – Bias of the ratio estimate. Book 2: Chapter 9 (Sections 9.1, 9.4); Chapter 6 (Sections 6.1, 6.2, 6.4, 6.6, 6.8)	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – IV	Fundamentals of Applied Statistics	V.K. Kapoor and S.C. Gupta	2017 Reprint, Sultan Chand & Sons, New Delhi.
V	Sampling Techniques	Cochran	2015, John Wiley & sons

Course Designed by :	Mrs. K. Kaviyamani	
Course Reviewed by :	Dr. S. Geetha	Dr. S. Geetha
Head of the Department :		

## B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Core IX Design of experiments	Course Code: 517W09
Semester: V	No. of Credits: 4
No. of hours : 75Hours	C:T: 65:10
CIA Max. Marks: 25	ESE Max. Marks: 75

(C: Contact hours, T: Tutorial)

### Course Objectives:

- to provide basic principles of experimentation
- to initiate discussions on the analysis of data relating to agriculture, biological sciences and industry.
- to impart the concept of analysis of variance
- to implement comparisons based on F distribution for various designs employed
- to imbibe estimation skills with missing observations and compare the efficiencies of various designs.

### Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Demonstrate the variation of information under conditions that are hypothesized to reflect the variation	U
CO2	Explain the partitioning of the total sum of squares into the 'within' and 'between' group components	R
CO3	Predict the outcome by introducing a change of pre-conditions, represented by one or more independent variables.	A
CO4	Study the effect of each factor on the response variable and the effects of interactions between factors on response variable	R
CO5	Increase statistical power by reducing the within-group error variance	A
CO6	Improve the robustness of the design or process.	A

### **R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I:</b>	<b>(15 Hours)</b>
Linear Model – Fixed, Mixed and Random Effect Models with examples – Analysis of Variance – Assumptions – ANOVA for One-Way and Two-Way Classifications for Fixed Effect Case – Estimators – Variance of the Estimators – Splitting Sum of Squares – Critical Difference.	
Book 1: Chapter 5 Sections 5.1, 5.2(5.2.1,5.2.2), 5.3(5.3.1,5.3.2)	
<b>Unit II</b>	<b>(11Hours)</b>
Experimentation – Terminology – Experimental Error – Principles of design – Uniformity trial – Completely Randomized Design(CRD) – Analysis of CRD – Merits and Demerits – Randomized Block Design(RBD) – Analysis of RBD – Merits and Demerits – Latin Square Design(LSD) – Analysis of LSD – Merits and Demerits.	
Book 1: Chapter 6 Sections 6.1 – 6.4, 6.5(6.5.1 – 6.5.5), 6.6(6.6.1 – 6.6.5)	
<b>Unit III</b>	<b>(13 Hours)</b>
Efficiency of RBD over CRD – Efficiency of LSD over RBD and CRD – Missing plot techniques in RBD and LSD with one and two missing observations.	
Book 1: Chapter 6 Sections 6.5(6.5.6, 6.5.7),6.6(6.6.6 – 6.6.8), 6.8	
<b>Unit IV</b>	<b>(13 Hours)</b>
Factorial Experiments – Advantages of Factorial Experiment over simple Experiment – Symmetrical and Asymmetrical Factorial Experiments – Analysis of $2^2$ , $2^3$ and $3^2$ Factorial Experiments.	
Book 1: Chapter 6 Section 6.9	
Book 2: Chapter 2 Sections 2.12	
<b>Unit V</b>	<b>(13 Hours)</b>
Analysis of Covariance – ANOCOVA in CRD and RBD with one concomitant variable – Split Plot Design and its Analysis (outline only)	
Book 1: Chapter 6 Sections 6.7, 6.12	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I-III	Fundamentals of Applied Statistics	Gupta S.C and Kapoor V.K,	Sultan Chand & sons, 2017 Reprint
IV- V	Fundamentals of Statistics (Vol. II)	A. M. Gun, M.K.Gupta & B Dasgupta	World Press, 9 <sup>th</sup> Edition, 2018 Reprint

**Books for Reference:**

S. No.	Name of the Book	Authors	Publishers with Edition
1	Design and Analysis of Experiments	Das, M.N. and Giri, N.L, Wiley Eastern	
2	Design and Analysis of Experiment,	Kempthorne,	Wiley Eastern Pvt. Ltd., Reprint 1967

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics**  
**Semester V**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core X Statistical Quality Control - I</b>	<b>Course Code: 517W10</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to introduce the concept of quality control and its need in real life.
- to impart knowledge of various tools used such as control charts and different sampling plans in quality aspects.
- Enable the students to skillfully handle the tools

**QCourse Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Describe the purpose and function of Quality control.	R
CO2	Demonstrate to control material reception, internal rejections, clients, claims and evaluation of the same corrective actions related to their follow-up.	U
CO3	Examine the difference between attributes and variables.	U
CO4	Measure and control the quality by monitoring the manufacturing process using various charts in quality system.	U



<b>CO5</b>	Develop and use the quality indicators to customer requirements and satisfaction and to the management.	<b>A</b>
<b>CO6</b>	Take decisions to accept or reject a lot using various sampling plans.	<b>A</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Quality Control – Quality characteristics – Cost of Quality – Optimum Cost of Performance – Value of Quality – Balance between the Cost and Value of Quality – Specification of Quality – Quality control and Inspection –Quality Policy – Statistical Quality Control – Benefits of SQC – Quality perspective. Book 1: Chapter 1 (Sections 1.9 – 1.20)	

<b>Unit II</b>	<b>(13Hours)</b>
Control Chart for Variables –Definition – Objectives – Control Limits – $\bar{X}$ R and $\sigma$ Charts – Simple Problems. Book 2: Chapter 1 (Section 1.8)	

<b>Unit III</b>	<b>(13 Hours)</b>
Control Chart for Attributes – np, p, c and u Charts –Comparison between Variable and Attribute Charts – Simple Problems. Book 2: Chapter 1 (Section 1.9)	

<b>Unit IV</b>	<b>(13 Hours)</b>
Acceptance Sampling Inspection Plans – Acceptance Sampling for Attributes – Producer’s Risk and Consumer’s Risk – OC, AOQ, ASN, AOQL and ATI curves – Single Sampling Plan – Derivation of OC, ASN and ATI – Double Sampling Plan – Derivation of OC, ASN and ATI – Single Sampling against Double Sampling Plans. Book 2: Chapter 1 Sections 1.11, 1.12(1.12.1 – 1.12.3)	

<b>Unit V</b>	<b>(13 Hours)</b>
Sequential Sampling Plan – Sequential Probability Ratio Test (SPRT) – Derivation of OC function of SPRT – Derivation of Five Points on OC Curve – Derivation of Five Points on ASN Curve. Book 2: Chapter 1 Section 1.12.4	

**Books for study:**

<b>Unit</b>	<b>Name of the Book</b>	<b>Authors</b>	<b>Publishers with Edition</b>
<b>I</b>	Statistical Quality Control	M. Mahajan	Dhanpat Rai & Sons, 2018 Reprint.
<b>II – V</b>	Fundamentals of Applied Statistics	S.C. Gupta and V. K. Kapoor	Sultan Chand & Sons, 2016 Reprint

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Quality Control,	E.L. Grant and R.S. Leavenworth	McGraw Hill (India) Pvt. Ltd., 2014, 22 <sup>nd</sup> Reprint
2	Introduction to Statistical Quality Control,	Douglas C. Montgomery	2008 Reprint, Wiley & Sons.

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

### B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Elective I Numerical Methods</b>	<b>Course Code: 517WE1</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to introduce interpolation concepts
- to effectively apply the appropriate formula for the data
- to provide knowledge about numerical integration as an alternative to direct integration.
- to develop problem solving skills.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Apply forward and backward interpolation in the correct context.	A
CO2	Demonstrate the application of central difference formula	U
CO3	Recognize the situations where interpolation with unequal intervals can be applied and apply the same.	R
CO4	Derive various numerical formulae	A
CO5	Compute derivatives of functions using interpolation methods	U

<b>CO6</b>	Compute integrals of functions using interpolation methods	<b>U</b>
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**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Finite differences: First difference-Express any value of $y$ in term of $y_n$ and the backward differences of $y_n$ – Differences of a polynomial – Factorial polynomial. Interpolation (for Equal Intervals): Introduction – Gregory-Newton forward Interpolation formula – Gregory-Newton backward Interpolation Formula – Equidistant terms with one or more missing values. Chapter 5 (Sections 5.1 – 5.4); Chapter 6 (Sections 6.1 – 6.3, 6.7)	
<b>Unit II</b>	<b>(13 Hours)</b>
Central Difference Interpolation formulae (For Equal Intervals): Central differences and central difference table – Central difference interpolation formula – Gauss’s forward interpolation formula – Gauss’s backward interpolation formula – Stirling’s formula – Bessel’s formula. Chapter 7 (Sections 7.1 – 7.6)	
<b>Unit III</b>	<b>(13 Hours)</b>
Interpolation With Unequal Intervals: Introduction – Divided differences – Properties of divided differences – Relation between divided differences and forward differences – Theorem: Newton’s interpolation formula for unequal intervals – Deduction: Deduce Gregory Newton interpolation forward formula for equal intervals – Lagrange’s interpolation formula (for unequal intervals) – Different form of Lagrange’s interpolation formula – Inverse Interpolation. Chapter 8 (Sections 8.1 – 8.8)	
<b>Unit IV</b>	<b>(13 Hours)</b>
Numerical differentiation and Integration: Introduction – Newton’s forward difference formula to get the derivative – Newton’s backward difference formula to compute the derivative – Derivative using Stirling’s formula – To find maxima and minima of the function given the tabular values. Chapter 9 (Sections 9.1 – 9.6)	
<b>Unit V</b>	<b>(13 Hours)</b>
Numerical Integration: Introduction – Trapezoidal rule – Simpson’s one-third rule – Simpson’s three-eighths rule. Numerical Solution of Ordinary Differential Equations: Introduction – Solution by Taylor Series (Type I) – Euler’s Series – Runge-Kutta Method. Chapter 9 (Sections 9.7, 9.9, 9.13 & 9.14) Chapter 11(Sections 11.5, 11.9, 11.12)	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Numerical Methods,	Dr.P.Kandasamy, Dr.K.Thilagavathy and Dr.K.Gunavathi,	S.Chand & Company limited, Reprint 2012,

**Books for Reference:**

S. No	Name of the Book	Authors	Publisherswith Edition
1	Numerical Methods in Science and Engineering,	Dr. M.K.Venkataraman	National Publishing company, 5 <sup>th</sup> edition, 1995
2	Finite differences and Numerical Analysis	H.C.Saxena,	S.Chand & Company Ltd., New Delhi, 2001
<b>Course Designed by :</b>		<b>Mrs. T. Vanjikkodi</b>	
<b>Course Reviewed by :</b>		<b>Mrs. A. Samsath</b>	
<b>Head of the Department :</b>			

## B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Elective I Biostatistics</b>	<b>Course Code: 517WE2</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>P:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(P: Practical hours, T: Tutorial)

**Course Objectives:**

- to provide appropriate statistical methods for the biological study.
- to identify and communicate findings from the biomedical research.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Compare the means of two or more than two samples simultaneously.	U
CO2	Evaluate the multiple regression coefficients and the suitability of the regression model.	A
CO3	Determining the association of variables used in the research.	U
CO4	Calculate and interpret the data using a wide variety of distribution free tests.	U

<b>CO5</b>	Develop and use survival curves to make conclusions of research work.	<b>A</b>
<b>CO6</b>	Interpreting the biological studies using various statistical tools.	<b>U</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:****List of Programs**

1. Application of t test in homozygous sickle-cell disease.
2. Application of paired t test for examining gallbladder function before and after fundoplication.
3. Application of Randomized Block Design in the comparison of methods for teaching patients to use a certain prosthetic device by a Physiotherapist.
4. Application of Two-way Analysis of Variance in examining the subjects with chronic, nonspecific low back pain.
5. Application of Correlation to analyze somatosensory evoked potentials and their Interactions.
6. Application of Multiple Regression in predicting the capacity to direct attention in elderly subjects using children age and education level.
7. Examine the association of short-term clinical, economic and humanistic outcomes of pharmaceutical care services for patients with diabetes using Chi-square Test.
8. Application of Sign test to test the mentally retarded girls while giving instruction in personal care and grooming for two weeks.
9. Investigating the measurement of cardiac output of post cardiac surgical patients in the left lateral position by using Wilcoxon Signed Rank Test.
10. Investigating the level of mental health of urban and rural male junior high school students by using the Median Test.
11. Experimenting the effects of prolonged inhalation of cadmium oxide which reduces hemoglobin level by using Mann-Whitney U Test.
12. Examining the fasting blood glucose determinations by using Kolmogorov-Smirnov Test.
13. Examining the relationship between age and mineral concentration using Spearman Rank Correlation.
14. Assessing results and identifying predictors of survival by reviewing the primary malignant tumors of the sternum by using the Kaplan-Mier Procedure.
15. To determine whether time to relapse among drug users is related to patient age and drug of choice using Hazard Regression Model.

**Book for Reference:**

<b>S. No</b>	<b>Name of the Book</b>	<b>Authors</b>	<b>Publishers with Edition</b>
1.	Biostatistics – Basic concepts and Methodology for the Health Sciences	Wayne W Daniel & Cad L. Cross	Wiley International, 2015 Reprint.

Course Designed by :	Mrs. S. Saranya	
Course Reviewed by :	Dr. G. Uma	Dr. G. Uma
Head of the Department :		

### B.Sc. Statistics Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Core XI Statistical Inference - II	Course Code: 617W11
Semester: VI	No. of Credits: 4
No. of hours : 75 (Total hours)	C:T: 65:10
CIA Max. Marks: 25	ESE Max. Marks: 75

(C: Contact hours, T: Tutorial)

#### Course Objectives:

- to impart knowledge on the methods of testing the hypothesis on different distributions.
- to educate the students to identify the areas of application of Neyman-Pearson Lemma.
- to provide a complete knowledge about testing procedures of means and variances
- to teach the fundamentals of sequential analysis.
- to enable the students to distinguish parametric and non-parametric methods.

#### Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Demonstrate the plausibility of pre-specified ideas about the parameters of the model by examining the area of hypothesis testing.	U
CO2	Identify the components of a classical hypothesis test including two types of errors, null and alternative hypothesis.	R
CO3	Demonstrate the theory of likelihood ratio test to test the significance of samples	U
CO4	Critically examine sequential procedures for appropriate statistical analysis.	U
CO5	Demonstrate the use of non-parametric statistical methods and to interpret and analyze the results.	U
CO6	Use the learnt statistical methods to analyze certain real life data	A

#### R-Remembrance U –Understanding A-Apply

**Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Testing of statistical Hypothesis – Simple and composite hypothesis null and alternative hypothesis –Critical Region – Types of errors – level of significance – size of the test – power of the test – Steps involved in testing of hypothesis. Chapter 18 Sections 18.1 – 18.3	
<b>Unit II</b>	<b>(13 Hours)</b>
Randomized and Non Randomized Test – Most Powerful Test – Neyman-Pearson Lemma and its applications – Unbiased test and unbiased critical Region – Optimum regions and sufficient statistics – Uniformly Most Powerful Critical Region – simple problems. Chapter 18 Sections 18.4, 18.5	
<b>Unit III</b>	<b>(13 Hours)</b>
Test of Significance – Test of significance for Single Proportion, difference of Proportions – Test of Significance for Single Mean, difference of Means – Test of Significance for the difference of Standard Deviation – Bartlett’s Test. Chapter 14 Sections 14.7, 14.8	
<b>Unit IV</b>	<b>(13 Hours)</b>
Likelihood ratio test – Test Procedure – Properties – Simple Problems – Sequential Analysis: Introduction – Sequential Probability Ratio Test (SPRT)-Operating Characteristic Function of SPRT – Average Sample Number – Simple Problems. Chapter 18 Sections 18.6(16.6.1), 18.8	
<b>Unit V</b>	<b>(13 Hours)</b>
Non-parametric Methods – Comparison between Parametric and Non-Parametric Methods – Run Test, Test for Randomness, Median Test, Sign Test, Mann-Whitney U Test – Kolmogorov-Smirnov Tests – Simple Problems. Chapter 18 Section 18.7	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Fundamentals of Mathematical Statistics	S.C Gupta and V.K. Kapoor	Sultan Chand & Sons, New Delhi, 2016 Reprint.

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Introduction to Mathematical Statistics	Robert V. Hogg and Allen T. Craig	Pearson Education, 5 <sup>th</sup> Edition, 2004
2	Statistical Inference,	George Casella, Roger C. Berger	Cengage Learning India Pvt. Ltd., 2016 Reprint. .

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics**  
**Semester VI**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course Part III – Core XII Statistical Quality Control -II</b>	<b>Course Code: 617W12</b>
<b>Semester: VI</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to expose the concepts of total quality management used in industries, quality system standards and reliability concepts to control the quality of industrial outputs.
- to create awareness about the ISO quality standards of institutions
- to equip the students with various tools of TQM.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
<b>CO1</b>	Apply and evaluate best practices for the attainment of total quality.	<b>A</b>
<b>CO2</b>	Develop various operating cost components and applications of JIT for operations management.	<b>A</b>
<b>CO3</b>	Elucidate the functioning and application of six-sigma in process control	<b>U</b>
<b>CO4</b>	Explain how ISO 9000 series is used in attaining quality standards	<b>U</b>



<b>CO5</b>	Demonstrate the fundamental concepts and methodologies used in reliability analysis.	<b>U</b>
<b>CO6</b>	Follow ethics while implementing the tools of TQM	<b>R</b>

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Total Quality Management (TQM) – Need for management of product quality – concept of TQM – TQM philosophies – TQM models – Dimensions of TQM – Elements of TQM. Book 1: Chapter 2(Sections 2.1 – 2.4, 2.12)	
<b>Unit II</b>	<b>(13 Hours)</b>
Waste Control Management – Just-in-time Manufacturing (JIT) – Characteristics, Goals – Elements of JIT – Kanban System – Functions, Rules – Benefits of JIT – Limitations of JIT – Total Quality Management for Excellence. Book 1: Chapter Sections 2.23, 2.25, 2.26	
<b>Unit III</b>	<b>(13 Hours)</b>
Statistical Process Control (SPC) – Evolution of six sigma quality approach – the mathematics of six sigma – Practical approach to six sigma quality – TQM and six sigma – Six sigma concept of process capability – Six sigma and Indian industries. Book 1: Chapter 3(Section 3.18) Book 1: Chapter 17	
<b>Unit IV</b>	<b>(13 Hours)</b>
Quality system standards – ISO Standards – Features of ISO: 9000 series standards – Various elements in ISO: 9001 model – ISO implementation – ISO 9001: 2008 – Transition to ISO 9001:2015 – Introduction – Revision process – user groups – Implementation guidelines. Book 2: Chapter 5( Sections 5.6, 5.8) <a href="http://">Http://</a> ISO 9001:2015 implementation guidance	
<b>Unit V</b>	<b>(13 Hours)</b>
Reliability – Quality Control and Reliability – Basic Elements of Reliability – Achievement of Reliability – Designing, Measurement, Cost, Maintenance and Availability – Failure Mode Effect and Criticality Analysis (FMECA) – Failure Rate and Hazard Function – Constant Hazard Mode – Linear Hazard Model – Mean time to failure. Book 1: Chapter 13(Sections 13.1 – 13.6)	

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
<b>I – III &amp; V</b>	Statistical Quality Control	M. Mahajan	Dhanpat Rai & Sons, 2018 Reprint
<b>IV</b>	Total quality Management	Dr. K. Maran and Dr. K. Raja	Eswar Press, Chennai, 2009 Reprint

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Quality Control,	E.L. Grant and R.S. Leavenworth,	McGraw Hill (India) Pvt. Ltd., 2014 Reprint

## B.Sc Statistics Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Elective II Matrices</b>	<b>Course Code: 617WE4</b>
<b>Semester: VI</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

