

# **NATIONAL COLLEGE (AUTONOMOUS)**

*(Affiliated to Bharathidasan University)*

TIRUCHIRAPPALLI – 620 001



**Estd. 1919**

## **DEPARTMENT OF STATISTICS**

### **B.Sc., STATISTICS**

### **SYLLABUS**

**Academic Year 2025-2026 Onwards**

## **Bachelor of Science (B.Sc.) Statistics**

### **Eligibility criteria**

HSC (+2) or Equivalent Qualification with one subject Statistics / Mathematics / Business Statistics / Business Mathematics

### **OBE & CBCS**

Credit refers to describe the quantum of syllabus in terms of hours of study. It indicates differential weight-age given according to the contents & duration of the courses in the curriculum design.

Core Courses are compulsory subjects offered

Elective, Skill Based Elective and Non-Major Elective Courses offered by Department

Supportive courses are of intermediary & introductory level in nature; aimed at bridging the gap in the curricula; enabling improvement skills in computation & communication.

The course is designed under lectures / practical work / project work / viva-voce.

Core Courses – 14 (Theory & Practical)

Allied Courses – 06 (Theory & Practical)

Elective Courses – 02

Project Work - 01

Non-Major Elective Courses - 02

Skill-Based Elective Courses – 03

Common Courses – 04

Extension Activity – 01 (NCC / NSS / Others)

**Head of the Department**

**Dean of Science**

**CDC**

## **PROGRAMME OUTCOMES – (PO)**

At the completion of the Undergraduate Programme, the student will be able to accomplish the following outcomes:

<b>PO No.</b>	<b>Programme Outcomes</b>	<b>Graduate Attributes</b>
<b>PO1</b>	Integrate a strong foundation in statistics	Disciplinary Knowledge
<b>PO2</b>	Develop language skills by helping them express their ideas and views clearly and effectively and Assist students in understanding the statistical skills and develop their ability to work both independently and in groups.	Communication Skills
<b>PO3</b>	Identify and apply appropriate principles and methodologies to solve a wide range of problems associated with statistics	Critical Thinking and Problem Solving
<b>PO4</b>	Help students do research projects and apply them for the upliftment for their career and gain proficiency in using statistical software for data analysis	Analytical Reasoning and Technology Competency
<b>PO5</b>	Involve students in various activities thereby help them apply the moral and ethical standards of statistics in their career.	Moral and Ethical Awareness
<b>PO6</b>	To make them familiar with the modern concepts in statistics and engage them in Self-regulating and life-long learning in the broadest perspective of hi-tech change	Self-Directed and Lifelong Learning

## **PROGRAMME SPECIFIC OUTCOMES – (PSO)**

At the completion of the Undergraduate Programme, the student will be able to accomplish the following outcomes:

<b>PSO No.</b>	<b>Programme Specific Outcomes</b>
<b>PSO1</b>	Understand how to collect, classify, analyze, compile and interpret the data
<b>PSO2</b>	Ability to analyze the data by using Microsoft Excel, R-Programming, C-Programming and SPSS Software
<b>PSO3</b>	Motivate students to pursue career in related disciplines, especially the Statistics, Bio-Statistics, Data Science and Actuarial Science
<b>PSO4</b>	Approach towards Higher Education in Statistics
<b>PSO5</b>	Probing attitude and a search for deeper knowledge in Statistical Project
<b>PSO6</b>	The relevance and application of Statistics in Software coding

## **KNOWLEDGE LEVEL – (KL)**

**K1:** Remember    **K2:** Understand    **K3:** Apply    **K4:** Analyze    **K5:** Evaluate    **K6:** Create

**B.Sc. STATISTICS SYLLABUS (2025 – 2026 ONWARDS)**

Semester	Part	Course Code	Title of the Course	Course Status	Contact Hrs. / Week	Credits	Theory/Practical	Course Type	Exam Hrs.	Internal	External	Total
I	I		Language	Lang.	6	3	Theory	Lecture	3	25	75	100
	II		Language	Lang.	6	3	Theory	Lecture	3	25	75	100
	III	U25ST1	Descriptive Statistics	Core-1	5	5	Theory	Lecture	3	25	75	100
		U25ST2P	Statistical Practical	Core-2 (NS)	3	-	Practical	Lecture		-	-	-
		U25AMST1	Mathematics For Statistics – I	Allied-1	5	5	Theory	Lecture	3	25	75	100
	IV	U25AMST2P	Allied Practical (Numerical Methods)	Allied-2 (NS)	3	-	Practical	Lecture	3	-	-	-
		U25ES	Environmental Studies	Common-1	2	2	Theory	Lecture	3	25	75	100
		<b>Total</b>			<b>30</b>	<b>18</b>						<b>500</b>
II	I		Language	Lang	6	3	Theory	Lecture	3	25	75	100
	II		Language	Lang	6	3	Theory	Lecture	3	25	75	100
	III	U25ST3	Probability Theory	Core-3	5	5	Theory	Lecture	3	25	75	100
		U25ST2P	Statistical Practical	Core-2	3	3	Practical	Lecture	3	25	75	100
		U25AMST2P	Allied Practical (Numerical Methods)	Allied-2	3	3	Practical	Lecture	3	25	75	100
	IV	U25AMST3	Mathematics For Statistics – II	Allied-3	5	5	Theory	Lecture	3	25	75	100
		U25STSBE1	Digital Era	SBE-1	2	2	Theory	Lecture	3	25	75	100
		<b>Total</b>			<b>30</b>	<b>24</b>						<b>700</b>
III	I		Language	Lang	6	3	Theory	Lecture	3	25	75	100
	II		Language	Lang	6	3	Theory	Lecture	3	25	75	100
	III	U25ST4	Discrete Probability Distributions	Core-4	5	5	Theory	Lecture	3	25	75	100
		U25ST5P	Computational Lab – I (Using R)	Core-5 (NS)	3	-	Practical	Lecture	3	-	-	-
		U25ACST1	Programming in C	Allied-4	4	4	Theory	Lecture	3	25	75	100
	IV	U25ACST2P	Computational Lab – II (Using C & Java)	Allied-5 (NS)	2	-	Practical	Lecture	3	-	-	-
		U25STSBE2	Introduction to Statistical Software's	SBE-2	2	2	Theory	Lecture	3	25	75	100
		U25STSBE3P	Statistical Analysis using Microsoft Excel	SBE-3	2	2	Practical	Lecture	3	25	75	100
		<b>Total</b>			<b>30</b>	<b>19</b>						<b>600</b>
IV	I		Language	Lang	6	3	Theory	Lecture	3	25	75	100
	II		Language	Lang	6	3	Theory	Lecture	3	25	75	100
	III	U25ST6	Continuous Probability Distributions	Core-6	5	5	Theory	Lecture	3	25	75	100
		U25ST5P	Computational Lab – I (Using R)	Core-5	3	3	Practical	Lecture	3	25	75	100
		U25ACST2P	Computational Lab – II (Using C & Java)	Allied-5	2	3	Practical	Lecture	3	25	75	100
	IV	U25ACST3	Programming with Java	Allied-6	4	4	Theory	Lecture	3	25	75	100
		U25STNME1	Basic Statistics - I	NME-1	2	2	Theory	Lecture	3	25	75	100
		U25VE	Value Education	Common-2	2	2	Theory	Lecture	3	25	75	100
		<b>Total</b>			<b>30</b>	<b>25</b>						<b>800</b>

(Cont.)

Semester	Part	Course Code	Title of the Course	Course Status	Contact Hrs. / Week	Credits	Theory/Practical	Course Type	Exam Hrs.	Internal	External	Total
V	III	U25ST7	Statistical Inference – I	Core-7	6	5	Theory	Lecture	3	25	75	100
		U25ST8	Applied Statistics	Core-8	6	5	Theory	Lecture	3	25	75	100
		U25ST9	Sampling Techniques	Core-9	6	5	Theory	Lecture	3	25	75	100
		U25ST10P	Computational Lab – III (Using Python)	Core-10	3	2	Practical	Lecture	3	25	75	100
		U25ST11E1 / U25ST11E2	Operations Research / Actuarial Statistics	Elective-1	5	4	Theory	Lecture	3	25	75	100
	IV	U25STNME2	Basic Statistics - II	NME-2	2	2	Theory	Lecture	3	25	75	100
		U25SS	Soft Skills	Common-3	2	2	Theory	Lecture	3	25	75	100
			<b>Total</b>		<b>30</b>	<b>25</b>						<b>700</b>
VI	III	U25ST12	Statistical Inference – II	Core-11	5	5	Theory	Lecture	3	25	75	100
		U25ST13	Design of Experiments	Core-12	5	5	Theory	Lecture	3	25	75	100
		U25ST14	Statistical Quality Control	Core-13	5	5	Theory	Lecture	3	25	75	100
		U25ST15P	Computational Lab – IV (Using SPSS)	Core-14	3	3	Practical	Lecture	3	25	75	100
		U25ST16E1 / U25ST16E2	Vital Statistics / Bio-Statistics	Elective-2	5	5	Theory	Lecture	3	25	75	100
		U25ST17P	Group Project	Core-15	6	5	Project	-	-	50	50	100
	IV	U25GS	Gender Studies	Common-4	1	1	Theory	Lecture	3	25	75	100
V		Extension Activity										
			<b>Total</b>		<b>30</b>	<b>29</b>						<b>700</b>
			<b>Grand Total</b>		<b>180</b>	<b>140</b>						<b>4000</b>