**Course Objectives:**

- to identify a system of linear equations and describe its solution set.
- to exploit elementary operations to reduce matrices to echelon forms.
- to be aware of the various characterizations of an invertible matrix.
- to apply the properties of determinants in their calculation
- □

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
<b>CO1</b>	Perform common matrix operations such as addition, multiplication and transposition.	<b>U</b>

<b>CO2</b>	Solve a system of linear equations and find out the feasible solution.	<b>A</b>
<b>CO3</b>	Establish a sufficient condition for invertibility in terms of elementary matrices.	<b>A</b>
<b>CO4</b>	Apply elementary transformations to reduce the matrix to Echelon and normal form and determine its rank.	<b>A</b>
<b>CO5</b>	Finding powers of a matrix and determining matrix inverse using Cayley-Hamilton Theorem.	<b>U</b>
<b>CO6</b>	Interpret existence and uniqueness of solutions geometrically.	<b>U</b>

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I</b>	<b>(13 Hours)</b>
Definition of a Matrix – Notations – Difference between a Matrix and a Determinant – Kinds of Matrices – Equality of Matrices – Addition of Matrices – Subtraction of Matrices – Properties of Matrix Addition – Multiplication of Two Matrices – Properties of Matrix Multiplication – Matrix Polynomial – Transpose of a Matrix –Symmetric and Skew-Symmetric Matrices – Conjugate of a Matrix – Hermitian Matrix – Skew-Hermitian Matrix – Simple Problems. Chapter 1: Page No.: 3 – 62; Chapter 2: Page No.: 67 – 105	

<b>Unit II</b>	<b>(13 Hours)</b>
Determinants – Minor Determinants – Cofactor of an Element – Properties of the Determinants – Notations – Product of two Determinants – Product of Two determinants of different Orders – Adjoint Determinant – Complementary Minor of a Determinant – Laplace Expansion of a determinant by the minors of first r columns – Cramer’s Rule – Symmetric and Skew-Symmetric Determinant – Simple Problems. Chapter 3: Page No.: 137 – 228	

<b>Unit III</b>	<b>(13 Hours)</b>
Adjoint of a Matrix – Inverse of a Matrix – Inversion of a Matrix by solving Algebraic Equations – Elementary Operations and Elementary Matrices – Symbols to be used for Elementary Transformations – Inverse of the Elementary Transformation – Symbols for Elementary Matrices – Equivalent Matrices – Reduction of a Matrix to Triangular Form – Partitioning of Matrices – Identically Partitioned Matrices – Matrices Partitioned Conformably for Multiplication. Chapter 4: Page No.: 229 – 336	

<b>Unit IV</b>	<b>(13 Hours)</b>
Rank of a Matrix – Sub-Matrix – Minor of a Matrix – Rank of a Matrix – Nullity of a Matrix – Invariance of Rank through Elementary Transformations – Normal Form – Procedure for Reduction to Normal Form – Rank of a Matrix Product – Simple Problems. Chapter 5: Page No.: 337 – 389	

<b>Unit V</b>	<b>(13 Hours)</b>
Characteristic Roots and Vectors: Matrix Polynomial – Equality of Two Matrix Polynomials – Mapping or Function or Transformation – Linear Transformation – Characteristic Roots and Vectors – Characteristic Value Problem – Some Definitions – Cayley-Hamilton Theorem – Simple Problems. Chapter 8: Page No.: 450 – 506	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	A Textbook of Matrices,	Hari Kishan,	Atlantic Publishers, NewDelhi, 2008.

**Book for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Matrices	A.R.Vasishtha and A.K.Vasishtha	Krishna Prakashan Media(P) Ltd., 18 <sup>th</sup> Edition, 2008.

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Mrs. T. Vanjikkodi</b>	
<b>Head of the Department :</b>		

**B.Sc. Statistics**  
**Semester VI**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III– Elective III – Psychological Statistics</b>	<b>Course Code: 617WE5</b>
<b>Semester: VI</b>	<b>No. of Credits: 3</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to gain knowledge in the application of scaling procedure and different types of rank correlation.
- to demonstrate the kinds of evidence that would be relevant to assessing the reliability and validity of a particular measure.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Measure the degree of similarity between the variables by using different ranking techniques.	U
CO2	Determine an ordinal relationship between rankings of different ordinal variable or different rankings of same variable.	U
CO3	Identify the consistency of a measure using reliability techniques.	R
CO4	Examines the issues involved in developing and validating multi-item self report scales of latent constructs.	U
CO5	Predict the relationship between the variables in psychological research.	A
CO6	Classify the research methods used in psychology and apply the statistical techniques used in psychological research.	A

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Introduction – Some Scaling Procedures – Scaling Individual Test Items in Terms of Difficulty – Scaling of scores on a test – $z$ or $\sigma$ Scores, Standard Scores, Normalized Scores, T-Score, Percentile Scores – Scaling of Ranking in terms of Normal probability curve – scaling of ratings in terms of Normal probability curve. Book 1: Chapter 8( Sections 8.1, 8.2)	
<b>Unit II</b>	<b>(13 Hours)</b>
Reliability of Test Scores – Definition of Reliability – Index of Reliability – Methods of Determining Test Reliability – The Test-Retest Methods – Alternate or Parallel form Method – Split-half method – The Rulon Method – Method of Rational Equivalence. Book 1: Chapter 8( Sections 8.3 – 8.3.4)	
<b>Unit III</b>	<b>(13 Hours)</b>
Validity of Test Scores – Estimation of Validity – Types of Validity – Validity and Test Length – Comparison between reliability and validity – Intelligence tests and Intelligence Quotient. Book 1: Chapter 8( Sections 8.4, 8.5)	
<b>Unit IV</b>	<b>(13 Hours)</b>

Correlation Ratio – Intra-Class Correlation – Multiple and Partial Correlation – Coefficient of Partial Correlation – Coefficient of Multiple Correlation – Simple Problem.  
Book 3: Chapter 12 (Sections 12.1, 12.2, 12.4, 12.7, 12.8)

**Unit V****(13 Hours)**

Correlation from Ranks –Biserial Correlation –Correlation from four-fold table – The Contingency Coefficient – Curvilinear or Non-linear Relationship.  
Book 2: Chapter 14

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I-III	Fundamental of Applied Statistics	S.C. Gupta and V.K. Kapoor	Sultan Chand & Sons, 2017 Reprint
V	Statistics in psychology and Education	Henry E Garrett	2014 Reprint, Paragon International publisher
IV	Fundamentals of Mathematical Statistics	S.C. Gupta and V.K. Kapoor	2016 Reprint, Sultan Chand & Sons

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

### Syllabus having direct bearing on Entrepreneurship Development

**B.Sc. Statistics****Semester VI**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core Practical III Statistical Practical-III (Using SPSS)</b>	<b>Course Code: 617WP3</b>
<b>Semester: VI</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 60 Hours</b>	<b>P:T: 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(T: Tutorial, P: Practical)**

**Course Objectives:**

The objectives of this course are

\_\_\_\_\_ to impart the fundamental features of SPSS

to secure knowledge in analyzing the data using SPSS software package.

to train the students to apply the appropriate statistical tools for data analysis.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Interpret results using various types of charts.	U
CO2	Carryout inferential statistical analysis using SPSS.	A
CO3	Test the significant relationship between the variables and interpret the result	A
CO4	Independently use the various tools to analyze real time data.	A

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

List of Programs	(52 Hours)
<ol style="list-style-type: none"> <li>1. Bar Chart, Line Chart, Pie Chart.</li> <li>2. Scatter Plots and Histograms.</li> <li>3. Construction of Frequency Distribution.</li> <li>4. Measures of Central tendency.</li> <li>5. Measures of Dispersion.</li> <li>6. Correlation.</li> <li>7. Linear Regression.</li> <li>8. t-test with one sample.</li> <li>9. Paired t test.</li> <li>10. Independent sample t test.</li> <li>11. ANOVA – One-way.</li> <li>12. ANOVA – Two- way.</li> <li>13. Non-Parametric Analysis: Chi-square test for goodness of fit,</li> <li>14. Spearman's Rank correlation</li> <li>15. Mann-Whitney U test.</li> <li>16. Wilcoxon signed rank test</li> <li>17. Kruskal-Wallis Test.</li> <li>18. Sign Test.</li> <li>19. Median Test.</li> <li>20. Kolmogorov-Smirnov Test.</li> <li>21. Control Charts for Attributes.</li> <li>22. Control Charts for Variables.</li> </ol>	

**Books for Reference:**

S. No.	Name of the Book	Authors	Publishers with Edition
1	SPSS 17.0 for	Dr. S. L Gupta and Hitesh	International Book House

	Researchers	Gupta	Pvt. Ltd., 2011 Reprint
2	Using SPSS-Interactive Hands on Approach	James B. Cunningham, James O.Aldrich	Sage Publications India Pvt. Ltd., 2012 Reprint
3	SPSS for you	A. Rajathi and P. Chandran	MJP Publisher, 2010 Reprint.

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

### B.Sc. Statistics Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Elective II Operations Research</b>	<b>Course Code: 617WE3</b>
<b>Semester: VI</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

#### Course Objectives:

The objectives of this course are

- to introduce the fundamentals of optimization techniques .
- to formulate a real life problem into a linear programming model.
- to solve and interpret the solutions of the LPP model
- to efficiently allocate resources
- to create an awareness of the application of optimization in inventory control
- to expose the networking techniques to the students

#### Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Formulate and solve linear programming problems using appropriate techniques and interpret the results obtained.	A
CO2	Build and solve transportation models and assignment models.	A
CO3	Propose good strategies in two person zero sum games.	R
CO4	Optimize the outputs in terms of time, cost or profit	U
CO5	Predict the profit and cost expenses in a simple inventory system	A



<b>CO6</b>	Compute the necessary parameters in a network	<b>U</b>
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**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Linear Programming: Introduction – Linear Programming Problem. Graphical Solution and Extension: Introduction - Graphical solution method – some exceptional cases-General Linear Programming Problem – Canonical and Standard forms of LPP – Simplex method: Introduction – computational Procedure – Use of Artificial Variables (Big M method only). Chapter 2(Section 2.1,2.2) Chapter, 3(3.1-3.5),Chapter 4(Sections 4.1 ,4.3, 4.4)	
<b>Unit II</b>	<b>(13 Hours)</b>
Transportation Problem : Introduction – LP formulation of the transportation Problem – The transportation table – Loops in transportation tables – Finding an initial basis feasible solution: North west corner method – least-cost method – Vogel’s Approximation method – Test for Optimality – Transportation Algorithm (MODI METHOD). Assignment Problem: Introduction – Mathematical formulation of the problem –Solution Method of Assignment problems. Chapter 10 (Sections 10.1,10.2, 10.5 , 10.6, 10.9,10.10,10.12,10.13), Chapter 11 (Sections 11.1 – 11.3)	
<b>Unit III</b>	<b>(13 Hours)</b>
Sequencing problem: Introduction – Problem of sequencing – Basic terms used in sequencing – Processing n Jobs through two machines - Processing n Jobs through k machines - Processing 2 Jobs through k machines. Games and Strategies: Introduction – Two- Person Zero-sum game – some basic terms – The Maximin-Minimax Principle – Games without Saddle point – mixed strategies -Graphical Solution of $2 \times n$ and $m \times 2$ games. Chapter 12 (Sections 12.1 – 12.6); Chapter 17 (Sections 17.1 – 17.6)	
<b>Unit IV</b>	<b>(13 Hours)</b>
Inventory Control I: Introduction – Types of inventories – Reasons for carrying inventories – The inventory decisions – Objectives of scientific inventory control – Costs associated with inventories – Factors affecting inventory control – An inventory control problem – The concept of EOQ – Deterministic inventory problems with no shortages – Deterministic inventory problems with shortages – Problems of EOQ with price breaks. Chapter 19 (Sections 19.1 – 19.12)	
<b>Unit V</b>	<b>(13 Hours)</b>

Network scheduling by PERT/CPM: Introduction – Network: Basic Components – Logical Sequencing – Rules of Network Construction – concurrent Activities – Critical Path Analysis – Probability Considerations in PERT – Distinction between PERT and CPM .  
Chapter 25 (Sections 25.1 – 25.8)

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Operations Research,	Kantiswarup, P.K. Gupta and Manmohan	Sultan Chand and Sons, New Delhi, 18 <sup>th</sup> Edition, 2015 Reprint

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Operations Research – Theory and Applications	J.K.Sharma,	Macmillan India Ltd, 4 <sup>th</sup> edition, 2012.
2	Operations Research: An Introduction	Hamdy A. Taha	Pearson India Education Pvt. Ltd., 2016 Reprint

<b>Course Designed by :</b>	<b>Ms. J.P. Thempaavai</b>	
<b>Course Reviewed by :</b>	<b>Ms. J. Priyadharshini</b>	
<b>Head of the Department :</b>		

**Syllabus having direct bearing on Skill Development****B.Sc. Statistics  
Semester II****(For the students admitted during the academic year 2017 – 2018 and onwards)**

<b>Course: Part III – Core Practical I Statistical Practical I</b>	<b>Course Code: 217WP1</b>
<b>Semester: II</b>	<b>No. of Credits: 3</b>
<b>No. of hours : 90 (Total hours)</b>	<b>T:P: 75:15</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(T:Tutorial, P:Practical)****Course Objectives:**

The objectives of this course are to

- | demonstrate the features of MS-Excel to handle the Basic Measures of Statistics and Forecasting Techniques.
- | Handle the data with ease to compute various statistical measures

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Apply the fundamental concepts in exploratory data analysis using MS Excel.	<b>A</b>
<b>CO2</b>	Construct the types of charts using MS Excel.	<b>A</b>
<b>CO3</b>	Calculate various measures of Descriptive Statistics using MS Excel.	<b>U</b>
<b>CO4</b>	Fit curves using MS Excel.	<b>U</b>
<b>CO5</b>	Apply the appropriate forecasting techniques to a given data.	<b>A</b>
<b>CO6</b>	Predict the price index for a real time data.	<b>A</b>

**R-Remembrance   U-Understanding   A-Apply**

**Syllabus:**

<b>List of Programs</b>	<b>75 hrs</b>
1. Formation of frequency distribution. Calculation of Arithmetic, Geometric Mean, Median and Mode. Calculation of Percentile. 2. Formation of Charts and Diagrams: Histogram, Bar diagram, Pie diagram Frequency Line, Scatter diagram. Formation of Ogive curves. 3. Calculation of Measures of Dispersion: Range, Variance, Standard Deviation, Mean deviation, Quartiles. 4. Calculation of Skewness and kurtosis. 5. Problems related to curve fitting. 6. Calculation of Correlation and Regression coefficients and formation of Regression lines. 7. Fitting straight line, non-linear trend lines and calculation of trend values using Moving averages. 8. Calculation of Index Numbers.	

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics  
Semester III**

**(For the students admitted during the academic year 2017 – 2018 and onwards)**

<b>Course: Part III – Core V Probability Distribution I</b>	<b>Course Code: 317W05</b>
<b>Semester: III</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 45 (Total hours)</b>	<b>C:T: 39:6</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

**(C: Contact hours, T: Tutorial)**

**Course Objectives:**

The objectives of this course are to

- | To gather a strong foundation in the concepts of random variable and a probability distribution.
- | To enable the students to distinguish between discrete and continuous random variables and to identify joint, marginal, conditional probability functions, expectation, conditional expectation and variance, generating functions
- | To enable the students to utilize the functions on law of large numbers and central limit theorem and thereby apply the same.

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>

<b>CO1</b>	Identify and predict types of variables.	<b>A</b>
<b>CO2</b>	Find the probabilities associated with a discrete probability distribution.	<b>U</b>
<b>CO3</b>	Compute the joint, marginal and continuous distribution functions for random variables.	<b>U</b>
<b>CO4</b>	Interpret the mean of a random variable in terms of the law of large number	<b>U</b>
<b>CO5</b>	Calculate the probabilities of mass and density function of random variables.	<b>U</b>
<b>CO6</b>	Apply central limit theorem to problems involving sums and averages from probability distributions.	<b>A</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(8 Hours)</b>
Random variables – Discrete and Continuous random variables – distribution function – Properties – Probability Mass function and Probability density function – various statistical measures of continuous probability distribution. Book 1: Chapter 5: (Sections 5.1 – 5.4)	
<b>Unit II</b>	<b>(8 Hours)</b>
Joint, marginal and conditional distribution functions and density functions – independence of random variables – Transformation of variables (one and two dimensional – concepts only). Book 1: Chapter 5: (Sections 5.5 – 5.7)	
<b>Unit III</b>	<b>(8 Hours)</b>
Mathematical Expectation –properties – addition and multiplication theorems – Cauchy-Schwartz inequality, conditional expectation and conditional variance. Book 1: Chapter 6 (fully)	
<b>Unit IV</b>	<b>(7 Hours)</b>
Moment Generating function, Cumulant Generating function, characteristic function and their properties. Book 1: Chapter 7:(Sections 7.1 – 7.3)	
<b>Unit V</b>	<b>(8 Hours)</b>
Tchebychev's inequality, convergence in probability, weak law of large numbers and central limit theorem. Book 1: Chapter 7: (Sections 7.5 – 7.7) Book 2: Chapter 5: Section: 5.4 (Pages 192–195)	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Fundamentals of Mathematical Statistics	Gupta.S.C and Kapoor.V.K	Sultan Chand & sons, 2016 Reprint
V	Introduction to Mathematical Statistics	R.V and Craig.A.G	Amerind Publication, 2004 Reprint.

Course Designed by :	Mrs. K. Kaviyamani	
Course Reviewed by :	Dr. S. Geetha	Dr. S. Geetha
Head of the Department :		

### B.Sc. Statistics Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Allied III Computer Programming for Statistical Analysis – I	Course Code: 317AW3
Semester: III	No. of Credits: 3
No. of hours : 75 (Total hours)	C:T: 65:10
CIA Max. Marks: 25	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

#### Course Objectives:

The objectives of this course are to

- | Introduce the programming concepts for statistical analysis
- | Enable the use of different types of operators, decision making statements, arrays and functions in the appropriate context.
- | Construct programs with a professional outlook that serves to operate on real time data.

#### Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Develop simple programs using the basic elements like control statements, arrays and strings.	A
CO2	Apply the concept of arrays to represent statistical data.	A
CO3	Illustrate the code reusability with the help of user defined functions.	U
CO4	Use string handling functions to address string oriented problems.	U
CO5	Utilize the structures to represent statistical problems and manipulate the data efficiently.	A

<b>CO6</b>	Develop programs for simple applications in an ethical manner.	<b>A</b>
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**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 hours)</b>
<p>Constants, Variables and Data types: Introduction – Character set- C tokens –Keywords and identifiers – Constants- Variables – Data types – Declaration of variables – Declaration of storage class-Assigning Values to variables – Defining symbolic constants – Declaring a variable as constant – Declaring a variable as Volatile. Operators and Expression: Introduction – Arithmetic operators – Relational operators – Logical operators – Assignment Operators – Increment and decrement operators – Conditional operator – Bit wise operators – Special operators – Arithmetic Expressions – Evaluation of expressions – Precedence of Arithmetic Operators – Some computational problems – Type Conversions in Expressions – Operator precedence and associativity – Mathematical functions. Chapter 2 and Chapter 3 (Pages 22 – 82)</p>	
<b>Unit II</b>	<b>(13 hours)</b>
<p>Managing Input and Output Operations: Introduction – Reading a Character – Writing a character – Formatted Input – Formatted Output. Decision making and branching: Introduction – Decision making with IF statement – Simple IF statement – The IF...ELSE statement – Nesting of IF...ELSE statements – The ELSE IF ladder – The switch statement – The ?: operator – The GOTO statement. Chapter 4 and Chapter 5 (Pages 83 – 150)</p>	
<b>Unit III</b>	<b>(13 hours)</b>
<p>Decision making and looping: Introduction – The WHILE statement – The DO statement – The FOR statement – Jumps in loops. Arrays: Introduction – One dimensional arrays – Declaration of one dimensional arrays – Initialization of One dimensional arrays – Two dimensional arrays – Initializing two dimensional arrays – Multi-dimensional arrays. Chapter 6 and Chapter 7 (Pages 151 – 236)</p>	
<b>Unit IV</b>	<b>(13 hours)</b>
<p>Character arrays and strings: Introduction – Declaring and initializing string variables – Reading strings from terminal – Writing strings to screen – Arithmetic operations on characters – Putting strings together – Comparison of two strings – String handling functions. User-Defined functions: Introduction – Need for user defined functions – A multi-function program –Elements of user defined functions – Definition of functions – Return values and their types – Function calls – Function Declaration – Category of functions – No arguments and no return values – Arguments but no return values – Arguments with return values – No arguments but returns a value – functions that return multiple values – Nesting of functions – Recursion – Passing Arrays to functions – Passing strings to functions – The scope, visibility and lifetime of Variables. Chapter 8 and Chapter 9 (Pages 237 – 323)</p>	

<b>Unit V</b>	<b>(13 hours)</b>
Structures and Unions: Introduction-Defining a Structure – Declaring Structure variables – Accessing Structure members – Structure Initialization Copying and comparing Structure variables – Operations on Individual members – Arrays of Structure – Arrays within Structures – Structures within Structures – Structures and functions – Unions – Size of Structures. Pointers: Introduction – Understanding Pointers – Accessing the Address of a Variable – Declaring Pointer Variables – Initialization of Pointer Variables – Accessing a Variables through its Pointer – Chain of Pointers – Pointer Expressions – Pointer Increments and Scale Factor-Pointers and Arrays – Pointers and Character Strings – Array of Pointers – Pointers as Function Arguments –Functions Returning Pointers –Pointers to Functions – Pointers and Structures – Troubles with Pointers. Chapter 10 and Chapter 11 (Pages 324 – 394)	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Programming in ANSI C	Balagurusamy. E	Tata McGraw Hill Education Private Limited, Seventh Edition 2017.

**Book for Reference:**

S.No.	Name of the Book	Authors	Publishers with Edition
1.	Let us C	Yaswant Kanetker	BPB publications New Delhi, 2018 Reprint

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics  
Semester III**

**(For students admitted during the academic year 2020-2021 only)**

<b>Course: Part IV: Skill Enhancement Course I-Professional English for Statistics</b>	<b>Course Code: 321WS1</b>
<b>Semester: III</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 45 hours</b>	<b>C: T : 39:6</b>
<b>CIA Max. Marks: 100</b>	<b>ESE Max. Marks: -</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To nurture the language skills of students in their discipline of study.
- To develop their lexical and grammatical competence in English.
- To guide them in appropriate and comprehensive use of the statistical terms so as improve their employable skills.



- To enhance the creativity of the students, and enable them to think of innovative ways to express their thoughts.
- To imbibe confidence in oral presentations in professional interviews, conferences or meetings.
- To provide training to develop their skills in writing reports and research proposals.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Develop listening skills and comprehend the keywords specific to statistics thereby improving their aural competence.	U
CO2	Prohibit correct usage of words in oral presentations with confidence.	A
CO3	Read and interpret unfamiliar texts and explain/write summary with clarity.	U
CO4	Write reports for simple case studies and data analysis.	A

U –Understanding A-Apply

Syllabus:

Unit I	(7Hours)
<p>Communication</p> <p>Listening: Listening to Instructions. Effectively understanding and correlating the essentials to respond appropriately and quickly. Listening to TED talks</p> <p>Speaking: Group discussions based on TED talks. Individual oral presentation based on listening to TED talks.</p> <p>Reading: Reading aloud to improve articulation.</p> <p>Writing: Reading diagrammatic information - interpretations maps, graphs and pie charts</p> <p>Vocabulary: Oral and written description of statistical terminology.</p>	
Unit II	(8Hours)
<p>Persuasive Communication</p> <p>Listening: Listening to advertisements - sensitizing learners to the nuances of persuasive communication – statistical analysis of data – responsiveness after listening</p> <p>Speaking: Debates on statistical interpretations of data–Just-A Minute activities regarding statistical tool usage.</p> <p>Reading: Reading texts on advertisements(on products relevant of the subject areas)and answering inferential questions.</p> <p>Writing: Writing an argumentative/persuasive essay on business strategies of industrialists.</p>	
Unit III	(8Hours)
<p>Digital competence</p> <p>Listening: Listen to audio and video lectures and use technology to appropriately integrate the ideas and create an audio or video file.</p> <p>Speaking: communicate, manage information and collaborate effectively Online. Creating Vlogs.</p> <p>Reading: Reading digital content, interpret the content and prepare and present a comprehensive report orally or in written forms.</p> <p>Writing: Create and share statistical content effectively, appropriately, securely, independently and ethically.</p>	

Unit IV	(8Hours)
<p>Creativity and Innovation</p> <p>Listening: Listening to lectures.</p> <p>Speaking: master the phonetics, the sounds, the rhythm, and to an extent the intonation, modulation and variation in the way to be effective in conveying ideas and information.</p> <p>Reading: Differentiating between facts &amp; opinions, Skimming &amp; Scanning – Reading passages on statistical tools -Understanding text structures: sequencing, comparing and contrasting, relating cause and effect.</p> <p>Writing: Paraphrasing without plagiarism. Note-making and summarizing - Preparing notes from reading texts and Summarize key ideas and information in an organized manner, from the notes prepared.</p>	

Unit V	(8Hours)
<p>Critical Thinking Skills</p> <p>Listening: Listening to interviews of specialists / Inventors in fields (Subject specific)</p> <p>Speaking: Brain storming sessions on. (Mind mapping). Small group discussions (Subject- Specific)- Framing opinion and judgment on charts, tables and graphs. Group Discussion: Discussing survey results in small groups.</p> <p>Reading: Book reading – popular Leaders like Steve Jobs, Ratan Tata, Bill gates .</p> <p>Writing: Essay Writing based on reading exercises – analysing statistical aspects of big businesses like amazon.</p>	

## Books for Reference:

S.No	Name of the Book	Authors	Publishers with Edition
1	Strategy Rules: Five Timeless Lessons from Bill Gates, Andy Grove and Steve Job	<u>B. David Yoffie</u> , <u>A. Michael Cusumano</u>	Paperback - 2015
2	Critical Thinking, Academic Writing and Presentation Skills:	<u>Marilyn Anderson</u>	Mg University Edition Paperback 2010
3	Critical Thinking: An Introduction	Alec <u>Fisher</u>	South Asian Edition Paperback 2011

## E-Resources:

1. <https://Voxy.com/Course/Career-aligned/english-for-statistics-for-data-science-bussiness-analysis/>
2. <https://www.onestopenglish.com>
3. <https://iase-web.org>

## Mapping of Course outcome with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	BTL
CO 1	M	H	H	H	-	-	H	-	U
CO 2	M	H	H	H	-	-	H	-	A
CO 3	M	H	H	H	-	-	H	-	U
CO 4	M	H	H	H	-	-	H	-	A

Correlation Level: H- High, M- Medium, L- Low

## B.Sc Statistics Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core VI Probability Distribution – II</b>	<b>Course Code: 417W06</b>
<b>Semester: III</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 60 (Total hours)</b>	<b>C:T: 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

### Course Objectives:

The objectives of this course are

- | to impart knowledge about discrete and continuous probability distributions.
- | to enable the application of concepts of discrete and continuous probability distributions in real life situations.
- | to provide skill in computing probabilities using discrete and continuous distributions.

### Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Compute the probabilities associated with discrete distributions.	U
CO2	Find probabilities associated with a normal probability distribution.	U
CO3	Approximate the binomial probabilities using a normal distribution and other discrete distributions.	U
CO4	Evaluate the expected value and variance of discrete and continuous probability distributions.	A
CO5	Decide the normal random variable leading to chi square, t and F distributions	U
CO6	Interpret and communicate probabilities obtained from probability distributions.	U

### R-Remembrance U –Understanding A-Apply

#### Syllabus:

<b>Unit I:</b>	<b>(10 Hours)</b>
Binomial, Poisson and Negative – Binomial distributions – Moments, m.g.f, cumulants, additive property, recurrence relation for the probabilities – simple problems. Chapter 8: (Sections 8.4 – 8.6)	
<b>Unit II</b>	<b>(11 Hours)</b>

Geometric distribution – moments, m.g.f – Hyper - geometric distribution – mean, variance, m.g.f, Binomial as a limiting form of Hyper - geometric distribution – Multinomial distribution – moments.

Chapter 8: (Sections 8.7 – 8.9)

**Unit III** **(11 Hours)**

Normal distribution – limiting form of Binomial distribution, properties, median, mode, moments, m.g.f, cumulants, mean deviation, area property, simple problems – Rectangular distribution – moments, m.g.f. characteristic function, mean deviation – Bivariate normal distribution.

Chapter 9: (Sections 9.2 & 9.3)

**Unit IV** **(10 Hours)**

Gamma, Beta distributions of I kind and II kind – constants – Exponential distribution – additive property.

Chapter 9: (Sections 9.5 – 9.8)

**Unit V (10 Hours)**

Functions of normal random variable leading to  $\chi^2$ , t and F distributions – inter relationship between the distributions and their properties.

Chapter 15: (Sections 15.2 & 15.3), Chapter 16: (Sections 16.2 – 16.6)

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Fundamentals of mathematical statistics	Gupta. S.C and Kapoor. V.K	Sultan Chand & sons, Reprint 2016

**Book for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1.	Introduction to Mathematical Statistics	Hogg R.V and Craig. A.G.,	Amerind, 2004 Reprint.

Course Designed by :	Mrs.S.Saranya	
Course Reviewed by :	Dr. S. Geetha	Dr. S. Geetha
Head of the Department :		

**B.Sc. Statistics**

**Semester IV**

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Core Practical II Statistical Practical II	Course Code: 417WP2
Semester: IV	No. of Credits: 3
No. of hours : 30 (Total hours)	T:P: 24:6
CIA Max. Marks: 25	ESE Max. Marks: 50

(T: Tutorial, P: Practical)

**Course Objectives:**

The objectives of this course are

- to provide the skill in applying basic measures of demography, constructing life table and to project the population.
- to solve problems based on discrete and continuous distributions.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Construct a life table used in mortality.	A

CO2	Illustrate various demographic techniques.	U
CO3	Determine the growth of population.	U
CO4	Fit binomial distribution to a data suitable for binomial distribution.	A
CO5	Fit Poisson distribution appropriately.	A
CO6	Fit Normal distribution using different methods.	A

**R-Remembrance U-Understanding A-Apply**

**Syllabus:**

<b>List of Problems</b>	<b>26 hrs</b>
<p><b>Demographic methods:</b></p> <ol style="list-style-type: none"> <li>1. Construction of life table.</li> <li>2. Determination of mortality, fertility and reproduction rates.</li> <li>3. Population projection using polynomials and exponential function.</li> <li>4. Fitting Gompertz curve.</li> <li>5. Fitting logistic curve to population data by the method of Pearl and Reed.</li> <li>6. Fitting of Logistic curve by Rhodes method.</li> </ol> <p><b>Probability and Distributions I &amp; II</b></p> <ol style="list-style-type: none"> <li>1. Fitting of Binomial distribution.</li> <li>2. Fitting of Poisson distribution.</li> <li>3. Fitting of Normal distribution by the method of ordinates.</li> <li>4. Fitting Normal distribution by area method.</li> </ol>	
<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>	

## B.Sc. Statistics Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Allied IV Computer Programming for Statistical Analysis – II</b>	<b>Course Code: 417AW4</b>
<b>Semester: IV</b>	<b>No. of Credits: 3</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

The objectives of this course are

- to introduce the basis of C++ programming.
- to gain capability to develop programs for Statistical problems using OOP's concept

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Describe the significance of object oriented programming.	R
CO2	Illustrate the use of various data types and decision making and looping structures.	R
CO3	Demonstrate the use overloading concepts.	U
CO4	Program using constructors.	A
CO5	Build programs classes using appropriate encapsulation and design principles.	A
CO6	Simulate problem in computer networks and real world problems.	A

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

Unit I:	(13 Hours)
<p><b>Principles of Object Oriented Programming:</b> Basic concepts of Object Oriented Programming – Benefits of OOPS. Beginning with C++ : Applications of C++ – Structure of C++ program. Tokens, Expressions and Control Structures: Introduction –Tokens – Keywords – Identifiers and Constants – Basic data Types – User-Defined Data Types – Derived data types – Symbolic constants – Type Compatibility – Declaration of variables – Dynamic initialization of Variables – Reference Variables – Operators in C++ – Scope Resolution Operator – Member Dereferencing Operators – Memory Management Operators – Manipulators – Typecast Operator – Expressions and their Types – Special Assignment Expressions – Implicit Conversions – Operator Overloading – Operator Precedence – Control Structures.</p> <p>Chapter 2, Chapter 3 (Pages 19 – 76)</p>	

Unit II	(13 Hours)
<p><b>Functions in C++:</b> Introduction – The Main Function – Function prototyping – Call by Reference – Return by reference – Inline functions – Default arguments – const Arguments – Recursion – Function Overloading – Friend and Virtual Functions – Math Library Functions. Classes and Objects: Introduction – C Structures Revisited – Specifying a Class – Defining Member Functions – A C++ Program with Class – Making an Outside Function Inline – Nesting of Member Functions – Private Member Functions – Arrays within a Class – Memory allocation for Objects – Static Data Members – Static Member Functions – Arrays of Objects – Objects as Function Arguments – Friendly Functions – Returning Objects – const Member Functions – Pointers to Members – Local Classes.</p>	

Chapter 4, Chapter 5(Pages 77 – 143)

**Unit III****(13 Hours)**

**Constructors and Destructors:** Introduction – Constructors – Parameterized Constructors – Multiple Constructors in a Class – Constructors with Default Arguments – Dynamic Initialization of Objects – Copy constructor – Dynamic Constructors – Constructing Two-Dimensional Arrays – const Objects – Destructors. **Operator Overloading and Type Conversions:** Introduction – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Overloading Binary Operators using Friends – Manipulation of Strings Using Operators – Rules for Overloading Operators – Type Conversions.

Chapter 6, Chapter 7(Pages 144 - 200)

**Unit IV****(13 Hours)**

**Inheritance:** Extending Classes: Introduction – Defining Derived Classes – Single Inheritance – Making a Private Member Inheritable – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Virtual Base Classes – Abstract Classes – Constructors in Derived Classes – Member Classes: Nesting of Classes. **Pointers, Virtual Functions and Polymorphism:** Introduction – Pointers- Pointers to Objects – this Pointer – Pointers to Derived Classes – Virtual Functions – Pure Virtual functions.

Chapter 8, Chapter 9 (Pages 201 - 289)

**Unit V****(13 Hours)**

**Working with files:** Introduction – Classes for File Stream Operations – Opening and Closing a File – Detecting End-of-File – More about Open():File modes – File Pointers and their Manipulations – Sequential Input and Output Operations – Updating a File: Random Access – Error handling During File Operations – Command – Line Arguments. **Exception Handling:** Introduction – Basics of Exception Handling – Exception Handling Mechanism- Throwing Mechanism – Catching Mechanism – Rethrowing an Exception – Specifying Exceptions.

Chapter 11 (Pages 323 - 358), Chapter 13 (Pages 380 - 400)

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Object oriented programming with C++	Balagurusamy. E	Tata McGraw Grill, 4 <sup>th</sup> Edition, 2008

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1.	Programming with C++	D. Ravichandran	Tata McGraw Grill, 3 <sup>rd</sup> Edition, 2011



Course Designed by :	Mrs. K. Kaviyamani	
Course Reviewed by :	Dr. G. Uma	Dr. G. Uma
Head of the Department :		

## B.Sc. Statistics Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Allied Practical C & C++ Programming	Course Code: 417WAP
Semester: IV	No. of Credits: 2
No. of hours : 30 (Total hours)	T:P: 26:4
CIA Max. Marks: 20	ESE Max. Marks: 30

(T: Tutorial, P: Practical)

### Course Objectives:

The objectives of this course are

- to enhance the programming capability to develop programs for statistical problems using C and C++ languages.
- to independently design and execute programs with the help of statistical tools.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Demonstrate frequency distributions.	U
CO2	Compute the various basic measures of descriptive statistics.	U
CO3	Sketch straight line using the least square method.	R
CO4	Fit Binomial and Poisson distributions.	A
CO5	Perform various matrix operations.	A
CO6	Sort an array of numbers in a specified order.	A

**R-Remembrance    U-Understanding    A-Apply**

### Syllabus:

List of Programs	75 hours
1. Program to form a frequency distribution for the given data $X_1, X_2, X_3, \dots, X_n$ , give the number of class intervals $K$ and the width of the class intervals $W$ . 2. Program to find the arithmetic mean, geometric mean and harmonic mean for the given frequency distribution. 3. Program to find Mean, Variance, Standard Deviation and Coefficient of variation. 4. Program to find the three quartiles $Q_1, Q_2$ and $Q_3$ and the coefficient of skewness.	

5. Program to find the first four moments about origin A and to find $\beta_1$ , $\beta_2$ , $\gamma_1$ and $\gamma_2$ . 6. Program to find simple correlation and regression coefficients for the given bivariate data. 7. Program to fit a straight line of the form $y = ax + b$ using the principle of least squares to the given bivariate data. 8. Program to fit Binomial distribution. 9. Program to fit a Poisson distribution. 10. Program to arrange one dimensional array of numbers in ascending and descending order. 11. Program to evaluate a matrix polynomial of the type $aX^2+bX+cI$ where X is a matrix of order $3 \times 3$ and I is an identity matrix and a, b and c are constants. 12. Program to solve the given system of simultaneous equations of three variables. 13. Program to open a file and store data in it and to read and display the data from the file.		
<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics  
Semester IV**

**(For the students admitted during the academic year 2020 – 2021 only)**

<b>Course: Part IV: Skill Enhancement Course II Actuarial Statistics</b>	<b>Course Code: 420WS2</b>
<b>Semester: IV</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 45 hours</b>	<b>C:T : 39:6</b>
<b>CIA Max. Marks: 100</b>	<b>ESE Max. Marks: -</b>

**(C: Contact hours, T: Tutorial)**

Course Objectives:

- To expose the major life insurance policies covered in Indian life insurance.
- To enable a good choice of investments and to make appropriate decision regarding policies.

Course Outcomes: On completion of the course, the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Explain the involved in Insurance business	U
CO2	Use discrete and continuous distributions in actuarial statistics.	A
CO3	Identify various risk models for short term.	A
CO4	Determine survival functions, median future life time and force of mortality.	A
CO5	Find expected number of survivals, construct life tables.	A

U –Understanding A-Apply

## Syllabus:

Unit I	(7 Hours)
Insurance Business: Introduction- What is an Actuarial Science- Insurance Companies as Business Organizations- Concept of Risk- How does the Insurance Business operate- Role of Statistics in Insurance – Insurance Business in India.	
Book1 : Chapter1 (Sections: 1.1-1.7)	

Unit II	(8 Hours)
Introductory Statistics: Introduction- Some Important- Discrete Distributions- Some Important Continuous Distributions- Multivariate Distributions.	
Book 1 : Chapter 2(Sections: 2.1-2.4)	

Unit III	(8 Hours)
Feasibility of Insurance Business and risk Models for Short t Term: Introduction- Expected Value Principle- Notion of Validity- Risk Models for Short Term.	
Book 1 : Chapter 3(Sections: 3.1-3.4)	

Unit IV	(8 Hours)
Future Lifetime Distribution and Life Tables: Introduction- Future Life time Random Variable- Curate Future- Lifetime.	
Book 1: Chapter 4(Sections: 4.1-4.3)	

Unit V	(8 Hours)
Future Lifetime Distribution and Life Tables: Life Tables- Assumptions of Fractional ages- Select and Ultimate Life Tables.	
Book 1: Chapter 4(Sections: 4.4-4.4.6)	

## Book for study:

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Actuarial statistics	Shailaja R Deshmukh	Universities Press(India) Private Limited 2009

## E-Resources : (Web resources &amp; E-books)

1. Actuarial Mathematics and Life-Table Statistics, Eric V.Slud, 2001, bookboon.com
2. Principles of Actuarial Science, Michael Sherris, 2011, bookboon.com

## Mapping of Course outcome with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	BTL
CO1	H	H	H	H	-	-	H	M	H	H	H	U
CO2	H	H	H	-	-	-	H	M	H	H	H	A
CO3	H	H	H	H	-	-	H	M	H	H	H	A
CO4	H	H	H	H	-	-	H	M	H	H	H	A
CO5	H	H	H	H	-	-	H	M	H	H	H	A

Correlation Level: H- High, M- Medium, L- Low

## B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Skill Enhancement Course III Elements of Econometrics</b>	<b>Course Code: 517WS3</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

**(C: Contact hours, T: Tutorial)**

### Course Objectives:

The objectives of this course are

- | to create awareness about the underlying concepts of econometrics.
- | to enable the students to effectively use the simple and multiple regression models.
- | to provide a complete overview of estimating autocorrelation.
- | to expose the problems of multicollinearity.