SBE: Skill Based Elective; NME: Non-Major Elective; NS: Non-Sitting; Extension Activity: NCC/NSS/Others

- \* Non-sitting courses are taught (Continuous) in odd and even semester. The Examination for that courses will be conducted on even semester
- \* NME Courses offered to students of other Departments

### Schematic of Examinations

<b>Theory (Except Common Courses)</b>			
<b>Internal</b>	<b>Marks</b>	<b>External</b>	<b>Marks</b>
CIA (2 Test)	14	Part – A (MCQ)	20
Assignment	6	Part – B (Either Or)	25
Attendance	5	Part – C (3 Out of 5)	30
<b>Total</b>	<b>25</b>		<b>75</b>
<b>G. Total</b>	<b>100</b>		
<b>Practical</b>			
<b>Internal</b>	<b>Marks</b>	<b>External</b>	<b>Marks</b>
Observation	10	2 out of 3 Questions	70
Record	10	Viva-Voce	05
Model Test	05		
<b>Total</b>	<b>25</b>		<b>75</b>
<b>G. Total</b>	<b>100</b>		
<b>Group Project</b>			
<b>Internal</b>	<b>Marks</b>	<b>External</b>	<b>Marks</b>
Review – I	10	Viva-Voce	50
Review – II	10		
Report Submission	30		
<b>Total</b>	<b>50</b>		<b>50</b>
<b>G. Total</b>	<b>100</b>		

**\* Must have secured at least 40% marks in internal and external categories.**

**SEMESTER - I**

## SEMESTER – I

### For those who joined from 2025 onwards

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST1	Core	DESCRIPTIVE STATISTICS	Lecture	5	5

### COURSE DESCRIPTION

This is an introductory course in statistics designed to provide students with the basic concepts of statistics. Descriptive statistics are used to describe the basic concept and analyze of a univariate and bivariate data in a study.

### COURSE OBJECTIVES

- To teach the basic concept of data, survey, and sampling methods
- To teach the data, diagrammatic and graphs
- To teach the individual and discrete case of central tendency and dispersion
- To analyse the coefficient of variation and correlation coefficient between two variables
- To teach relationship between Correlation and Regression

### UNITS

#### Unit I

(15 Hrs)

Statistics – Definition, Functions, Applications and Limitations – Statistical Survey (Concept Only) – Data – Primary and Secondary – Drafting the Questionnaire – Pilot Survey

#### Unit II

(15 Hrs)

Sampling – Census and Sample – Methods of Sampling (Concept only) – Classification of Data – Types – Tabulation – Role, Parts and Rules – Diagrammatic and Graphs

#### Unit III

(15 Hrs)

Measures of Central Tendency: Average – Definition – Types – Arithmetic Mean – Merits and Demerits – Median – Merits and Demerits - Mode – Relationship of Averages – Geometric Mean – Harmonic Mean – Simple Problems (Individual and Discrete Series Only)

#### Unit IV

(15 Hrs)

Measures of Dispersion: Properties – Range – Quartile Deviation – Mean Deviation – Standard Deviation – Variance – Simple Problems (Individual and Discrete Series Only) – Coefficient of Variation – Skewness and Kurtosis (Concept Only)

#### Unit V

(15 Hrs)

Correlation Coefficients – Definition - Karl Pearson's – Spearman's Rank Correlation – Regression Analysis – Definition – Uses – Regression Equations – Simple Problems

### Text Books:

1. S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[321]

Unit – I : Page No.: 1.7 – 1.16, 2.2, 3.2 – 3.11

Unit – II : Page No.: 4.2 & 4.5, 5.3 & 5.4, 5.15 – 5.19, 6.2 – 6.5, 6.24 & 6.25, 6.36

Unit – III : Page No.: 7.4 – 7.7, 7.16 – 7.19, 7.29 – 7.32, 7.38 – 7.40, 7.47 & 7.48 & 7.52

Unit – IV : Page No.: 8.4 – 8.20, 8.25, 9.2 – 9.5 & 9.20

Unit – V : Page No.: 10.2 – 10.11, 10.25 – 10.31, 11.2 – 11.8

2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers.[330.9]

\* **Simple and Multiple bar diagrams based questions only for Unit – II** (Diagrammatic and Graphs)

- \* Students should be trained to Solved Problems Questions based on Text Book – 1
- \* Students should be trained to Objective Type Questions based on Text Book – 2

**Reference Book:**

S. C. Gupta and V. K. Kapoor (2020): Fundamental of Mathematical Statistics, 12<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511]

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. [https://incois.gov.in/documents/ITCOocean/C4\\_descriptive%20statistics.pdf](https://incois.gov.in/documents/ITCOocean/C4_descriptive%20statistics.pdf)
2. <https://cosmologist.info/teaching/STAT/CHAP4.pdf>

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	Recall the basic concept of data, survey, and sampling methods	K1/K2
CO2	Classify the data, diagrammatic and graphs	K2/K3
CO3	Apply the individual and discrete case of central tendency and dispersion	K3/K4
CO4	Analyze the coefficient of variation and correlation coefficient between two variables, and inference of regression lines	K4
CO5	Interpret the relationship of averages, coefficient of variation, Karl Pearson’s correlation and Spearman rank correlation	K5
CO6	Construct regression equations based on X and Y	K6

**CO – PO MAPPING (Course Articulation Matrix)**

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	9	9
CO3	9	9	1	1	9	3
CO4	3	3	9	9	3	3
CO5	9	9	9	9	3	3
CO6	9	9	1	1	3	1
Weightage	48	48	38	38	36	28
Weighted Percentage of Course contribution to PO’s	88.88	88.88	70.37	70.37	66.67	51.85

Correlation between CO & PO 1: Low 3: Medium 9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **DESCRIPTIVE\_STATISTICS** course in the **B.Sc. STATISTICS Programme** is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## **SEMESTER – I & II**

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST2P	Core	STATISTICAL PRACTICAL	Practical	3	3

### **COURSE DESCRIPTION**

The main emphasis of this course is to equip the student with necessary analytic and technical skills to compute the various descriptive measures and probability theory concept by using calculator.

### **COURSE OBJECTIVES**

- To teach the basic notations and formulas of descriptive statistics and probability theory
- To teach the concept of statistical data using frequency table, graphical representations, descriptive statistics and Bayes theorem
- To teach the univariate and bivariate data of descriptive statistics, discrete and continuous random variables
- To analyse the conditional probability Distributions.
- To teach the correlation and regression

### **CONTENT**

1. Construction of Frequency Table
2. Diagrammatic and Graphical Representations
3. Measures of Central Tendency (Continuous Case)
4. Measures of Dispersion (Continuous Case)
5. Measures of Skewness and Kurtosis (Continuous Case)
6. Correlation Coefficient
7. Regression Equations
8. Conditional Probability
9. Baye's Theorem
10. Two Dimensional Random Variables

### **Text Books:**

1. S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[321]
2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers.[330.9]

### **Reference Book:**

S. C. Gupta and V. K. Kapoor (2020): Fundamental of Mathematical Statistics, 12<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511]

### **DIGITAL OPEN EDUCATIONAL RESOURCES:**

- 1.[https://incois.gov.in/documents/ITCOcean/C4\\_descriptive%20statistics.pdf](https://incois.gov.in/documents/ITCOcean/C4_descriptive%20statistics.pdf)
- 2.<https://cosmologist.info/teaching/STAT/CHAP4.pdf>

## COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	List the basic notations and formulas of descriptive statistics and probability theory	K1
CO2	Demonstrate the concept of statistical data using frequency table, graphical representations, descriptive statistics and Bayes theorem	K2
CO3	Solve the univariate and bivariate data of descriptive statistics, discrete and continuous random variables	K3
CO4	Examine the skewness, kurtosis, and random variables in probability theory	K4
CO5	Evaluate the concept of correlation coefficient, regression equations and Bayes theorem	K5
CO6	Solve the problems of conditional probability situation	K6

### CO – PO MAPPING (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	3
CO2	9	9	9	3	3	3
CO3	1	9	3	3	3	3
CO4	9	3	3	1	1	1
CO5	9	3	3	1	1	1
CO6	1	3	1	1	1	3
<b>Weightage</b>	<b>38</b>	<b>36</b>	<b>28</b>	<b>18</b>	<b>18</b>	<b>14</b>
<b>Weighted Percentage of Course contribution to PO's</b>	<b>70.37</b>	<b>66.67</b>	<b>51.85</b>	<b>33.33</b>	<b>33.33</b>	<b>25.93</b>

Correlation between CO & PO 1: Low                      3: Medium                      9: High

### Course Outcome mapped with Knowledge level ( Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

<b>K Levels</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>Total Scholastic Marks</b>	<b>Non Scholastic Marks C4</b>	<b>CIA Total</b>	<b>% of Assessment</b>
	<b>T1 4 Marks</b>	<b>T2 10 Marks</b>	<b>Assignment 6 Marks</b>	<b>20 Marks</b>	<b>Attendance 5 Marks</b>	<b>25 Marks</b>	
<b>K1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>K2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>K3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>16</b>
<b>K4</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>16</b>
<b>K5</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>K6</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>Non Scholastic</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>5</b>	<b>5</b>	<b>20</b>
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **STATISTICAL PRACTICAL** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – I

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25AMST1	Allied	MATHEMATICS FOR STATISTICS – I	Lecture	5	5

### COURSE DESCRIPTION

The learning objective of the algebra, theory of equations and matrices is to provide students with important concept of fundamentals.