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Describe the basic principles of specification of econometric models	<b>R</b>
<b>CO2</b>	Demonstrate an understanding of variations and generalizations of the basic regression models	<b>U</b>
<b>CO3</b>	Predict the relationship of the variables based on the value of two or more variables	<b>A</b>
<b>CO4</b>	Find the occurrence of high-inter correlations among independent variable in a multi-regression model	<b>U</b>
<b>CO5</b>	Express consequences of using OLS in the presence of autocorrelation	<b>U</b>
<b>CO6</b>	Explain, interpret, forecast and take policy actions relative to the economic phenomenon of interest	<b>A</b>

**R-Remembrance U –Understanding A-Apply**

### Syllabus:

<b>Unit I:</b>	<b>(7 Hours)</b>
Definition, Scope, Goals and Divisions of Econometrics – Methodology of Econometric Research. Chapter 1 & 2	

<b>Unit II</b>	<b>(8 Hours)</b>
Simple Linear Regression Model – Assumptions – Least Square Criterion and the Normal Equations of OLS – Properties of Least square Estimates – Unbiasedness, Least-Variance, Efficiency, Best Linear Unbiasedness, Least Mean-Square-Error, Sufficiency. Chapter 4: Sections: 4.1, 4.2, 4.4; Chapter 6: Sections: 6.1.1	

<b>Unit III</b>	<b>(8 Hours)</b>
Multiple Regression – Model with two explanatory variables – General Linear Regression Model – Linear and Non-linear Relationships. Chapter 7: Sections: 7.1, 7.2, 7.4	

<b>Unit IV</b>	<b>(8 Hours)</b>
Autocorrelation – Assumptions – Sources – Plausibility – Consequences – Tests for Autocorrelation – The Durbin-Watson Test – Solutions for the case of Autocorrelation – Methods for Estimating Autocorrelation. Chapter 10: Sections: 10.1 – 10.3, 10.5, 10.6.2, 10.7, 10.8	

<b>Unit V</b>	<b>(8 Hours)</b>
Multicollinearity – Assumptions – Plausibility – Consequences – Tests for Detecting Multicollinearity – Solutions for Multicollinearity – Multicollinearity and Prediction – Multicollinearity and Identification. Chapter 11: Sections: 11.1 – 11.7	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I –V	Theory of Econometrics	A. Koutsoyiannis	Macmillan Press, London, 1999 Reprint

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Econometrics	K. Dhanasekaran,	Vrinda Publications (P) Ltd, Delhi, 2011
2	Basic Econometrics	Damodar N. Gujarati	McGraw Hill, Singapore, 2009

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

## B.Sc. Statistics Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core Practical IV Statistical Practical-IV</b>	<b>Course Code: 617WP4</b>
<b>Semester: VI</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>P:T: 65:10</b>
<b>CIA Max. Marks: 40</b>	<b>ESE Max. Marks: 60</b>

**(T: Tutorial, P: Practical)**

### Course Objectives:

The objectives of this course are

- to enable the students to estimate the parameters of distributions.
- to provide skills to analyze data with reference to basic sampling theory
- to teach the nuances of design of experiments
- to instill a complete knowledge of tests of significance
- to equip the students with simple statistical quality control tools.

### Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Estimate the parameters by using different methods practically.	U
CO2	Estimate sample size, mean and variance for different probability sampling methods practically	U
CO3	Test the significance between the variables using various linear model designs and interpret them statistically.	A
CO4	Fit the hypothesis to test the given samples using various statistical tools.	U
CO5	Check whether the product can be accepted or rejected using various quality control methods.	A
CO6	Utilize the tools to interpret and analyze a real time data with an ethical insight	A

**R-Remembrance U –Understanding A-Apply**

### Syllabus:

<b>Unit I: Statistical Inference-I</b>	<b>(13 Hours)</b>
1. Estimation of parameters of the distribution by the methods of maximum likelihood and moments with regard to discrete and continuous distributions. 2. Confidence intervals based on Single mean, Difference of Means (Large Samples and Small Samples), Single Variance and Ratio of Two Variance.	

<b>Unit II Sampling theory</b>	<b>(13 Hours)</b>
1. Estimation of mean and variance of the population and the variance of the estimator of the mean using Simple Random Sampling. 2. Stratified Random Sampling – Estimation of mean and variance of the population and of the variance of the estimator of the mean under Proportional and Optimum Allocation. 3. Systematic Sampling.	

<b>Unit III Design of Experiments</b>	<b>(13 Hours)</b>
1. Analysis RBD and LSD lay outs. 2. Missing plot techniques in RBD and LSD. 3. Analysis of $2^2, 2^3$ and $3^2$ factorial designs.	

<b>Unit IV Statistical Inference-II</b>	<b>(13 Hours)</b>
1. Standard Normal and Exact tests of significance with regard to proportions, mean, variance. 2. Non-parametric Tests: Run test, test for randomness, median test, sign test, Mann-Whitney U Test.	

<b>Unit V Statistical quality control</b>	<b>(13 Hours)</b>
1. Control chart for attributes and variables: $\bar{X}$ , R, p, np and c charts 2. Single sampling plan and double sampling plan for attributes: OC, AOQ, ASN, ATI curves.	

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

## B.Sc Statistics Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Skill Enhancement Course IV Project</b>	<b>Course Code: 617WS4</b>
<b>Semester: VI</b>	<b>No. of Credits: 3</b>
<b>No. of hours : 45 (Total hours)</b>	<b>C:T: 39:6</b>
<b>CIA Max. Marks: 75</b>	<b>ESE Max. Marks: -</b>

(C: Contact hours, T: Tutorial)

### Preamble:

This course is offered with an aim of promoting knowledge. It enables the students to communicate and contribute their ability to enhance their skills. A project work has to be carried out individually in an emerging area and a report must be submitted individually.

Viva-voce examination will be conducted.

**Course Objectives:**

The objectives of this course are

- | to create awareness of applications of statistics in various fields and to interpret the results.
- | to enable the students to explore various areas of statistical applications.
- | to instill confidence to prepare and submit reports.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Develop, practice and improve technical skills	A
CO2	Apply basic statistical concepts and analytical tools appropriately.	A
CO3	Demonstrate the analyzing skills in exploratory data analysis.	U
CO4	Predict results for a current scenario.	A
CO5	Compare two different sets of samples and interpret the result	U
CO6	Propose the scope of research	A

**R-Remembrance U –Understanding A-Apply**

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		



Curriculum Design  
 Sri G.V.G Visalakshi College for Women (Autonomous)  
 Affiliated to Bharathiar University  
 Department of Statistics  
 B.Sc Statistics  
 Scheme of Examination – CBCS Pattern  
 (For the students admitted during the academic year 2017-2018 onwards)

Sem	Course Code	Course Title	Ins. Hrs/ Week	Examination				Credits
				Dur. Hrs	CIA Marks	ESE Marks	Total Marks	
I	117TA1/ 117MY1/ 117HD1/ 117FR1	Part I Language I	6	3	25	75	100	4
	117EN1	Part II English I	6	3	25	75	100	4
		Part III						
	117W01	Core I Descriptive Statistics - I	4	3	25	75	100	4
	117W02	Core II Descriptive Statistics - II	4	3	25	75	100	4
	217WP1	Core Practical I Statistical Practical I	2	-	-	-	-	-
	117AW1	Allied I Mathematics for Statistics I	6	3	25	75	100	4
	117EVS	Part IV-Environmental Studies	2	3	50	-	50	2
II	217TA2/ 217MY2/ 217HD2/ 217FR2	Part I Language II	6	3	25	75	100	4
	217EN2	Part II English II	6	3	25	75	100	4
		Part III						
	217W03	Core III Applied Statistics	6	3	25	75	100	4
	217WP1	Core Practical I Statistical Practical I	4	3	25	50	75	3
	217AW2	Allied II Mathematics for Statistics II	6	3	25	75	100	4

	217VEC	Part IV-Value Education	2	3	50	-	50	2
III	317TA3/ 317MY3/ 317HD3/ 317FR3	Part I Language III	6	3	25	75	100	4
	317EN3	Part II English III	6	3	25	75	100	4
		Part III						
	317W04	Core IV Demographic methods	3	3	25	75	100	4
	317W05	Core V Probability Distribution I	3	3	25	75	100	4
	317AW3	Allied III Computer programming for Statistical Analysis I	5	3	25	50	75	3
	417AWP	Allied Practical C & C++ programming	2	-	-	-	-	-
	317NSA	Part IV – Non Major Elective Statistical Analysis	2	2	50	-	50	2
	317WS1	Part IV- Skill Enhancement Course I Actuarial Statistics I	3	3	75	-	75	3
IV	417TA4/ 417MY4/ 417HD4/ 417FR4	Part I Language IV	6	3	25	75	100	4
	417EN4	Part II English IV	6	3	25	75	100	4
		Part III						
	417W06	Core IV Probability Distribution II	4	3	25	75	100	4
	417WP2	Core Practical II Statistical Practical II	2	3	25	50	75	3
	417AW4	Allied IV Computer programming for Statistical Analysis II	5	3	25	50	75	3
	417AWP	Allied Practical C & C++ programming	2	3	20	30	50	2
	417NGA	Part IV- General Awareness and Information Security	2	1	50	-	50	2
	417WS2	Part IV- Skill Enhancement Course - I	3	3	75	-	75	3

		Actuarial Statistics I						
V	517W07	Part III Core VII Statistical Inference I	5	3	25	75	100	4
	517W08	Core VIII Sampling theory	5	3	25	75	100	4
	517W09	Core IX Design of Experiments	5	3	25	75	100	4
	517W10	Core X Statistical Quality Control I	5	3	25	75	100	4
	617WP3	Core Practical III Statistical Practical III - Using SPSS	2	-	-	-	-	-
	517WE1/ 517WE2	Elective I	5	3	25	50	75	4
	517WS3	Part IV- Skill Enhancement Course – III Elements of Econometrics	3	3	75	-	75	3
VI	617W11	Part III Core XI Statistical Inference II	5	3	25	75	100	4
	617W12	Core XII Statistical Quality Control II	5	3	25	75	100	4
	617WP3	Core Practical III Statistical Practical III - Using SPSS	2	3	25	50	75	2
	617WP4	Core Practical IV Statistical Practical IV	5	3	40	60	100	3
	617WE3/ 617WE4	Elective II	5	3	25	50	75	4
	617WE5	Elective III Psychological Statistics	5	3	25	50	75	3
	617WS4	Part IV- Skill Enhancement Course - IV Project	3	3	75	-	75	3
	617EX1/ 617EX2/ 617EX3/ 617EX4/ 617EX5	Part V- Extension activities	-	-	50	-	50	2
		<b>Total</b>					<b>3500</b>	<b>140</b>

\*Starred credits are treated as additional credits (Optional)

List of Electives:

Semester V – Elective - I

517WE1 - Numerical Methods

517ME2 - Biostatistics

Semester VI – Elective - II

617ME3 - Operations Research

617ME4 - Matrices

**Syllabus having direct bearing on Employability****B.Sc. Statistics****Semester I**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III: Core I Descriptive Statistics - I</b>	<b>Course Code: 117W01</b>
<b>Semester: I</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 60 (Total hours)</b>	<b>C:T: 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

**(C: Contact hours, T: Tutorial)****Course Objectives:**

- to impart the basic measures of statistics
- to provide a strong foundation in basic descriptive measures such as measures of central tendency, dispersion and skewness.

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Demonstrate the ability to apply fundamental concepts in exploratory data analysis.	<b>U</b>
<b>CO2</b>	Classify and present the data	<b>R</b>
<b>CO3</b>	Interpret examples of methods for summarizing data set which are most appropriate to highlight interesting features of the data.	<b>U</b>
<b>CO4</b>	Construct and interpret graphical summaries of data.	<b>A</b>
<b>CO5</b>	Compute the descriptive measures and its dispersion	<b>U</b>
<b>CO6</b>	Fit curves transformable to the form of least square.	<b>A</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I</b>	<b>(11 Hours)</b>
Origin, scope, limitations and misuse of Statistics – Collection – Classification – Tabulation of data. Diagrammatic representation of data: one dimensional and two dimensional diagrams – graphic representation: line diagram, frequency polygon, frequency curve, histogram and Ogive curves. Book 1: Chapter 1, Chapter 2: (Sections 2.2 & 2.3).	
<b>Unit II</b>	<b>(11 Hours)</b>

Measures of central tendency: Mean, Median, Mode, Geometric mean and Harmonic mean – Partition values: Quartiles, Deciles and Percentiles – Measures of Dispersion: Mean deviation, Quartile deviation and Standard deviation – Coefficient of variation.

Book 1: Chapter 2: (Sections 2.4 – 2.14)

**Unit III (10 Hours)**

Moments – measures of Skewness – Pearson’s and Bowley’s Coefficient of skewness, Coefficient of Skewness based on moments – Kurtosis.

Book 1: Chapter 2: (Sections 2.15 – 2.17)

**Unit IV (10 Hours)**

Curve fitting: principle of least squares, fitting of the curves of the form  $y = a + bx$ ,  $y = a + bx + cx^2$  and curves transformable to the above form.

Book 2: Chapter 2: (Section 2.4.3)

**Unit V (10 Hours)**

Case study and problems relating to all the above units.

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – III	Fundamentals of Mathematical Statistics	Gupta. S.C and Kapoor. V.K	Sultan Chand & Sons, 2016 Reprint
IV	Fundamentals of Applied Statistics	Gupta. S.C and Kapoor. V.K	Sultan Chand & Sons, 2017 Reprint

**Book for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Methods – Part I	Mills. F.C.	Pitman Publishing, 1965

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G.Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics****Semester I****(For the students admitted during the academic year 2017 – 2018 and onwards)**

<b>Course: Part III: Core II: Descriptive Statistics – II</b>	<b>Course Code: 117W02</b>
<b>Semester: I</b>	<b>No. of Credits: 4</b>
<b>No. of hours :60 (Total hours)</b>	<b>C:T: 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks:75</b>

**(C: Contact hours, T: Tutorial)****Course Objectives:**

- to enable the students to effectively use bivariate measures such as correlation and regression for data analysis.
- to make the students demonstrate the association of attributes and its measures.
- to provide basic concepts in probability and operations with theorems.

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Associate the data and find its measure.	<b>U</b>
<b>CO2</b>	Fit the line of best fit and its coefficient.	<b>A</b>
<b>CO3</b>	Measure the dependence and independence of data by method of attributes.	<b>U</b>
<b>CO4</b>	Recognize the degree of uncertainty that is involved before making important decisions.	<b>R</b>
<b>CO5</b>	Interpret the success or failure in terms of probability conditions.	<b>U</b>
<b>CO6</b>	Use an appropriate statistical tool for data summary and exploratory data analysis	<b>A</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I</b>	<b>(10 Hours)</b>
Linear correlation – scatter diagram, Pearson's coefficient of correlation, correlation in a bivariate table, Rank correlation, Coefficient of concurrent deviation – Regression equations – properties of regression coefficients. Chapter 10, Chapter 11: (Section 11.2)	
<b>Unit II</b>	<b>(11 Hours)</b>
Association of attributes: Relation between class frequencies, consistency of data, independence of attributes, criterion of independence, association of attributes: Yule's coefficient of association, Yule's coefficient of colligation. Chapter 13	

<b>Unit III</b>	<b>(11 Hours)</b>
Probability: Sample Space – Concepts of events – Algebraic Operations on events – Definitions of probability. Chapter 3: (Sections 3.2, 3.7 & 3.8)	

<b>Unit IV</b>	<b>(10 Hours)</b>
Generalized addition and compound Theorems of probability – independent events – Conditional probability – Baye’s Theorem. Chapter: 3 (Sections 3.9.1, 3.12 & 3.13) Chapter 4 (Section 4.2)	

<b>Unit V</b>	<b>(10 Hours)</b>
Case study and problems related to all the above units.	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Fundamentals of Mathematical Statistics	Gupta. S.C and Kapoor V.K	Sultan Chand & Sons, 2017 Reprint

**Book for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Methods – Part I	Mills. F.C.	Pitman Publishing, 1965

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

## B.Sc. Statistics Semester II

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III: Core III: Applied Statistics</b>	<b>Course Code: 217W03</b>
<b>Semester: II</b>	<b>No. of Credits: 4</b>
<b>No. of hours :90 (Total hours)</b>	<b>C:T: 75:15</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to introduce time series to enable the students to forecast the data relating to economics and business.
- to demonstrate the use of index numbers in solving problems.
- to provide a strong foundation in basic demographic measures.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Formulate methods for using time series analysis for addressing business problems.	A
CO2	Define price and quality indices and construct price, quantity and value indexes.	R
CO3	Predict future values for the present data by various techniques of time series analysis.	A
CO4	Identify and compare the advantages and disadvantages of the different sources of Demographic data.	R
CO5	Describe the distribution of a population using various demographic characteristics.	R
CO6	Present appropriate techniques to ensure comparability of the measures across the birth population	A

**R-Remembrance U –Understanding A-Apply****Syllabus:****Unit I : Time series****(15 Hours)**

Concept – components of time series – additive and multiplicative models – Resolving components of a time series – measuring trend: Graphic, semi – averages, moving average and principle of least squares methods.  
Chapter 2: (Sections 2.1 - 2.4.6)

**Unit II Time series****(15 Hours)**

Seasonal variation – measuring seasonal variation: method of simple averages, ratio to trend method, ratio to moving average method and link relative method – Cyclical and Random fluctuations – variate difference method.  
Chapter 2: (Sections 2.5, 2.6 & 2.9)

**Unit III Index Numbers****(15 Hours)**

Index numbers and their definitions – construction and uses of fixed and chain based index numbers – simple and weighted index numbers – Laspeyre's, Paache's, Fisher's, and Marshall- Edgeworth index numbers – optimum tests for index numbers – Cost of living index numbers.  
Chapter 3: (Sections 3.1 – 3.5)

**Unit IV Demographic methods****(15 Hours)**

Demography – definition – sources of demographic data: vital registration – population census – population register – demographic surveys – population data as aid to social, economic and healthy planning – process of Indian Civil registration and census.  
Chapter 9: (Sections 9.1 – 9.3)



<b>Unit V Demographic methods</b>	<b>(15 Hours)</b>
Fertility measurements: Fertility as a component of population change – crude birth rate – general, specific and total fertility rates – gross and net reproduction rates and their interpretation.	
Chapter 9: (Sections 9.7 & 9.8)	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Fundamentals of Applied Statistics	Gupta S.C and Kapoor, V.K,	Sultan Chand & Sons, 2017 Reprint.