### COURSE OBJECTIVES

- To teach the basic ideas partial fractions and binomial series
- To teach the concept of Horner 's method and Newton method,
- To teach the matrices, Eigen values and vectors
- To teach the concept of partial fractions, transpose and inverse matrix
- To teach Horner's method, newton's method and Cayley-Hamilton theorem

### UNITS

#### Unit-I

(15 Hrs)

Rational fractions – Partial fractions – Resolution of rational into partial fractions – Binomial Series – Statement – Important expansions – Simple problems

#### Unit-II

(15 Hrs)

Nature of Roots – Equation with real coefficients, imaginary roots occur in pairs – Equation with rational coefficients irrational roots occur in pairs – Horner's method (Concept only) – Newton's method – Geometrical interpolation – Simple problems

#### Unit-III

(15 Hrs)

Matrix – Definition – Notation – Square matrix – Row matrix – Column matrix – Equality of matrices – Diagonal matrix – Unit matrix – Null matrix – Addition, Subtraction, Commutative and Associative laws – Simple problems

#### Unit -IV

(15 Hrs)

Product of matrices – Fundamental properties of scalar algebra – Transpose of a matrix – Singular matrix – Symmetric matrix – Skew symmetric matrix – Adjoint matrix – Inverse of matrix – Simple problems

#### Unit-V

(15 Hrs)

Rank of a matrix – Elementary transformations – Equivalent matrices – Eigen values – Eigen vectors Cayley-Hamilton Theorem – Simple problems

**\* Students should be trained to solve examples only.**

#### Text Book:

1. Narayanan S, Hanumantha Rao R and T K Manicavachagom Pillay (2015): Ancillary Mathematics (Vol. I), S.Vishwanathan (Printers & Publishers) Pvt. Ltd. [511]

Unit – I : Page No.: 1 – 5 (Examples: 1 to 6) & 7 – 10 (Examples: 7 to 11)

Unit – II : Page No.: 59 – 63 (Examples: 1 to 5), 89, & 95 – 98 (Examples: 20 & 21)

Unit – III : Page No.: 104 – 110 (Exercises: 1 to 3)

Unit – IV : Page No.: 111 – 116, 120 – 125 & 127 (Example: 1)

Unit – V : Page No.: 137 – 140 (Examples: 1 to 5) & 151 – 156 (Examples: 9 & 10)

**Reference Book:**

1. P R Vittal (2012): Allied Mathematics, 3<sup>rd</sup> Ed, Margham Publications[ 341.5]

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://web.stanford.edu/~boyd/ee102/rational.pdf>
2. <https://www.dr-eriksen.no/teaching/GRA6035/2010/lecture2-hand.pdf>

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	Relate the basic ideas partial fractions and binomial series	K1
CO2	Illustrate the concept of Horner 's method and Newton method	K2
CO3	Utilize the matrices, Eigen values and vectors	K3
CO4	Distinguish rational and irrational roots	K4
CO5	Justify the concept of partial fractions, transpose and inverse matrix	K5
CO6	Discuss Horner's method, newton's method and Cayley-Hamilton theorem	K6

**CO – PO MAPPING (Course Articulation Matrix)**

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	3	3
CO2	9	9	9	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	1	1	1	1
CO6	1	1	1	3	1	1
Weightage	28	28	26	22	14	14
Weighted Percentage of Course contribution to PO's	51.85	51.85	48.15	40.74	25.93	25.93

Correlation between CO & PO 1: Low 3: Medium 9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
<b>K1</b>	1	1	1	3	-	3	12
<b>K2</b>	1	1	1	3	-	3	12
<b>K3</b>	1	2	1	4	-	4	16
<b>K4</b>	1	2	1	4	-	4	16
<b>K5</b>	-	2	1	3	-	3	12
<b>K6</b>	-	2	1	3	-	3	12
<b>Non Scholastic</b>	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **MATHEMATICS FOR STATISTICS – I** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER –I & II

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25AMST2P	Allied	ALLIED PRACTICAL (NUMERICAL METHODS)	Practical	3	3

### COURSE DESCRIPTION

The learning objective of the bisection, false position method, finite differences, Newton's difference formula and Lagrange's interpolation.

### COURSE OBJECTIVES

- To teach the basic concept of numerical methods
- To teach the method of bisection. False position, backward and forward differences
- To teach the Newton Raphson method and Lagrange's interpolation formula
- To teach the concept of Lagrange's interpolation method and Newton difference formula
- To teach to find root the solution of various equations and finite differences

### CONTENT

1. Bisection Method
2. Method of False Position
3. Newton Raphson Method
4. Newton's Forward Difference
5. Newton's Backward Difference
6. Lagrange's Interpolation Method

### Text Book:

1. K Gunavathi (2006), Numerical Methods, Vol-IV , Sultan Chand & Sons, New Delhi. [374]

### Reference Book:

1. E.Balaguruswamy (2012), Numerical Methods, McGraw Hill Education (India)

### DIGITAL OPEN EDUCATIONAL RESOURCES:

1. <https://annamalaiuniversity.ac.in/studport/download/engg/math/resources/Dr%20ST-BS401-Numerical%20Methods-Module-4&5.pdf>
2. <https://rajdhnicollege.ac.in/admin/ckeditor/ckfinder/userfiles/files/numerical%20methods%20notes.pdf>

## COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	List the basic concept of numerical methods	K1
CO2	Explain the method of bisection. False position, backward and forward differences	K2
CO3	Apply the Newton Raphson method and Lagrange's interpolation formula	K3
CO4	Examine the solutions of numerical methods and finite differences	K4
CO5	Interpret the concept of Lagrange's interpolation method and Newton difference formula	K5
CO6	Adapt to find root the solution of various equations and finite differences	K6

## CO – PO MAPPING (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	3	3	3
CO2	9	9	9	3	3	1
CO3	1	1	1	3	3	3
CO4	9	9	9	1	1	1
CO5	9	9	9	3	3	3
CO6	1	1	1	3	3	3
Weightage	38	38	38	16	16	14
Weighted Percentage of Course contribution to PO's	70.37	70.37	70.37	29.63	29.63	25.93

Correlation between CO & PO 1: Low 3: Medium 9: High

## Course Outcome mapped with Knowledge level ( Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
<b>K1</b>	1	1	1	3	-	3	12
<b>K2</b>	1	1	1	3	-	3	12
<b>K3</b>	1	2	1	4	-	4	16
<b>K4</b>	1	2	1	4	-	4	16
<b>K5</b>	-	2	1	3	-	3	12
<b>K6</b>	-	2	1	3	-	3	12
<b>Non Scholastic</b>	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **ALLIED PRACTICAL (NUMERICAL METHODS)** course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

**SEMESTER - II**

## SEMESTER – II

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST3	Core	PROBABILITY THEORY	Lecture	5	5

### COURSE DESCRIPTION

The learning objective of the Probability Theory and Random Variables is to provide students with essential tools in probability theory to understand the theory of univariate and bivariate probability distributions and including the concept of Bayes' theorem.

### COURSE OBJECTIVES

- To teach the basic knowledge on fundamental probability concepts, random variable, distribution function and mathematical expectation.
- To teach the concept of addition and multiplication probability, conditional probability, probability mass function and probability density function.
- To teach the related concept of discrete and continuous random variables and their probability distributions including expectation and moments.
- To analyse the theory of probability, conditional probability.
- To teach the mathematical Expectation.

### UNITS

#### Unit – I

(15 Hrs)

Probability – Classical and Empirical – Terminology – Axiomatic Probability – Addition Theorem - Multiplication Theorem – Conditional Probability - Baye's Theorem

#### Unit – II

(15 Hrs)

Random Variables - Discrete Case – Probability Mass Function - Continuous Case - Probability Density Function – Distribution Function – Properties - Simple Problems

#### Unit – III

(15 Hrs)

Two Dimensional Random Variables – Joint and Marginal Probability Mass Function – Joint and Marginal Density Function – Simple Problems

#### Unit – IV

(15 Hrs)

Mathematical Expectation – Properties – Variance - Properties – Covariance - Simple Problems

#### Unit – V

(15 Hrs)

Moment Generating Function – Properties – Cumulants - Properties – Characteristic Function - Properties – Inversion Theorem (Statement Only) – Uniqueness Theorem (Statement Only) - Hally Bray Theorem (Statement Only) - Chebychev's Inequality

#### Text Book:

1. S. C. Gupta and V. K. Kapoor (2020): Fundamental of Mathematical Statistics, 12<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511]

Unit – I : Page No.: 3.3 – 3.12, 3.27 – 3.29, 3.31, 3.41 – 3.43, 3.52 – 3.54 & 4.4

Unit – II : Page No.: 5.3 – 5.22

Unit – III : Page No.: 5.34 – 5.51

Unit – IV : Page No.: 6.3 – 6.20

Unit – V : Page No.: 7.3 – 7.18, 7.28 – 7.36

2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers.[330.9]