**Books for Reference:**

S.No.	Name of the Book	Authors	Publishers with Edition
1	Applied General Statistics	Croxton, F.E and Cowden, D.J	Prentice Hall, 3 <sup>rd</sup> Edition, 1967.
2	Fundamentals of Applied Statistics	Gun.A.M, Gupta.M.K and Das Gupta	World Press, 2018 Reprint.
3	The Advanced Theory of Statistics - Vol.III	Kendall.M.G and Alan Stuart.	Macmillan Pub Co, 4th Edition, 1983

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

### B.Sc. Statistics Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core IV Demographic Methods</b>	<b>Course Code: 317W04</b>
<b>Semester: III</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 45 (Total hours)</b>	<b>C:T: 39:6</b>
<b>CIA Max. Marks: 25 Marks</b>	<b>ESE Max. Marks: 75 Marks</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to create awareness about the core social demographic variables such as mortality, migration.
- to provide skills to construct life tables and to calculate survival rates.
- to illustrate the influence of the demographic variables on population growth, composition and projection.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Construct and analyze simple and abridged life tables.	A
CO2	Project a population using appropriate equations and assumptions.	A
CO3	Recognize and analyze typical demographic patterns arising from the data.	R
CO4	Describe basic demographic indicators and elaborate on their computation and interpretation	R
CO5	Interpret the data base on which are built population projections and work force projections.	U
CO6	Estimate the rate of change in a population.	U

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I</b>	<b>(8 Hours)</b>
<b>Mortality Measurements:</b> Crude Death Rate – Specific Death Rates – Standardized Death Rates – direct and indirect methods. Book 1: Chapter 9: (Sections 9.4.1 – 9.4.3)	
<b>Unit II</b>	<b>(8 Hours)</b>
Comparative Mortality Index – Infant Mortality Rate – Maternal Mortality Rate – cause – of – Death Rate – case fatality rate – force of mortality – graduation of mortality rates – Gompertz and Makeham's laws. Book 1: Chapter9: (Sections 9.4.3, 9.5.4 & 9.9)	
<b>Unit III</b>	<b>(7 Hours)</b>
Assumptions, Description and Construction of Various columns of a life table and their Relationships – Uses of a life table – Age pyramid. Book 1: Chapter 9: (Sections 9.5, 9.5.5 & 9.5.6)	
<b>Unit IV</b>	<b>(8 Hours)</b>
Construction of an Abridged life table – Reid and Merrell Method – Greville's Method – Migration – Factors Effecting Migration – Gross and Net Migration Rates. Book 1 Chapter 9: (Sections 9.6, 9.6.1 & 9.6.2) Book 2: Chapter 10 (fully)	
<b>Unit V</b>	<b>(8 Hours)</b>
Population Projection – Population Estimates and Projection – Arithmetic, Geometric and Exponential growth rates – Logistics curves – Pearl and Reed method – method of Rhodes – Basic ideas of stationary and stable population. Book 1: Chapter9: (Sections 9.5.1 & 9.5.2)	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I - III, IV & V	Fundamentals of Applied Statistics	Gupta.S.C and Kapoor.V.K,	Sultan Chand & Sons, 2017 Reprint
IV	Principles of Population Studies	Asha A.Bende and Tara Karitkar	Himalaya publishing, 2006 Reprint.

**Books for Reference:**

S. No.	Name of the Book	Authors	Publisherswith Edition
1.	Fundamentals of Statistics	Gun A.M, Gupta.M.K and Das Gupta	World Press, Calcutta, 2018 Reprint
2.	An introduction to the study of population	Bhaskar D. Misra	South Asian Publishers, 1982

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

### B.Sc. Statistics Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Non-Major Elective Statistical Analysis</b>	<b>Course Code: 317NSA</b>
<b>Semester: III</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 30 (Total hours)</b>	<b>C:T: 26:4</b>
<b>CIA Max. Marks: 50</b>	<b>ESE Max. Marks: -</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to expose the history of Statistics
- to provide a base in various statistical descriptive measures
- to enable the use of simple statistical tools in analyzing real time data.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Identify the history and applications of statistics in various fields.	R
CO2	Demonstrate the ability to apply various statistical tools in data analysis.	U

<b>CO3</b>	Interpret the data using various kinds of charts and diagrams.	<b>U</b>
<b>CO4</b>	Evaluate and analyze methods for examining central tendencies and dispersion.	<b>A</b>
<b>CO5</b>	Measure the degree of relationship between the variables.	<b>U</b>
<b>CO6</b>	Predict and forecast the relationship among the variables.	<b>A</b>

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I:</b>	<b>(8 Hours)</b>
Origin, Scope, Limitations and Misuse of Statistics – Collection – Classification – Tabulation of data. Chapter 1 (Page No. 2 – 23), Chapter 3(Page No. 40 – 52), Chapter 5(Page No. 92 -126)	

<b>Unit II</b>	<b>(7 Hours)</b>
<b>Diagrammatic representation of data:</b> one dimensional and two dimensional diagrams – graphic representation: line diagram, frequency polygon, frequency curve, histogram and Ogive curves. Chapter 6(Page No. 128 – 176)	

<b>Unit III</b>	<b>(6 Hours)</b>
<b>Measures of Central Tendency:</b> Mean, Median, Mode, Geometric mean and Harmonic mean – Partition values: Quartiles, Deciles and Percentiles Chapter 7(Page No. 178 – 270)	

<b>Unit IV</b>	<b>(7 Hours)</b>
<b>Measures of Dispersion:</b> Mean deviation, Quartile deviation and Standard deviation – Coefficient of variation. Chapter 8(Page No. 272 – 335)	

<b>Unit V</b>	<b>(7 Hours)</b>
<b>Correlation:</b> Types of correlation – Regression – Properties of regression coefficients. Chapter 10(Page No. 390 – 450), Chapter 11(Page No. 452 – 470)	

**Books for study:**

<b>Unit</b>	<b>Name of the Book</b>	<b>Authors</b>	<b>Publishers with Edition</b>
<b>I – V</b>	Statistical Methods	S.P. Gupta	Sultan Chand & Sons, 2016 Reprint

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

## B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core VII Statistical Inference - I</b>	<b>Course Code: 517W07</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

### Course Objectives:

- to generate the contingency tables.
- to provide a strong foundation in point estimation and interval estimation, and their properties.
- to enable the students to draw conclusions about the populations using the computed value of the parameters.

### Course Outcomes: On completion of the Course the student will be able to

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Construct contingency tables to test independence and homogeneity of the samples	<b>A</b>
<b>CO2</b>	Demonstrate approaches to include a measure of accuracy for estimation procedures.	<b>U</b>
<b>CO3</b>	Formulate estimators and test procedures based on point estimation.	<b>A</b>
<b>CO4</b>	Find the Cramer-Rao lower bound for the variances of unbiased estimators.	<b>U</b>
<b>CO5</b>	Compute confidence interval and confidence limit for a population parameter.	<b>U</b>
<b>CO6</b>	Analyze and interpret real time empirical data.	<b>A</b>

### **R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Order Statistics – Cumulative Distribution Function of a Single Order Statistic – Probability Density Function of a Single Order Statistic – Joint p.d.f. of two Order Statistic – Joint p.d.f. of all n order Statistic – Distribution of Range and Other Systematic Statistics. Application of Chi-square Tests: Inferences about a Population Variance, Goodness of Fit, Test of Independence of Attributes- Contingency Tables – Yate’s Correction – Chi-square Test of Homogeneity of Correlation Coefficients. Chapter 9: Section 9.15; Chapter 15: Section 15.6 (15.6.1 – 15.6.4, 15.6.6)	
<b>Unit II</b>	<b>(13 Hours)</b>
Theory of Estimation: Parameter Space, Statistics, Estimators and Estimate – Characteristics of Estimators – Unbiasedness – Consistency – Invariance Property of Consistent Estimators – Sufficient Conditions for Consistency – Efficient Estimators – Most Efficient Estimator – Minimum Variance Unbiased Estimators – Simple Problems. Chapter 17: Sections: 17.1, 17.2 (17.2.2, 17.2.3)	
<b>Unit III</b>	<b>(13 Hours)</b>
Sufficiency – Neymann Factorization Theorem – Cramer-Rao Inequality – Conditions for the equality sign in Cramer-Rao Inequality – Complete Family of Distributions – MVU and Blackwellisation – Rao-Blackwell Theorem – Simple Problems. Chapter 17: Sections: 17.2.4, 17.3, 17.4, 17.5	
<b>Unit IV</b>	<b>(13 Hours)</b>
Methods of Estimation: Method of Maximum Likelihood Estimation – Properties of Maximum Likelihood Estimators – Method of Minimum Variance – Method of Moments – Method of Minimum Chi-square Estimation – Simple Problems. Chapter 17: Sections: 17.6	
<b>Unit V</b>	<b>(13 Hours)</b>
Interval estimation: Confidence Interval and Confidence Limits – Derivation of Confidence Interval based on Normal, t, Chi-square and F Distributions – Confidence Interval for Large Samples – Simple Problems. Chapter 17: Section: 17.7	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Fundamentals of Mathematical Statistics	S.C Gupta and V.K. Kapoor	Sultan Chand & Sons, New Delhi, 2016 Reprint.

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Introduction of Mathematical Statistics	Robert V. Hogg and Allen T. Craig	Pearson Education, 2004
2	Statistical Inference	George Casella and Roger L. Berger	Cengage Learning, 2016

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics**  
**Semester V**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course Part III – Core VIII Sampling Theory</b>	<b>Course Code: 517W08</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks 75</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to create awareness on census surveys
- to introduce various sampling methods and the different types of populations to which the sampling methods are applicable.
- to provide skills to determine the efficiency of the estimators in various sampling methods.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Estimate the sample size for a research or a study.	U
CO2	Demonstrate the optimum results with the available sources at the disposal by studying the sample values.	U
CO3	Develop an understanding about different sampling methods based on probability and non-probability sampling	A
CO4	Obtain best possible estimates of the population parameters.	U
CO5	Increase the level of efficiency and cost reduction of sampling.	A
CO6	Evaluate mean and variance of the parameter based on different sampling methods.	A

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I</b>	<b>(13 Hours)</b>
Introduction – Parameter and Statistic – The Principal steps in a Sample Survey – Principles of sample survey – Sampling and Non-sampling errors – Merits of sampling Technique – Limitations of sampling. Book 1: Chapter 7 (Sections 7.1 – 7.7)	
<b>Unit II</b>	<b>(13 Hours)</b>
Types of Sampling – Simple Random Sampling: Selection of simple random sample – Notations and Terminology of SRS – Theorems related to Simple random sampling without and with replacement – Estimation of population mean and Variance – Merits and Demerits of Simple Random Sampling. Book 1: Chapter 7: Sections: 7.8, 7.9(7.9.2, 7.9.4, 7.9.5)	
<b>Unit III</b>	<b>(13 Hours)</b>
Stratified Random Sampling: Introduction – Advantages of Stratified Random Sampling – Notations and Terminology – Theorems related to Estimate of population mean and variance – Allocation of Sample Size – Comparison a Stratified Random Sampling with Simple Random Sampling without Stratification. Book 1: Chapter 7: Sections: 7.10 (7.10.1 – 7.10.4)	
<b>Unit IV</b>	<b>(13 Hours)</b>
Systematic Sampling – Notations and terminology – Variance of the estimated mean – Systematic Sampling versus Stratified Random Sampling – Merits and Demerits of systematic Sampling- Circular Systematic Sampling. Book 1: Chapter 7: Sections: 7.11 (7.11.1 – 7.11.3, 7.11.5, 7.11.6)	
<b>Unit V</b>	<b>(13 Hours)</b>
Single-Stage cluster sampling (clusters of equal sizes) – Reasons for Cluster Sampling – Variance in terms of Intracluster Correlation – Ratio estimators: Methods of Estimation – The Ratio Estimator – Estimation of variance from a sample – Comparison of the Ratio Estimate with the Mean per Unit – Bias of the ratio estimate. Book 2: Chapter 9 (Sections 9.1, 9.4); Chapter 6 (Sections 6.1, 6.2, 6.4, 6.6, 6.8)	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – IV	Fundamentals of Applied Statistics	V.K. Kapoor and S.C. Gupta	2017 Reprint, Sultan Chand & Sons, New Delhi.
V	Sampling Techniques	Cochran	2015, John Wiley & sons



Course Designed by :	Mrs. K. Kaviyamani	
Course Reviewed by :	Dr. S. Geetha	Dr. S. Geetha
Head of the Department :		

## B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Core IX Design of experiments	Course Code: 517W09
Semester: V	No. of Credits: 4
No. of hours : 75Hours	C:T: 65:10
CIA Max. Marks: 25	ESE Max. Marks: 75

(C: Contact hours, T: Tutorial)

### Course Objectives:

- to provide basic principles of experimentation
- to initiate discussions on the analysis of data relating to agriculture, biological sciences and industry.
- to impart the concept of analysis of variance
- to implement comparisons based on F distribution for various designs employed
- to imbibe estimation skills with missing observations and compare the efficiencies of various designs.

### Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Demonstrate the variation of information under conditions that are hypothesized to reflect the variation	U
CO2	Explain the partitioning of the total sum of squares into the 'within' and 'between' group components	R
CO3	Predict the outcome by introducing a change of pre-conditions, represented by one or more independent variables.	A
CO4	Study the effect of each factor on the response variable and the effects of interactions between factors on response variable	R
CO5	Increase statistical power by reducing the within-group error variance	A
CO6	Improve the robustness of the design or process.	A

### **R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I:</b>	<b>(15 Hours)</b>
Linear Model – Fixed, Mixed and Random Effect Models with examples – Analysis of Variance – Assumptions – ANOVA for One-Way and Two-Way Classifications for Fixed Effect Case – Estimators – Variance of the Estimators – Splitting Sum of Squares – Critical Difference. Book 1: Chapter 5 Sections 5.1, 5.2(5.2.1,5.2.2), 5.3(5.3.1,5.3.2)	
<b>Unit II</b>	<b>(11Hours)</b>
Experimentation – Terminology – Experimental Error – Principles of design – Uniformity trial – Completely Randomized Design(CRD) – Analysis of CRD – Merits and Demerits – Randomized Block Design(RBD) – Analysis of RBD – Merits and Demerits – Latin Square Design(LSD) – Analysis of LSD – Merits and Demerits. Book 1: Chapter 6 Sections 6.1 – 6.4, 6.5(6.5.1 – 6.5.5), 6.6(6.6.1 – 6.6.5)	
<b>Unit III</b>	<b>(13 Hours)</b>
Efficiency of RBD over CRD – Efficiency of LSD over RBD and CRD – Missing plot techniques in RBD and LSD with one and two missing observations. Book 1: Chapter 6 Sections 6.5(6.5.6, 6.5.7),6.6(6.6.6 – 6.6.8), 6.8	
<b>Unit IV</b>	<b>(13 Hours)</b>
Factorial Experiments – Advantages of Factorial Experiment over simple Experiment – Symmetrical and Asymmetrical Factorial Experiments – Analysis of $2^2$ , $2^3$ and $3^2$ Factorial Experiments. Book 1: Chapter 6 Section 6.9 Book 2: Chapter 2 Sections 2.12	
<b>Unit V</b>	<b>(13 Hours)</b>
Analysis of Covariance – ANOCOVA in CRD and RBD with one concomitant variable – Split Plot Design and its Analysis (outline only) Book 1: Chapter 6 Sections 6.7, 6.12	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I-III	Fundamentals of Applied Statistics	Gupta S.C and Kapoor V.K,	Sultan Chand & sons, 2017 Reprint
IV- V	Fundamentals of Statistics (Vol. II)	A. M. Gun, M.K.Gupta & B Dasgupta	World Press, 9 <sup>th</sup> Edition, 2018 Reprint

**Books for Reference:**

S. No.	Name of the Book	Authors	Publishers with Edition
1	Design and Analysis of Experiments	Das, M.N. and Giri, N.L, Wiley Eastern	
2	Design and Analysis of Experiment,	Kempthorne,	Wiley Eastern Pvt. Ltd., Reprint 1967

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

### B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core X Statistical Quality Control - I</b>	<b>Course Code: 517W10</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to introduce the concept of quality control and its need in real life.
- to impart knowledge of various tools used such as control charts and different sampling plans in quality aspects.
- Enable the students to skillfully handle the tools
- □

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Describe the purpose and function of Quality control.	R
CO2	Demonstrate to control material reception, internal rejections, clients, claims and evaluation of the same corrective actions related to their follow-up.	U
CO3	Examine the difference between attributes and variables.	U
CO4	Measure and control the quality by monitoring the manufacturing process using various charts in quality system.	U

<b>CO5</b>	Develop and use the quality indicators to customer requirements and satisfaction and to the management.	<b>A</b>
<b>CO6</b>	Take decisions to accept or reject a lot using various sampling plans.	<b>A</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Quality Control – Quality characteristics – Cost of Quality – Optimum Cost of Performance – Value of Quality – Balance between the Cost and Value of Quality – Specification of Quality – Quality control and Inspection –Quality Policy – Statistical Quality Control – Benefits of SQC – Quality perspective. Book 1: Chapter 1 (Sections 1.9 – 1.20)	

<b>Unit II</b>	<b>(13Hours)</b>
Control Chart for Variables –Definition – Objectives – Control Limits – $\bar{X}$ R and $\sigma$ Charts – Simple Problems. Book 2: Chapter 1 (Section 1.8)	

<b>Unit III</b>	<b>(13 Hours)</b>
Control Chart for Attributes – np, p, c and u Charts –Comparison between Variable and Attribute Charts – Simple Problems. Book 2: Chapter 1 (Section 1.9)	

<b>Unit IV</b>	<b>(13 Hours)</b>
Acceptance Sampling Inspection Plans – Acceptance Sampling for Attributes – Producer’s Risk and Consumer’s Risk – OC, AOQ, ASN, AOQL and ATI curves – Single Sampling Plan – Derivation of OC, ASN and ATI – Double Sampling Plan – Derivation of OC, ASN and ATI – Single Sampling against Double Sampling Plans. Book 2: Chapter 1 Sections 1.11, 1.12(1.12.1 – 1.12.3)	

<b>Unit V</b>	<b>(13 Hours)</b>
Sequential Sampling Plan – Sequential Probability Ratio Test (SPRT) – Derivation of OC function of SPRT – Derivation of Five Points on OC Curve – Derivation of Five Points on ASN Curve. Book 2: Chapter 1 Section 1.12.4	

**Books for study:**

<b>Unit</b>	<b>Name of the Book</b>	<b>Authors</b>	<b>Publishers with Edition</b>
<b>I</b>	Statistical Quality Control	M. Mahajan	Dhanpat Rai & Sons, 2018 Reprint.
<b>II – V</b>	Fundamentals of Applied Statistics	S.C. Gupta and V. K. Kapoor	Sultan Chand & Sons, 2016 Reprint

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Quality Control,	E.L. Grant and R.S. Leavenworth	McGraw Hill (India) Pvt. Ltd., 2014, 22 <sup>nd</sup> Reprint
2	Introduction to Statistical Quality Control,	Douglas C. Montgomery	2008 Reprint, Wiley & Sons.