**\* Students should be trained to Descriptive and Solved Problems Questions based on Text Book – 1**

**\* Students should be trained to Objective Type Questions based on Text Book – 2**

### **Reference Book:**

1. Sheldon Ross (2022): A First Course in Probability, 10<sup>th</sup> Ed., Pearson Education

2. S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi. [321]

### **DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://webspaces.maths.qmul.ac.uk/p.j.cameron/notes/prob.pdf>

2. <https://ncert.nic.in/pdf/publication/exemplarproblem/classXII/mathematics/leep213.pdf>

### **COURSE OUTCOMES**

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	<b>Remember</b> the basic knowledge on fundamental probability concepts, random variable, distribution function and mathematical expectation.	<b>K1</b>
CO2	<b>Understand</b> the concept of addition and multiplication probability, conditional probability, probability mass function and probability density function.	<b>K2</b>
CO3	<b>Apply</b> the related concept of discrete and continuous random variables and their probability distributions including expectation and moments.	<b>K3</b>
CO4	<b>Analyze</b> the properties of probability mass function, probability density function and bivariate random variables.	<b>K4</b>
CO5	<b>Evaluate</b> the theory of probability, conditional probability and mathematical Expectation.	<b>K5</b>
CO6	<b>Build</b> the applications of Chebychev's Inequality	<b>K6</b>

### **CO – PO MAPPING (Course Articulation Matrix)**

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	9	9
CO3	9	9	1	1	9	3
CO4	3	3	9	9	3	3
CO5	9	9	9	9	3	3
CO6	9	9	1	1	3	1
Weightage	<b>48</b>	<b>48</b>	<b>38</b>	<b>38</b>	<b>36</b>	<b>28</b>
Weighted Percentage of	<b>88.88</b>	<b>88.88</b>	<b>70.37</b>	<b>70.37</b>	<b>66.67</b>	<b>51.85</b>

Course contribution to PO's						
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Correlation between CO & PO 1: Low 3: Medium 9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **PROBABILITY THEORY** course in the **B.Sc.STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – II

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25AMST3	Allied	MATHEMATICS FOR STATISTICS – II	Lecture	5	5

### COURSE DESCRIPTION

The learning objective of the finite differences, calculus, integration, ordinary and partial differentiation is to provide students with important concept of fundamentals.

### COURSE OBJECTIVES

- To teach the basic ideas of finite differences, calculus and integration
- To teach the concept of equal and unequal interval interpolation.
- To teach the evaluation of integrals, Jacobian and differential equations
- To analyse the newton's forward and backward interpolation formulae
- To teach ordinary and partial differential equations.

### UNITS

#### Unit –I

(15 Hrs)

Differential Calculus – Higher derivatives – Standard results – Trigonometrical transformation (Concept only) – Formation of equations involving derivatives – Simple problems

#### Unit–II

(15 Hrs)

Leibnitz formula for the  $n^{\text{th}}$  derivatives of a product – Jacobian – Curvature (Concept only) – Maxima and Minima of functions of two variables – Working rule – Simple problems

#### Unit–III

(15 Hrs)

Integration – Definition – Important formulae – Important results – Methods of integration – Integral of functions  $f(ax + b)$  – Integration of rational algebraic functions (Concept only) – Simple problems

#### Unit–IV

(15 Hrs)

Ordinary Differential Equations – Variable separable – Homogeneous equations – Non-homogeneous – Linear equation – Partial Differential Equations – Simple problems

#### Unit–V

(15 Hrs)

Vector Analysis – Definition – Equal vectors – Addition and Subtraction – Position – Components – Vector products – Differentiation of vectors

**\* Students should be trained to solve examples only.**

#### Text Books:

1. Narayanan S, Hanumantha Rao R and T K Manicavachagom Pillay (2015): Ancillary Mathematics (Vol. I), S.Vishwanathan (Printers & Publishers) Pvt. Ltd. [511]

Unit – I: Page No.: 266 – 269 (Examples: 1 to 3) & 273 – 275 (Examples: 6 to 8)

Unit – II: Page No.: 277 – 279 (Examples: 9 & 10), 282 & 283 (Examples: 6 & 7), 296 & 318 – 323 (Examples: 26 & 27)

2. Narayanan S, Hanumantha Rao R and T K Manicavachagom Pillay (2015): Ancillary Mathematics (Vol. II), S.Vishwanathan (Printers & Publishers) Pvt. Ltd.[511.0]

Unit – III: Page No.: 1 – 10 (Examples: 1 to 8) & 23

Unit – IV: Page No.: 205 – 213 (Examples: 1 to 8) & 252 – 254 (Examples: 1 to 4)