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

### B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Elective I Numerical Methods</b>	<b>Course Code: 517WE1</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to introduce interpolation concepts
- to effectively apply the appropriate formula for the data
- to provide knowledge about numerical integration as an alternative to direct integration.
- to develop problem solving skills.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Apply forward and backward interpolation in the correct context.	A
CO2	Demonstrate the application of central difference formula	U
CO3	Recognize the situations where interpolation with unequal intervals can be applied and apply the same.	R
CO4	Derive various numerical formulae	A
CO5	Compute derivatives of functions using interpolation methods	U

<b>CO6</b>	Compute integrals of functions using interpolation methods	<b>U</b>
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**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Finite differences: First difference-Express any value of $y$ in term of $y_n$ and the backward differences of $y_n$ – Differences of a polynomial – Factorial polynomial. Interpolation (for Equal Intervals): Introduction – Gregory-Newton forward Interpolation formula – Gregory-Newton backward Interpolation Formula – Equidistant terms with one or more missing values. Chapter 5 (Sections 5.1 – 5.4); Chapter 6 (Sections 6.1 – 6.3, 6.7)	
<b>Unit II</b>	<b>(13 Hours)</b>
Central Difference Interpolation formulae (For Equal Intervals): Central differences and central difference table – Central difference interpolation formula – Gauss’s forward interpolation formula – Gauss’s backward interpolation formula – Stirling’s formula – Bessel’s formula. Chapter 7 (Sections 7.1 – 7.6)	
<b>Unit III</b>	<b>(13 Hours)</b>
Interpolation With Unequal Intervals: Introduction – Divided differences – Properties of divided differences – Relation between divided differences and forward differences – Theorem: Newton’s interpolation formula for unequal intervals – Deduction: Deduce Gregory Newton interpolation forward formula for equal intervals – Lagrange’s interpolation formula (for unequal intervals) – Different form of Lagrange’s interpolation formula – Inverse Interpolation. Chapter 8 (Sections 8.1 – 8.8)	
<b>Unit IV</b>	<b>(13 Hours)</b>
Numerical differentiation and Integration: Introduction – Newton’s forward difference formula to get the derivative – Newton’s backward difference formula to compute the derivative – Derivative using Stirling’s formula – To find maxima and minima of the function given the tabular values. Chapter 9 (Sections 9.1 – 9.6)	
<b>Unit V</b>	<b>(13 Hours)</b>
Numerical Integration: Introduction – Trapezoidal rule – Simpson’s one-third rule – Simpson’s three-eighths rule. Numerical Solution of Ordinary Differential Equations: Introduction – Solution by Taylor Series (Type I) – Euler’s Series – Runge-Kutta Method. Chapter 9 (Sections 9.7, 9.9, 9.13 & 9.14) Chapter 11(Sections 11.5, 11.9, 11.12)	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Numerical Methods,	Dr.P.Kandasamy, Dr.K.Thilagavathy and Dr.K.Gunavathi,	S.Chand & Company limited, Reprint 2012,

**Books for Reference:**

S. No	Name of the Book	Authors	Publisherswith Edition
1	Numerical Methods in Science and Engineering,	Dr. M.K.Venkataraman	National Publishing company, 5 <sup>th</sup> edition, 1995
2	Finite differences and Numerical Analysis	H.C.Saxena,	S.Chand & Company Ltd., New Delhi, 2001
<b>Course Designed by :</b>		<b>Mrs. T. Vanjikkodi</b>	
<b>Course Reviewed by :</b>		<b>Mrs. A. Samsath</b>	
<b>Head of the Department :</b>			

## B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Elective I Biostatistics</b>	<b>Course Code: 517WE2</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>P:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(P: Practical hours, T: Tutorial)

**Course Objectives:**

- to provide appropriate statistical methods for the biological study.
- to identify and communicate findings from the biomedical research.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Compare the means of two or more than two samples simultaneously.	U
CO2	Evaluate the multiple regression coefficients and the suitability of the regression model.	A
CO3	Determining the association of variables used in the research.	U
CO4	Calculate and interpret the data using a wide variety of distribution free tests.	U

<b>CO5</b>	Develop and use survival curves to make conclusions of research work.	<b>A</b>
<b>CO6</b>	Interpreting the biological studies using various statistical tools.	<b>U</b>

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

**List of Programs**

1. Application of t test in homozygous sickle-cell disease.
2. Application of paired t test for examining gallbladder function before and after fundoplication.
3. Application of Randomized Block Design in the comparison of methods for teaching patients to use a certain prosthetic device by a Physiotherapist.
4. Application of Two-way Analysis of Variance in examining the subjects with chronic, nonspecific low back pain.
5. Application of Correlation to analyze somatosensory evoked potentials and their Interactions.
6. Application of Multiple Regression in predicting the capacity to direct attention in elderly subjects using children age and education level.
7. Examine the association of short-term clinical, economic and humanistic outcomes of pharmaceutical care services for patients with diabetes using Chi-square Test.
8. Application of Sign test to test the mentally retarded girls while giving instruction in personal care and grooming for two weeks.
9. Investigating the measurement of cardiac output of post cardiac surgical patients in the left lateral position by using Wilcoxon Signed Rank Test.
10. Investigating the level of mental health of urban and rural male junior high school students by using the Median Test.
11. Experimenting the effects of prolonged inhalation of cadmium oxide which reduces hemoglobin level by using Mann-Whitney U Test.
12. Examining the fasting blood glucose determinations by using Kolmogorov-Smirnov Test.
13. Examining the relationship between age and mineral concentration using Spearman Rank Correlation.
14. Assessing results and identifying predictors of survival by reviewing the primary malignant tumors of the sternum by using the Kaplan-Mier Procedure.
15. To determine whether time to relapse among drug users is related to patient age and drug of choice using Hazard Regression Model.

**Book for Reference:**

<b>S. No</b>	<b>Name of the Book</b>	<b>Authors</b>	<b>Publishers with Edition</b>
1.	Biostatistics – Basic concepts and Methodology for the Health Sciences	Wayne W Daniel & Cad L. Cross	Wiley International, 2015 Reprint.



Course Designed by :	Mrs. S. Saranya	
Course Reviewed by :	Dr. G. Uma	Dr. G. Uma
Head of the Department :		

### B.Sc. Statistics Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Core XI Statistical Inference - II	Course Code: 617W11
Semester: VI	No. of Credits: 4
No. of hours : 75 (Total hours)	C:T: 65:10
CIA Max. Marks: 25	ESE Max. Marks: 75

(C: Contact hours, T: Tutorial)

#### Course Objectives:

- to impart knowledge on the methods of testing the hypothesis on different distributions.
- to educate the students to identify the areas of application of Neyman-Pearson Lemma.
- to provide a complete knowledge about testing procedures of means and variances
- to teach the fundamentals of sequential analysis.
- to enable the students to distinguish parametric and non-parametric methods.

#### Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Demonstrate the plausibility of pre-specified ideas about the parameters of the model by examining the area of hypothesis testing.	U
CO2	Identify the components of a classical hypothesis test including two types of errors, null and alternative hypothesis.	R
CO3	Demonstrate the theory of likelihood ratio test to test the significance of samples	U
CO4	Critically examine sequential procedures for appropriate statistical analysis.	U
CO5	Demonstrate the use of non-parametric statistical methods and to interpret and analyze the results.	U
CO6	Use the learnt statistical methods to analyze certain real life data	A

#### R-Remembrance U –Understanding A-Apply

**Syllabus:****Unit I: (13 Hours)**

Testing of statistical Hypothesis – Simple and composite hypothesis null and alternative hypothesis –Critical Region – Types of errors – level of significance – size of the test – power of the test – Steps involved in testing of hypothesis.

Chapter 18 Sections 18.1 – 18.3

**Unit II (13 Hours)**

Randomized and Non Randomized Test – Most Powerful Test – Neyman-Pearson Lemma and its applications – Unbiased test and unbiased critical Region – Optimum regions and sufficient statistics – Uniformly Most Powerful Critical Region – simple problems.

Chapter 18 Sections 18.4, 18.5

**Unit III (13 Hours)**

Test of Significance – Test of significance for Single Proportion, difference of Proportions – Test of Significance for Single Mean, difference of Means – Test of Significance for the difference of Standard Deviation – Bartlett's Test.

Chapter 14 Sections 14.7, 14.8

**Unit IV (13 Hours)**

Likelihood ratio test – Test Procedure – Properties – Simple Problems – Sequential Analysis: Introduction – Sequential Probability Ratio Test (SPRT)-Operating Characteristic Function of SPRT – Average Sample Number – Simple Problems.

Chapter 18 Sections 18.6(16.6.1), 18.8

**Unit V (13 Hours)**

Non-parametric Methods – Comparison between Parametric and Non-Parametric Methods – Run Test, Test for Randomness, Median Test, Sign Test, Mann-Whitney U Test – Kolmogorov-Smirnov Tests – Simple Problems.

Chapter 18 Section 18.7

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Fundamentals of Mathematical Statistics	S.C Gupta and V.K. Kapoor	Sultan Chand & Sons, New Delhi, 2016 Reprint.

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Introduction to Mathematical Statistics	Robert V. Hogg and Allen T. Craig	Pearson Education, 5 <sup>th</sup> Edition, 2004
2	Statistical Inference,	George Casella, Roger C. Berger	Cengage Learning India Pvt. Ltd., 2016 Reprint. .

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics**  
**Semester VI**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course Part III – Core XII Statistical Quality Control -II</b>	<b>Course Code: 617W12</b>
<b>Semester: VI</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to expose the concepts of total quality management used in industries, quality system standards and reliability concepts to control the quality of industrial outputs.
- to create awareness about the ISO quality standards of institutions
- to equip the students with various tools of TQM.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
<b>CO1</b>	Apply and evaluate best practices for the attainment of total quality.	<b>A</b>
<b>CO2</b>	Develop various operating cost components and applications of JIT for operations management.	<b>A</b>
<b>CO3</b>	Elucidate the functioning and application of six-sigma in process control	<b>U</b>
<b>CO4</b>	Explain how ISO 9000 series is used in attaining quality standards	<b>U</b>

<b>CO5</b>	Demonstrate the fundamental concepts and methodologies used in reliability analysis.	<b>U</b>
<b>CO6</b>	Follow ethics while implementing the tools of TQM	<b>R</b>

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Total Quality Management (TQM) – Need for management of product quality – concept of TQM – TQM philosophies – TQM models – Dimensions of TQM – Elements of TQM. Book 1: Chapter 2(Sections 2.1 – 2.4, 2.12)	
<b>Unit II</b>	<b>(13 Hours)</b>
Waste Control Management – Just-in-time Manufacturing (JIT) – Characteristics, Goals – Elements of JIT – Kanban System – Functions, Rules – Benefits of JIT – Limitations of JIT – Total Quality Management for Excellence. Book 1: Chapter Sections 2.23, 2.25, 2.26	
<b>Unit III</b>	<b>(13 Hours)</b>
Statistical Process Control (SPC) – Evolution of six sigma quality approach – the mathematics of six sigma – Practical approach to six sigma quality – TQM and six sigma – Six sigma concept of process capability – Six sigma and Indian industries. Book 1: Chapter 3(Section 3.18) Book 1: Chapter 17	
<b>Unit IV</b>	<b>(13 Hours)</b>
Quality system standards – ISO Standards – Features of ISO: 9000 series standards – Various elements in ISO: 9001 model – ISO implementation – ISO 9001: 2008 – Transition to ISO 9001:2015 – Introduction – Revision process – user groups – Implementation guidelines. Book 2: Chapter 5( Sections 5.6, 5.8) Http:// ISO 9001:2015 implementation guidance	
<b>Unit V</b>	<b>(13 Hours)</b>
Reliability – Quality Control and Reliability – Basic Elements of Reliability – Achievement of Reliability – Designing, Measurement, Cost, Maintenance and Availability – Failure Mode Effect and Criticality Analysis (FMECA) – Failure Rate and Hazard Function – Constant Hazard Mode – Linear Hazard Model – Mean time to failure. Book 1: Chapter 13(Sections 13.1 – 13.6)	

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
<b>I – III &amp; V</b>	Statistical Quality Control	M. Mahajan	Dhanpat Rai & Sons, 2018 Reprint
<b>IV</b>	Total quality Management	Dr. K. Maran and Dr. K. Raja	Eswar Press, Chennai, 2009 Reprint

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Statistical Quality Control,	E.L. Grant and R.S. Leavenworth,	McGraw Hill (India) Pvt. Ltd., 2014 Reprint

## B.Sc Statistics Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Elective II Matrices</b>	<b>Course Code: 617WE4</b>
<b>Semester: VI</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

**Course Objectives:**

- to identify a system of linear equations and describe its solution set.
- to exploit elementary operations to reduce matrices to echelon forms.
- to be aware of the various characterizations of an invertible matrix.
- to apply the properties of determinants in their calculation
- □

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
<b>CO1</b>	Perform common matrix operations such as addition, multiplication and transposition.	<b>U</b>

<b>CO2</b>	Solve a system of linear equations and find out the feasible solution.	<b>A</b>
<b>CO3</b>	Establish a sufficient condition for invertibility in terms of elementary matrices.	<b>A</b>
<b>CO4</b>	Apply elementary transformations to reduce the matrix to Echelon and normal form and determine its rank.	<b>A</b>
<b>CO5</b>	Finding powers of a matrix and determining matrix inverse using Cayley-Hamilton Theorem.	<b>U</b>
<b>CO6</b>	Interpret existence and uniqueness of solutions geometrically.	<b>U</b>

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I</b>	<b>(13 Hours)</b>
Definition of a Matrix – Notations – Difference between a Matrix and a Determinant – Kinds of Matrices – Equality of Matrices – Addition of Matrices – Subtraction of Matrices – Properties of Matrix Addition – Multiplication of Two Matrices – Properties of Matrix Multiplication – Matrix Polynomial – Transpose of a Matrix –Symmetric and Skew-Symmetric Matrices – Conjugate of a Matrix – Hermitian Matrix – Skew-Hermitian Matrix – Simple Problems. Chapter 1: Page No.: 3 – 62; Chapter 2: Page No.: 67 – 105	

<b>Unit II</b>	<b>(13 Hours)</b>
Determinants – Minor Determinants – Cofactor of an Element – Properties of the Determinants – Notations – Product of two Determinants – Product of Two determinants of different Orders – Adjoint Determinant – Complementary Minor of a Determinant – Laplace Expansion of a determinant by the minors of first r columns – Cramer’s Rule – Symmetric and Skew-Symmetric Determinant – Simple Problems. Chapter 3: Page No.: 137 – 228	

<b>Unit III</b>	<b>(13 Hours)</b>
Adjoint of a Matrix – Inverse of a Matrix – Inversion of a Matrix by solving Algebraic Equations – Elementary Operations and Elementary Matrices – Symbols to be used for Elementary Transformations – Inverse of the Elementary Transformation – Symbols for Elementary Matrices – Equivalent Matrices – Reduction of a Matrix to Triangular Form – Partitioning of Matrices – Identically Partitioned Matrices – Matrices Partitioned Conformably for Multiplication. Chapter 4: Page No.: 229 – 336	

<b>Unit IV</b>	<b>(13 Hours)</b>
Rank of a Matrix – Sub-Matrix – Minor of a Matrix – Rank of a Matrix – Nullity of a Matrix – Invariance of Rank through Elementary Transformations – Normal Form – Procedure for Reduction to Normal Form – Rank of a Matrix Product – Simple Problems. Chapter 5: Page No.: 337 – 389	

<b>Unit V</b>	<b>(13 Hours)</b>
Characteristic Roots and Vectors: Matrix Polynomial – Equality of Two Matrix Polynomials – Mapping or Function or Transformation – Linear Transformation – Characteristic Roots and Vectors – Characteristic Value Problem – Some Definitions – Cayley-Hamilton Theorem – Simple Problems. Chapter 8: Page No.: 450 – 506	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	A Textbook of Matrices,	Hari Kishan,	Atlantic Publishers, NewDelhi, 2008.

**Book for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Matrices	A.R.Vasishtha and A.K.Vasishtha	Krishna Prakashan Media(P) Ltd., 18 <sup>th</sup> Edition, 2008.

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Mrs. T. Vanjikkodi</b>	
<b>Head of the Department :</b>		

**B.Sc. Statistics  
Semester VI**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III– Elective III – Psychological Statistics</b>	<b>Course Code: 617WE5</b>
<b>Semester: VI</b>	<b>No. of Credits: 3</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- to gain knowledge in the application of scaling procedure and different types of rank correlation.
- to demonstrate the kinds of evidence that would be relevant to assessing the reliability and validity of a particular measure.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Measure the degree of similarity between the variables by using different ranking techniques.	U
CO2	Determine an ordinal relationship between rankings of different ordinal variable or different rankings of same variable.	U
CO3	Identify the consistency of a measure using reliability techniques.	R
CO4	Examines the issues involved in developing and validating multi-item self report scales of latent constructs.	U
CO5	Predict the relationship between the variables in psychological research.	A
CO6	Classify the research methods used in psychology and apply the statistical techniques used in psychological research.	A

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Introduction – Some Scaling Procedures – Scaling Individual Test Items in Terms of Difficulty – Scaling of scores on a test – $z$ or $\sigma$ Scores, Standard Scores, Normalized Scores, T-Score, Percentile Scores – Scaling of Ranking in terms of Normal probability curve – scaling of ratings in terms of Normal probability curve. Book 1: Chapter 8( Sections 8.1, 8.2)	
<b>Unit II</b>	<b>(13 Hours)</b>
Reliability of Test Scores – Definition of Reliability – Index of Reliability – Methods of Determining Test Reliability – The Test-Retest Methods – Alternate or Parallel form Method – Split-half method – The Rulon Method – Method of Rational Equivalence. Book 1: Chapter 8( Sections 8.3 – 8.3.4)	
<b>Unit III</b>	<b>(13 Hours)</b>
Validity of Test Scores – Estimation of Validity – Types of Validity – Validity and Test Length – Comparison between reliability and validity – Intelligence tests and Intelligence Quotient. Book 1: Chapter 8( Sections 8.4, 8.5)	
<b>Unit IV</b>	<b>(13 Hours)</b>



Correlation Ratio – Intra-Class Correlation – Multiple and Partial Correlation – Coefficient of Partial Correlation – Coefficient of Multiple Correlation – Simple Problem.  
Book 3: Chapter 12 (Sections 12.1, 12.2, 12.4, 12.7, 12.8)

**Unit V** (13 Hours)  
Correlation from Ranks –Biserial Correlation –Correlation from four-fold table – The Contingency Coefficient – Curvilinear or Non-linear Relationship.  
Book 2: Chapter 14

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I-III	Fundamental of Applied Statistics	S.C. Gupta and V.K. Kapoor	Sultan Chand & Sons, 2017 Reprint
V	Statistics in psychology and Education	Henry E Garrett	2014 Reprint, Paragon International publisher
IV	Fundamentals of Mathematical Statistics	S.C. Gupta and V.K. Kapoor	2016 Reprint, Sultan Chand & Sons

Course Designed by :	Mrs. K. Kaviyamani	
Course Reviewed by :	Dr. S. Geetha	Dr. S. Geetha
Head of the Department :		

**Syllabus having direct bearing on Entrepreneurship Development**

**B.Sc. Statistics**

**Semester III**

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part IV – Skill Enhancement Course I Actuarial Statistics I	Course Code: 317WS1
Semester: III	No. of Credits: 3
No. of hours : 45 (Total hours)	C:T: 39:6
CIA Max. Marks: 75	ESE Max. Marks: -

(C: Contact hours, T: Tutorial)

**Course Objectives:**

- To expose the major life insurance policies covered in Indian life insurance
- Infuse skill in decision making regarding risk
- Demonstrate the use of mortality tables.
- Enable a good choice of investments
- Make appropriate decision regarding policies.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Describe the theoretical and practical aspects of actuarial science.	R
CO2	Explain the legality and administrative issues of life policies	R
CO3	Demonstrate the skills for interpreting and analyzing actuarial and statistical information.	A
CO4	Compare various kinds of life insurance policies and their benefits.	U
CO5	Demonstrate mortality concepts in life insurance.	A
CO6	Estimating the policy value of life insurance using annuities	U

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(8 Hours)</b>
Principles of Life Assurance: Nature of Insurance – Classification of Insurance – History of Life Insurance in India. Chapter 1: (Pages 3 – 7), Chapter 2: (Pages 8 – 11)	
<b>Unit II</b>	<b>(8 Hours)</b>
Definition of whole life assurance – term assurance – pure endowment – endowment assurance – critical illness assurance – whole life level annuity – temporary level annuity premium, benefit – assurance and annuity contracts. Chapter 6: (Pages 43 – 50), Chapter 7:(Pages 82 – 84)	
<b>Unit III</b>	<b>(8 Hours)</b>
Selection of Risk – Purpose of selections – Factors affecting risks – Sources of risk information – Insurance of ladies and minors – Non-medical business – Classes of risk – Methods of risk classification – Measurement of Risk – Treatment of sub-standard risks – Methods of treating sub-standard risks – Mortality table – Features – Construction of death rate on yearly basis – Sources of mortality information – Construction of mortality table – Types of mortality tables – Interest factor. Chapter 8: (Pages 85 – 100), Chapter 9: (Pages 103 – 113), Chapter 11: (Pages 128 – 131)	

<b>Unit IV</b>	<b>(8 Hours)</b>
The Reserve: Nature, definition, origin, sources, need - Methods of calculating Reserve – Investment of funds: Need, Sources – Problems of investment – The principles of investment – Suitability of various types of investments – Surrender value – Basis of calculating surrender value – Forms of payment – Valuation and Surplus – The calculation process – Sources of surplus – Difference between surplus and profit – Bases of allotment of profit – Distribution of surplus – Bonus – Classification – Options. Chapter 12: (Pages 132 – 138), Chapter 13: (Pages 140 – 146), Chapter 14: (Pages 156 – 159), Chapter 15: (Pages 160 – 165)	

<b>Unit V</b>	<b>(8 Hours)</b>
Policy condition – Life insurance for under privileged – Industrial life insurance – Group life insurance – Disability Benefit policies – Social security schemes – Pension Plans – Micro life insurance. Chapter 16: (Pages 166 – 171), Chapter 17: (Pages 178 – 191)	

**Book for study:**

<b>Unit</b>	<b>Name of the Book</b>	<b>Authors</b>	<b>Publisherswith Edition</b>
<b>I – V</b>	Insurance Principles and practice	M.N. Mishra and S.B. Mishra	S. Chand and Sons, 21 <sup>st</sup> Edition, 2014.

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

### **B.Sc. Statistics Semester VI**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core Practical III Statistical Practical-III (Using SPSS)</b>	<b>Course Code: 617WP3</b>
<b>Semester: VI</b>	<b>No. of Credits: 2</b>
<b>No. of hours : 60 Hours</b>	<b>P:T: 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(T: Tutorial, P: Practical)**

**Course Objectives:**

The objectives of this course are

| to impart the fundamental features of SPSS

to secure knowledge in analyzing the data using SPSS software package.

to train the students to apply the appropriate statistical tools for data analysis.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Interpret results using various types of charts.	U
CO2	Carryout inferential statistical analysis using SPSS.	A
CO3	Test the significant relationship between the variables and interpret the result	A
CO4	Independently use the various tools to analyze real time data.	A

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

List of Programs	(52 Hours)
<ol style="list-style-type: none"> <li>1. Bar Chart, Line Chart, Pie Chart.</li> <li>2. Scatter Plots and Histograms.</li> <li>3. Construction of Frequency Distribution.</li> <li>4. Measures of Central tendency.</li> <li>5. Measures of Dispersion.</li> <li>6. Correlation.</li> <li>7. Linear Regression.</li> <li>8. t-test with one sample.</li> <li>9. Paired t test.</li> <li>10. Independent sample t test.</li> <li>11. ANOVA – One-way.</li> <li>12. ANOVA – Two- way.</li> <li>13. Non-Parametric Analysis: Chi-square test for goodness of fit,</li> <li>14. Spearman's Rank correlation</li> <li>15. Mann-Whitney U test.</li> <li>16. Wilcoxon signed rank test</li> <li>17. Kruskal-Wallis Test.</li> <li>18. Sign Test.</li> <li>19. Median Test.</li> <li>20. Kolmogorov-Smirnov Test.</li> <li>21. Control Charts for Attributes.</li> <li>22. Control Charts for Variables.</li> </ol>	

**Books for Reference:**

S. No.	Name of the Book	Authors	Publishers with Edition
1	SPSS 17.0 for	Dr. S. L Gupta and Hitesh	International Book House

	Researchers	Gupta	Pvt. Ltd., 2011 Reprint
2	Using SPSS-Interactive Hands on Approach	James B. Cunningham, James O.Aldrich	Sage Publications India Pvt. Ltd., 2012 Reprint
3	SPSS for you	A. Rajathi and P. Chandran	MJP Publisher, 2010 Reprint.

<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

### B.Sc. Statistics Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Skill Enhancement Course II Actuarial Statistics - II</b>	<b>Course Code: 417WS2</b>
<b>Semester: IV</b>	<b>No. of Credits: 3</b>
<b>No. of hours : 45 (Total hours)</b>	<b>C:T: 39:6</b>
<b>CIA Max. Marks: 75</b>	<b>ESE Max. Marks: -</b>

(C: Contact hours, T: Tutorial)

#### Course Objectives:

The objectives of this course are

- | to comprehend and explain various concepts relating to marine insurance, policy conditions and payments of marine insurance.
- | to possess a sound knowledge about various marine insurance business in India and to utilize the same in their profession

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Determine the various policies unique to the marine insurance industry	<b>U</b>
<b>CO2</b>	Explore the different sectors within marine insurance: cargo insurance, Hull and Machinery insurance and others	<b>U</b>
<b>CO3</b>	Provide complete details of the claims process	<b>R</b>
<b>CO4</b>	Identify the different roles played within the marine insurance industry	<b>R</b>
<b>CO5</b>	Classify the insurance needs of the owners and charterers as well as being able to identify relevant covers and the markets available for placing the covers.	<b>U</b>
<b>CO6</b>	Identify and describe legal and policy issues in commercial contexts.	<b>R</b>

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I:</b>	<b>(8 Hours)</b>
Marine insurance – Definition – Subject matter – Hull insurance – Cargo insurance – Freight insurance – Liability insurance – Documents of marine insurance – Procedure to effect marine insurance – Elements of marine insurance – History – Marine publications – Marine insurance policies – Classes of policies. Chapter 19 (Pages 267 – 286), Chapter 20 (Pages 287 – 291)	
<b>Unit II</b>	<b>(8 Hours)</b>
Policy conditions – Lloyd’s form of policy – Description of the clauses – Risk covered by ICC (A) – Premium calculation – Rate making in marine insurance – Return of premium. Chapter 21(Pages 292 – 298), Chapter 22 (Pages 299 – 302)	
<b>Unit III</b>	<b>(8 Hours)</b>
Marine losses – Marine perils – Total loss – Partial loss – Particular average loss – Illustration – General average – Types of general average loss – General average contribution – Application of general average to insurance – Expenses. Chapter 23(Pages 303 – 314)	
<b>Unit IV</b>	<b>(7 Hours)</b>
Payment of claims – Documents Required for claim – Documents in different types of claims – Extent of liability – Some practical problems. Chapter 24 (Pages 315 – 321)	
<b>Unit V</b>	<b>(8 Hours)</b>
Marine insurance business in India – Business of Indian Insurers progress before Nationalization – Indian Insurers – Gross direct premium income – Net premium income – Underwriting experiences in Marine insurance – Some articles in marine insurance. Chapter 25 (Pages 322 – 350)	

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Insurance Principle and practice	M.N.Mishra and S.B. Mishra	S.Chand & Co
<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>		
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>		<b>Dr. G. Uma</b>
<b>Head of the Department :</b>			

**B.Sc. Statistics**  
**Semester VI**

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Elective II Operations Research</b>	<b>Course Code: 617WE3</b>
<b>Semester: VI</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)****Course Objectives:**

The objectives of this course are

- | to introduce the fundamentals of optimization techniques .
- | to formulate a real life problem into a linear programming model.
- | to solve and interpret the solutions of the LPP model
- | to efficiently allocate resources
- | to create an awareness of the application of optimization in inventory control
- | to expose the networking techniques to the students

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Formulate and solve linear programming problems using appropriate techniques and interpret the results obtained.	<b>A</b>
<b>CO2</b>	Build and solve transportation models and assignment models.	<b>A</b>
<b>CO3</b>	Propose good strategies in two person zero sum games.	<b>R</b>
<b>CO4</b>	Optimize the outputs in terms of time, cost or profit	<b>U</b>
<b>CO5</b>	Predict the profit and cost expenses in a simple inventory system	<b>A</b>
<b>CO6</b>	Compute the necessary parameters in a network	<b>U</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 Hours)</b>
Linear Programming: Introduction – Linear Programming Problem. Graphical Solution and Extension: Introduction - Graphical solution method – some exceptional cases-General Linear Programming Problem – Canonical and Standard forms of LPP – Simplex method: Introduction – computational Procedure – Use of Artificial Variables (Big M method only). Chapter 2(Section 2.1,2.2) Chapter, 3(3.1-3.5),Chapter 4(Sections 4.1 ,4.3, 4.4)	

<b>Unit II</b>	<b>(13 Hours)</b>
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Transportation Problem : Introduction – LP formulation of the transportation Problem – The transportation table – Loops in transportation tables – Finding an initial basis feasible solution: North west corner method – least-cost method – Vogel’s Approximation method – Test for Optimality – Transportation Algorithm (MODI METHOD). Assignment Problem: Introduction – Mathematical formulation of the problem –Solution Method of Assignment problems.  
Chapter 10 (Sections 10.1,10.2, 10.5 , 10.6, 10.9,10.10,10.12,10.13),  
Chapter 11 (Sections 11.1 – 11.3)

**Unit III (13 Hours)**

Sequencing problem: Introduction – Problem of sequencing – Basic terms used in sequencing – Processing n Jobs through two machines - Processing n Jobs through k machines - Processing 2 Jobs through k machines. Games and Strategies: Introduction – Two- Person Zero-sum game – some basic terms – The Maximin-Minimax Principle – Games without Saddle point – mixed strategies -Graphical Solution of  $2 \times n$  and  $m \times 2$  games.  
Chapter 12 (Sections 12.1 – 12.6); Chapter 17 (Sections 17.1 – 17.6)

**Unit IV (13 Hours)**

Inventory Control I: Introduction – Types of inventories – Reasons for carrying inventories – The inventory decisions – Objectives of scientific inventory control – Costs associated with inventories – Factors affecting inventory control – An inventory control problem – The concept of EOQ – Deterministic inventory problems with no shortages – Deterministic inventory problems with shortages – Problems of EOQ with price breaks.  
Chapter 19 (Sections 19.1 – 19.12)

**Unit V (13 Hours)**

Network scheduling by PERT/CPM: Introduction – Network: Basic Components – Logical Sequencing –Rules of Network Construction – concurrent Activities – Critical Path Analysis – Probability Considerations in PERT – Distinction between PERT and CPM .  
Chapter 25 (Sections 25.1 – 25.8)

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I -V	Operations Research,	Kantiswarup, P.K. Gupta and Manmohan	Sultan Chand and Sons, New Delhi, 18 <sup>th</sup> Edition, 2015 Reprint

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Operations Research – Theory and Applications	J.K.Sharma,	Macmillan India Ltd, 4 <sup>th</sup> edition, 2012.



2	Operations Research: An Introduction	Hamdy A. Taha	Pearson India Education Pvt. Ltd., 2016 Reprint
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<b>Course Designed by :</b>	<b>Ms. J.P. Thempaavai</b>	
<b>Course Reviewed by :</b>	<b>Ms. J. Priyadharshini</b>	
<b>Head of the Department :</b>		

### Syllabus having direct bearing on Skill Development

#### B.Sc. Statistics

#### Semester II

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core Practical I Statistical Practical I</b>	<b>Course Code: 217WP1</b>
<b>Semester: II</b>	<b>No. of Credits: 3</b>
<b>No. of hours : 90 (Total hours)</b>	<b>T:P: 75:15</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(T:Tutorial, P:Practical)**

#### Course Objectives:

The objectives of this course are to

- | demonstrate the features of MS-Excel to handle the Basic Measures of Statistics and Forecasting Techniques.
- | Handle the data with ease to compute various statistical measures

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Apply the fundamental concepts in exploratory data analysis using MS Excel.	<b>A</b>
<b>CO2</b>	Construct the types of charts using MS Excel.	<b>A</b>
<b>CO3</b>	Calculate various measures of Descriptive Statistics using MS Excel.	<b>U</b>
<b>CO4</b>	Fit curves using MS Excel.	<b>U</b>
<b>CO5</b>	Apply the appropriate forecasting techniques to a given data.	<b>A</b>
<b>CO6</b>	Predict the price index for a real time data.	<b>A</b>

**R-Remembrance   U –Understanding   A-Apply**

**Syllabus:**

<b>List of Programs</b>	<b>75 hrs</b>
1. Formation of frequency distribution. Calculation of Arithmetic, Geometric Mean, Median and Mode. Calculation of Percentile. 2. Formation of Charts and Diagrams: Histogram, Bar diagram, Pie diagram Frequency Line, Scatter diagram. Formation of Ogive curves. 3. Calculation of Measures of Dispersion: Range, Variance, Standard Deviation, Mean deviation, Quartiles. 4. Calculation of Skewness and kurtosis. 5. Problems related to curve fitting. 6. Calculation of Correlation and Regression coefficients and formation of Regression lines. 7. Fitting straight line, non-linear trend lines and calculation of trend values using Moving averages. 8. Calculation of Index Numbers.	

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

**B.Sc. Statistics  
Semester III**

**(For the students admitted during the academic year 2017 – 2018 and onwards)**

<b>Course: Part III – Core V Probability Distribution I</b>	<b>Course Code: 317W05</b>
<b>Semester: III</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 45 (Total hours)</b>	<b>C:T: 39:6</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

**(C: Contact hours, T: Tutorial)**

**Course Objectives:**

The objectives of this course are to

- | To gather a strong foundation in the concepts of random variable and a probability distribution.
- | To enable the students to distinguish between discrete and continuous random variables and to identify joint, marginal, conditional probability functions, expectation, conditional expectation and variance, generating functions
- | To enable the students to utilize the functions on law of large numbers and central limit theorem and thereby apply the same.

**Course Outcomes: On completion of the Course the student will be able to**

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>

<b>CO1</b>	Identify and predict types of variables.	<b>A</b>
<b>CO2</b>	Find the probabilities associated with a discrete probability distribution.	<b>U</b>
<b>CO3</b>	Compute the joint, marginal and continuous distribution functions for random variables.	<b>U</b>
<b>CO4</b>	Interpret the mean of a random variable in terms of the law of large number	<b>U</b>
<b>CO5</b>	Calculate the probabilities of mass and density function of random variables.	<b>U</b>
<b>CO6</b>	Apply central limit theorem to problems involving sums and averages from probability distributions.	<b>A</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(8 Hours)</b>
Random variables – Discrete and Continuous random variables – distribution function – Properties – Probability Mass function and Probability density function – various statistical measures of continuous probability distribution. Book 1: Chapter 5: (Sections 5.1 – 5.4)	
<b>Unit II</b>	<b>(8 Hours)</b>
Joint, marginal and conditional distribution functions and density functions – independence of random variables – Transformation of variables (one and two dimensional – concepts only). Book 1: Chapter 5: (Sections 5.5 – 5.7)	
<b>Unit III</b>	<b>(8 Hours)</b>
Mathematical Expectation –properties – addition and multiplication theorems – Cauchy-Schwartz inequality, conditional expectation and conditional variance. Book 1: Chapter 6 (fully)	
<b>Unit IV</b>	<b>(7 Hours)</b>
Moment Generating function, Cumulant Generating function, characteristic function and their properties. Book 1: Chapter 7:(Sections 7.1 – 7.3)	
<b>Unit V</b>	<b>(8 Hours)</b>
Tchebychev's inequality, convergence in probability, weak law of large numbers and central limit theorem. Book 1: Chapter 7: (Sections 7.5 – 7.7) Book 2: Chapter 5: Section: 5.4 (Pages 192–195)	

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Fundamentals of Mathematical Statistics	Gupta.S.C and Kapoor.V.K	Sultan Chand & sons, 2016 Reprint
V	Introduction to Mathematical Statistics	R.V and Craig.A.G	Amerind Publication, 2004 Reprint.

Course Designed by :	Mrs. K. Kaviyamani	
Course Reviewed by :	Dr. S. Geetha	Dr. S. Geetha
Head of the Department :		

### B.Sc. Statistics Semester III

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Allied III Computer Programming for Statistical Analysis – I	Course Code: 317AW3
Semester: III	No. of Credits: 3
No. of hours : 75 (Total hours)	C:T: 65:10
CIA Max. Marks: 25	ESE Max. Marks: 50

(C: Contact hours, T: Tutorial)

#### Course Objectives:

The objectives of this course are to

- | Introduce the programming concepts for statistical analysis
- | Enable the use of different types of operators, decision making statements, arrays and functions in the appropriate context.
- | Construct programs with a professional outlook that serves to operate on real time data.

#### Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Develop simple programs using the basic elements like control statements, arrays and strings.	A
CO2	Apply the concept of arrays to represent statistical data.	A
CO3	Illustrate the code reusability with the help of user defined functions.	U
CO4	Use string handling functions to address string oriented problems.	U
CO5	Utilize the structures to represent statistical problems and manipulate the data efficiently.	A

<b>CO6</b>	Develop programs for simple applications in an ethical manner.	<b>A</b>
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**R-Remembrance U –Understanding A-Apply****Syllabus:**

<b>Unit I:</b>	<b>(13 hours)</b>
<p>Constants, Variables and Data types: Introduction – Character set- C tokens –Keywords and identifiers – Constants- Variables – Data types – Declaration of variables – Declaration of storage class-Assigning Values to variables – Defining symbolic constants – Declaring a variable as constant – Declaring a variable as Volatile. Operators and Expression: Introduction – Arithmetic operators – Relational operators – Logical operators – Assignment Operators – Increment and decrement operators – Conditional operator – Bit wise operators – Special operators – Arithmetic Expressions – Evaluation of expressions – Precedence of Arithmetic Operators – Some computational problems – Type Conversions in Expressions – Operator precedence and associativity – Mathematical functions.</p> <p>Chapter 2 and Chapter 3 (Pages 22 – 82)</p>	
<b>Unit II</b>	<b>(13 hours)</b>
<p>Managing Input and Output Operations: Introduction – Reading a Character – Writing a character – Formatted Input – Formatted Output. Decision making and branching: Introduction – Decision making with IF statement – Simple IF statement – The IF...ELSE statement – Nesting of IF...ELSE statements – The ELSE IF ladder – The switch statement – The ?: operator – The GOTO statement.</p> <p>Chapter 4 and Chapter 5 (Pages 83 – 150)</p>	
<b>Unit III</b>	<b>(13 hours)</b>
<p>Decision making and looping: Introduction – The WHILE statement – The DO statement – The FOR statement – Jumps in loops. Arrays: Introduction – One dimensional arrays – Declaration of one dimensional arrays – Initialization of One dimensional arrays – Two dimensional arrays – Initializing two dimensional arrays – Multi-dimensional arrays.</p> <p>Chapter 6 and Chapter 7 (Pages 151 – 236)</p>	
<b>Unit IV</b>	<b>(13 hours)</b>
<p>Character arrays and strings: Introduction – Declaring and initializing string variables – Reading strings from terminal – Writing strings to screen – Arithmetic operations on characters – Putting strings together – Comparison of two strings – String handling functions. User-Defined functions: Introduction – Need for user defined functions – A multi-function program –Elements of user defined functions – Definition of functions – Return values and their types – Function calls – Function Declaration – Category of functions – No arguments and no return values – Arguments but no return values – Arguments with return values – No arguments but returns a value – functions that return multiple values – Nesting of functions – Recursion – Passing Arrays to functions – Passing strings to functions – The scope, visibility and lifetime of Variables.</p> <p>Chapter 8 and Chapter 9 (Pages 237 – 323)</p>	

<b>Unit V</b>	<b>(13 hours)</b>
Structures and Unions: Introduction-Defining a Structure – Declaring Structure variables – Accessing Structure members – Structure Initialization Copying and comparing Structure variables – Operations on Individual members – Arrays of Structure – Arrays within Structures – Structures within Structures – Structures and functions – Unions – Size of Structures. Pointers: Introduction – Understanding Pointers – Accessing the Address of a Variable – Declaring Pointer Variables – Initialization of Pointer Variables – Accessing a Variables through its Pointer – Chain of Pointers – Pointer Expressions – Pointer Increments and Scale Factor-Pointers and Arrays – Pointers and Character Strings – Array of Pointers – Pointers as Function Arguments –Functions Returning Pointers –Pointers to Functions – Pointers and Structures – Troubles with Pointers. Chapter 10 and Chapter 11 (Pages 324 – 394)	

**Book for study:**

<b>Unit</b>	<b>Name of the Book</b>	<b>Authors</b>	<b>Publishers with Edition</b>
I – V	Programming in ANSI C	Balagurusamy. E	Tata McGraw Hill Education Private Limited, Seventh Edition 2017.

**Book for Reference:**

<b>S.No.</b>	<b>Name of the Book</b>	<b>Authors</b>	<b>Publishers with Edition</b>
1.	Let us C	Yaswant Kanetker	BPB publications New Delhi, 2018 Reprint

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

## B.Sc Statistics Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core VI Probability Distribution – II</b>	<b>Course Code: 417W06</b>
<b>Semester: III</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 60 (Total hours)</b>	<b>C:T: 52:8</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

**Course Objectives:**

The objectives of this course are

- to impart knowledge about discrete and continuous probability distributions.

to enable the application of concepts of discrete and continuous probability distributions in real life situations.

to provide skill in computing probabilities using discrete and continuous distributions.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Compute the probabilities associated with discrete distributions.	U
CO2	Find probabilities associated with a normal probability distribution.	U
CO3	Approximate the binomial probabilities using a normal distribution and other discrete distributions.	U
CO4	Evaluate the expected value and variance of discrete and continuous probability distributions.	A
CO5	Decide the normal random variable leading to chi square, t and F distributions	U
CO6	Interpret and communicate probabilities obtained from probability distributions.	U

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

**Unit I: (10 Hours)**

Binomial, Poisson and Negative – Binomial distributions – Moments, m.g.f, cumulants, additive property, recurrence relation for the probabilities – simple problems.

Chapter 8: (Sections 8.4 – 8.6)

**Unit II (11 Hours)**

Geometric distribution – moments, m.g.f – Hyper - geometric distribution – mean, variance, m.g.f, Binomial as a limiting form of Hyper - geometric distribution – Multinomial distribution – moments.

Chapter 8: (Sections 8.7 – 8.9)

**Unit III (11 Hours)**

Normal distribution – limiting form of Binomial distribution, properties, median, mode, moments, m.g.f, cumulants, mean deviation, area property, simple problems – Rectangular distribution – moments, m.g.f. characteristic function, mean deviation – Bivariate normal distribution.

Chapter 9: (Sections 9.2 & 9.3)

**Unit IV (10 Hours)**

Gamma, Beta distributions of I kind and II kind – constants – Exponential distribution – additive property.

Chapter 9: (Sections 9.5 – 9.8)

**Unit V (10 Hours)**

Functions of normal random variable leading to  $\chi^2$ , t and F distributions – inter relationship between the distributions and their properties.

Chapter 15: (Sections 15.2 & 15.3), Chapter 16: (Sections 16.2 – 16.6)

**Book for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I - V	Fundamentals of mathematical statistics	Gupta. S.C and Kapoor. V.K	Sultan Chand & sons, Reprint 2016

**Book for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1.	Introduction to Mathematical Statistics	Hogg R.V and Craig. A.G.,	Amerind, 2004 Reprint.

Course Designed by :	Mrs.S.Saranya	
Course Reviewed by :	Dr. S. Geetha	Dr. S. Geetha
Head of the Department :		

**B.Sc. Statistics****Semester IV**

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Core Practical II Statistical Practical II	Course Code: 417WP2
Semester: IV	No. of Credits: 3
No. of hours : 30 (Total hours)	T:P: 24:6
CIA Max. Marks: 25	ESE Max. Marks: 50

(T: Tutorial, P: Practical)

**Course Objectives:**

The objectives of this course are

- to provide the skill in applying basic measures of demography, constructing life table and to project the population.
- to solve problems based on discrete and continuous distributions.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Construct a life table used in mortality.	A



CO2	Illustrate various demographic techniques.	U
CO3	Determine the growth of population.	U
CO4	Fit binomial distribution to a data suitable for binomial distribution.	A
CO5	Fit Poisson distribution appropriately.	A
CO6	Fit Normal distribution using different methods.	A

**R-Remembrance U-Understanding A-Apply**

**Syllabus:**

<b>List of Problems</b>	<b>26 hrs</b>
<p><b>Demographic methods:</b></p> <ol style="list-style-type: none"> <li>1. Construction of life table.</li> <li>2. Determination of mortality, fertility and reproduction rates.</li> <li>3. Population projection using polynomials and exponential function.</li> <li>4. Fitting Gompertz curve.</li> <li>5. Fitting logistic curve to population data by the method of Pearl and Reed.</li> <li>6. Fitting of Logistic curve by Rhodes method.</li> </ol> <p><b>Probability and Distributions I &amp; II</b></p> <ol style="list-style-type: none"> <li>1. Fitting of Binomial distribution.</li> <li>2. Fitting of Poisson distribution.</li> <li>3. Fitting of Normal distribution by the method of ordinates.</li> <li>4. Fitting Normal distribution by area method.</li> </ol>	
<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>	

## B.Sc. Statistics Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Allied IV Computer Programming for Statistical Analysis – II</b>	<b>Course Code: 417AW4</b>
<b>Semester: IV</b>	<b>No. of Credits: 3</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 50</b>

**(C: Contact hours, T: Tutorial)**

**Course Objectives:**

The objectives of this course are

- | to introduce the basis of C++ programming.
- | to gain capability to develop programs for Statistical problems using OOP's concept

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Describe the significance of object oriented programming.	R
CO2	Illustrate the use of various data types and decision making and looping structures.	R
CO3	Demonstrate the use overloading concepts.	U
CO4	Program using constructors.	A
CO5	Build programs classes using appropriate encapsulation and design principles.	A
CO6	Simulate problem in computer networks and real world problems.	A

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

Unit I:	(13 Hours)
<p><b>Principles of Object Oriented Programming:</b> Basic concepts of Object Oriented Programming – Benefits of OOPS. Beginning with C++ : Applications of C++ – Structure of C++ program. Tokens, Expressions and Control Structures: Introduction –Tokens – Keywords – Identifiers and Constants – Basic data Types – User-Defined Data Types – Derived data types – Symbolic constants – Type Compatibility – Declaration of variables – Dynamic initialization of Variables – Reference Variables – Operators in C++ – Scope Resolution Operator – Member Dereferencing Operators – Memory Management Operators – Manipulators – Typecast Operator – Expressions and their Types – Special Assignment Expressions – Implicit Conversions – Operator Overloading – Operator Precedence – Control Structures.</p> <p>Chapter 2, Chapter 3 (Pages 19 – 76)</p>	

Unit II	(13 Hours)
<p><b>Functions in C++:</b> Introduction – The Main Function – Function prototyping – Call by Reference – Return by reference – Inline functions – Default arguments – const Arguments – Recursion – Function Overloading – Friend and Virtual Functions – Math Library Functions. Classes and Objects: Introduction – C Structures Revisited – Specifying a Class – Defining Member Functions – A C++ Program with Class – Making an Outside Function Inline – Nesting of Member Functions – Private Member Functions – Arrays within a Class – Memory allocation for Objects – Static Data Members – Static Member Functions – Arrays of Objects – Objects as Function Arguments – Friendly Functions – Returning Objects – const Member Functions – Pointers to Members – Local Classes.</p>	

Chapter 4, Chapter 5(Pages 77 – 143)

**Unit III****(13 Hours)**

**Constructors and Destructors:** Introduction – Constructors – Parameterized Constructors – Multiple Constructors in a Class – Constructors with Default Arguments – Dynamic Initialization of Objects – Copy constructor – Dynamic Constructors – Constructing Two-Dimensional Arrays – const Objects – Destructors. **Operator Overloading and Type Conversions:** Introduction – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Overloading Binary Operators using Friends – Manipulation of Strings Using Operators – Rules for Overloading Operators – Type Conversions.

Chapter 6, Chapter 7(Pages 144 - 200)

**Unit IV****(13 Hours)**

**Inheritance:** Extending Classes: Introduction – Defining Derived Classes – Single Inheritance – Making a Private Member Inheritable – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Virtual Base Classes – Abstract Classes – Constructors in Derived Classes – Member Classes: Nesting of Classes. **Pointers, Virtual Functions and Polymorphism:** Introduction – Pointers- Pointers to Objects – this Pointer – Pointers to Derived Classes – Virtual Functions – Pure Virtual functions.

Chapter 8, Chapter 9 (Pages 201 - 289)

**Unit V****(13 Hours)**

**Working with files:** Introduction – Classes for File Stream Operations – Opening and Closing a File – Detecting End-of-File – More about Open():File modes – File Pointers and their Manipulations – Sequential Input and Output Operations – Updating a File: Random Access – Error handling During File Operations – Command – Line Arguments. **Exception Handling:** Introduction – Basics of Exception Handling – Exception Handling Mechanism- Throwing Mechanism – Catching Mechanism – Rethrowing an Exception – Specifying Exceptions.

Chapter 11 (Pages 323 - 358), Chapter 13 (Pages 380 - 400)

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I – V	Object oriented programming with C++	Balagurusamy. E	Tata McGraw Grill, 4 <sup>th</sup> Edition, 2008

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1.	Programming with C++	D. Ravichandran	Tata McGraw Grill, 3 <sup>rd</sup> Edition, 2011

Course Designed by :	Mrs. K. Kaviyamani	
Course Reviewed by :	Dr. G. Uma	Dr. G. Uma
Head of the Department :		

## B.Sc. Statistics Semester IV

(For the students admitted during the academic year 2017 – 2018 and onwards)

Course: Part III – Allied Practical C & C++ Programming	Course Code: 417WAP
Semester: IV	No. of Credits: 2
No. of hours : 30 (Total hours)	T:P: 26:4
CIA Max. Marks: 20	ESE Max. Marks: 30

(T: Tutorial, P: Practical)

### Course Objectives:

The objectives of this course are

- to enhance the programming capability to develop programs for statistical problems using C and C++ languages.
- to independently design and execute programs with the help of statistical tools.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Demonstrate frequency distributions.	U
CO2	Compute the various basic measures of descriptive statistics.	U
CO3	Sketch straight line using the least square method.	R
CO4	Fit Binomial and Poisson distributions.	A
CO5	Perform various matrix operations.	A
CO6	Sort an array of numbers in a specified order.	A

**R-Remembrance    U-Understanding    A-Apply**

### Syllabus:

List of Programs	75 hours
1. Program to form a frequency distribution for the given data $X_1, X_2, X_3, \dots, X_n$ , give the number of class intervals $K$ and the width of the class intervals $W$ . 2. Program to find the arithmetic mean, geometric mean and harmonic mean for the given frequency distribution. 3. Program to find Mean, Variance, Standard Deviation and Coefficient of variation. 4. Program to find the three quartiles $Q_1, Q_2$ and $Q_3$ and the coefficient of skewness.	

5. Program to find the first four moments about origin A and to find $\beta_1$ , $\beta_2$ , $\gamma_1$ and $\gamma_2$ .
6. Program to find simple correlation and regression coefficients for the given bivariate data.
7. Program to fit a straight line of the form $y = ax + b$ using the principle of least squares to the given bivariate data.
8. Program to fit Binomial distribution.
9. Program to fit a Poisson distribution.
10. Program to arrange one dimensional array of numbers in ascending and descending order.
11. Program to evaluate a matrix polynomial of the type $aX^2+bX+cI$ where X is a matrix of order $3 \times 3$ and I is an identity matrix and a, b and c are constants.
12. Program to solve the given system of simultaneous equations of three variables.
13. Program to open a file and store data in it and to read and display the data from the file.
<b>Course Designed by :</b> Mrs. K. Kaviyamani
<b>Course Reviewed by :</b> Dr. G. Uma
<b>Head of the Department :</b>

## B.Sc. Statistics Semester V

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Skill Enhancement Course III Elements of Econometrics</b>	<b>Course Code: 517WS3</b>
<b>Semester: V</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>C:T: 65:10</b>
<b>CIA Max. Marks: 25</b>	<b>ESE Max. Marks: 75</b>

(C: Contact hours, T: Tutorial)

### Course Objectives:

The objectives of this course are

- | to create awareness about the underlying concepts of econometrics.
- | to enable the students to effectively use the simple and multiple regression models.
- | to provide a complete overview of estimating autocorrelation.
- | to expose the problems of multicollinearity.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Describe the basic principles of specification of econometric models	R

<b>CO2</b>	Demonstrate an understanding of variations and generalizations of the basic regression models	<b>U</b>
<b>CO3</b>	Predict the relationship of the variables based on the value of two or more variables	<b>A</b>
<b>CO4</b>	Find the occurrence of high-inter correlations among independent variable in a multi-regression model	<b>U</b>
<b>CO5</b>	Express consequences of using OLS in the presence of autocorrelation	<b>U</b>
<b>CO6</b>	Explain, interpret, forecast and take policy actions relative to the economic phenomenon of interest	<b>A</b>

**R-Remembrance U –Understanding A-Apply**

**Syllabus:**

<b>Unit I:</b>	<b>(7 Hours)</b>
Definition, Scope, Goals and Divisions of Econometrics – Methodology of Econometric Research. Chapter 1 & 2	
<b>Unit II</b>	<b>(8 Hours)</b>
Simple Linear Regression Model – Assumptions – Least Square Criterion and the Normal Equations of OLS – Properties of Least square Estimates – Unbiasedness, Least-Variance, Efficiency, Best Linear Unbiasedness, Least Mean-Square-Error, Sufficiency. Chapter 4: Sections: 4.1, 4.2, 4.4; Chapter 6: Sections: 6.1.1	
<b>Unit III</b>	<b>(8 Hours)</b>
Multiple Regression – Model with two explanatory variables – General Linear Regression Model – Linear and Non-linear Relationships. Chapter 7: Sections: 7.1, 7.2, 7.4	
<b>Unit IV</b>	<b>(8 Hours)</b>
Autocorrelation – Assumptions – Sources – Plausibility – Consequences – Tests for Autocorrelation – The Durbin-Watson Test – Solutions for the case of Autocorrelation – Methods for Estimating Autocorrelation. Chapter 10: Sections: 10.1 – 10.3, 10.5, 10.6.2, 10.7, 10.8	
<b>Unit V</b>	<b>(8 Hours)</b>
Multicollinearity – Assumptions – Plausibility – Consequences – Tests for Detecting Multicollinearity – Solutions for Multicollinearity – Multicollinearity and Prediction – Multicollinearity and Identification.	

Chapter 11: Sections: 11.1 – 11.7

**Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I –V	Theory of Econometrics	A. Koutsoyiannis	Macmillan Press, London, 1999 Reprint

**Books for Reference:**

S. No	Name of the Book	Authors	Publishers with Edition
1	Econometrics	K. Dhanasekaran,	Vrinda Publications (P) Ltd, Delhi, 2011
2	Basic Econometrics	Damodar N. Gujarati	McGraw Hill, Singapore, 2009

<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. S. Geetha</b>	<b>Dr. S. Geetha</b>
<b>Head of the Department :</b>		

## B.Sc. Statistics Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part III – Core Practical IV Statistical Practical-IV</b>	<b>Course Code: 617WP4</b>
<b>Semester: VI</b>	<b>No. of Credits: 4</b>
<b>No. of hours : 75 (Total hours)</b>	<b>P:T: 65:10</b>
<b>CIA Max. Marks: 40</b>	<b>ESE Max. Marks: 60</b>

(T: Tutorial, P: Practical))

**Course Objectives:**

The objectives of this course are

- | to enable the students to estimate the parameters of distributions.
- | to provide skills to analyze data with reference to basic sampling theory
- | to teach the nuances of design of experiments
- | to instill a complete knowledge of tests of significance
- | to equip the students with simple statistical quality control tools.

**Course Outcomes: On completion of the Course the student will be able to**

CO	Statement	Bloom's Taxonomy level
CO1	Estimate the parameters by using different methods practically.	U
CO2	Estimate sample size, mean and variance for different	U

	probability sampling methods practically	
<b>CO3</b>	Test the significance between the variables using various linear model designs and interpret them statistically.	<b>A</b>
<b>CO4</b>	Fit the hypothesis to test the given samples using various statistical tools.	<b>U</b>
<b>CO5</b>	Check whether the product can be accepted or rejected using various quality control methods.	<b>A</b>
<b>CO6</b>	Utilize the tools to interpret and analyze a real time data with an ethical insight	<b>A</b>

**R-Remembrance U –Understanding A-Apply****Syllabus:****Unit I: Statistical Inference-I****(13 Hours)**

1. Estimation of parameters of the distribution by the methods of maximum likelihood and moments with regard to discrete and continuous distributions.
2. Confidence intervals based on Single mean, Difference of Means (Large Samples and Small Samples), Single Variance and Ratio of Two Variance.

**Unit II Sampling theory****(13 Hours)**

1. Estimation of mean and variance of the population and the variance of the estimator of the mean using Simple Random Sampling.
2. Stratified Random Sampling – Estimation of mean and variance of the population and of the variance of the estimator of the mean under Proportional and Optimum Allocation.
3. Systematic Sampling.

**Unit III Design of Experiments****(13 Hours)**

1. Analysis RBD and LSD lay outs.
2. Missing plot techniques in RBD and LSD.
3. Analysis of  $2^2$ ,  $2^3$  and  $3^2$  factorial designs.

**Unit IV Statistical Inference-II****(13 Hours)**

1. Standard Normal and Exact tests of significance with regard to proportions, mean, variance.
2. Non-parametric Tests: Run test, test for randomness, median test, sign test, Mann-Whitney U Test.

**Unit V Statistical quality control****(13 Hours)**

1. Control chart for attributes and variables:  $\bar{X}$ , R, p, np and c charts
2. Single sampling plan and double sampling plan for attributes: OC, AOQ, ASN, ATI curves.



<b>Course Designed by :</b>	<b>Mrs. K. Kaviyamani</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		

## B.Sc Statistics Semester VI

(For the students admitted during the academic year 2017 – 2018 and onwards)

<b>Course: Part IV – Skill Enhancement Course IV Project</b>	<b>Course Code: 617WS4</b>
<b>Semester: VI</b>	<b>No. of Credits: 3</b>
<b>No. of hours : 45 (Total hours)</b>	<b>C:T: 39:6</b>
<b>CIA Max. Marks: 75</b>	<b>ESE Max. Marks: -</b>

**(C: Contact hours, T: Tutorial)**

### Preamble:

This course is offered with an aim of promoting knowledge. It enables the students to communicate and contribute their ability to enhance their skills. A project work has to be carried out individually in an emerging area and a report must be submitted individually. Viva-voce examination will be conducted.

### Course Objectives:

The objectives of this course are

- | to create awareness of applications of statistics in various fields and to interpret the results.
- | to enable the students to explore various areas of statistical applications.
- | to instill confidence to prepare and submit reports.

### Course Outcomes: On completion of the Course the student will be able to

<b>CO</b>	<b>Statement</b>	<b>Bloom's Taxonomy level</b>
<b>CO1</b>	Develop, practice and improve technical skills	<b>A</b>
<b>CO2</b>	Apply basic statistical concepts and analytical tools appropriately.	<b>A</b>
<b>CO3</b>	Demonstrate the analyzing skills in exploratory data analysis.	<b>U</b>
<b>CO4</b>	Predict results for a current scenario.	<b>A</b>
<b>CO5</b>	Compare two different sets of samples and interpret the result	<b>U</b>
<b>CO6</b>	Propose the scope of research	<b>A</b>

### **R-Remembrance U –Understanding A-Apply**

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<b>Course Designed by :</b>	<b>Mrs. S. Saranya</b>	
<b>Course Reviewed by :</b>	<b>Dr. G. Uma</b>	<b>Dr. G. Uma</b>
<b>Head of the Department :</b>		