Unit – V: Page No.: 321 – 331

### Reference Book:

P R Vittal (2012): Allied Mathematics, Margham Publications (3<sup>rd</sup> Ed).[361.1]

### **DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. [https://personal.math.ubc.ca/~feldman/m101/clp/clp\\_notes\\_100.pdf](https://personal.math.ubc.ca/~feldman/m101/clp/clp_notes_100.pdf)
2. <https://people.bath.ac.uk/mir20/images/odenotes.pdf>
3. <https://assets.v mou.ac.in/MPH02.pdf>

### COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	Recall the basic ideas of finite differences, calculus and integration	K1
CO2	Classify the concept of equal and unequal interval interpolation	K2
CO3	Construct the evaluation of integrals, Jacobian and differential equations	K3
CO4	Compare the newton's forward and backward interpolation formulae, ordinary and partial differential equations	K4
CO5	Evaluate Leibnitz formula and maxima and minima functions	K5
CO6	Solve the differential calculus and integration	K6

### CO – PO MAPPING (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	9	3
CO3	1	1	3	3	3	3
CO4	9	9	3	3	3	3
CO5	9	9	3	3	1	1
CO6	1	1	1	1	1	3
Weightage	38	38	28	28	26	22
Weighted Percentage of Course contribution to PO's	70.37	70.37	51.85	51.85	48.15	40.74

Correlation between CO & PO 1: Low

3: Medium

9: High

Course Outcome mapped with Knowledge level ( Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6

CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

### Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **MATHEMATICS FOR STATISTICS – II** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## **SEMESTER – II**

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25STSBE1	SBE	DIGITAL ERA	Lecture	2	2

### **COURSE DESCRIPTION**

The learning objective of the computers, office tools, University grants commission, e-learning and MOSPI is to provide students with important concept of fundamentals.

### **COURSE OBJECTIVES**

- To teach the basic ideas of computers, office tools and MOOC, NSSO
- To teach the concept of operating system, and e-learning.
- To teach MOOC, Swayam and digital library

### **UNITS**

#### **Unit – I**

**(6 Hrs)**

Fundamentals of Computers – Input-Process-Output Model- Characteristics of Computer -Advantages- Disadvantages- Booting- Classification-Super Computer

#### **Unit – II**

**(6 Hrs)**

Software Concepts-System Software—Operating System- Language Processor -Device Drivers - Application Software -Utility Software –Assembler- Interpreter- Compiler

#### **Unit – III**

**(4 Hrs)**

Open-Source Software- Significances- Characteristics- Types Advantages-Office Tools- Word Processor –Spreadsheet- Presentation Tool- Database Management System

#### **Unit – IV**

**(8 Hrs)**

Digital India – Digital Locker-University Grants Commission – E-Learning – Objectives – Massive Open Online Course (MOOC) – Swayam – Digital Library – E-Journals and Books

#### **Unit – V**

**(6 Hrs)**

Ministry of Statistics Planning and Implementation (MOSPI)-National Sample Survey Office (NSSO) - Central Statistics Office (CSO) - Functions

### **Reference Book:**

1. E. Balagurusamy (2009): Fundamentals of Computers, McGraw Hill Education (India) Pvt. Ltd.
2. Paul Kim (2014): Massive Open Online Courses: The MOOC Revolution, Illustrated edition, Routledge

### **DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. [https://www.tutorialspoint.com/basics\\_of\\_computers/index.htm](https://www.tutorialspoint.com/basics_of_computers/index.htm)

2. <https://www.mospi.gov.in/>

\* Students should be trained to Objective and Descriptive Type Questions based on Study Materials

### COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	Define the basic ideas of computers, office tools and MOOC, NSSO	K1
CO2	Summarize the concept of operating system, and e-learning	K2
CO3	Construct the concept of soft wares, applications of soft wares	K3
CO4	Theme of MOOC, Swayam and digital library	K4
CO5	Explain the concept of E-journals and books	K5
CO6	Elaborate the use and Functions of MOSPI, NSSO, CSO	K6

### CO – PO MAPPING (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	1	1
CO2	9	9	9	9	9	9
CO3	9	9	3	3	9	9
CO4	9	9	3	3	1	1
CO5	1	1	3	3	1	1
CO6	1	1	1	1	1	1
Weightage	38	38	28	28	22	22
Weighted Percentage of Course contribution to PO's	70.37	70.37	51.85	51.85	40.70	40.70

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
<b>K1</b>	1	1	1	3	-	3	12
<b>K2</b>	1	1	1	3	-	3	12
<b>K3</b>	1	2	1	4	-	4	16
<b>K4</b>	1	2	1	4	-	4	16
<b>K5</b>	-	2	1	3	-	3	12
<b>K6</b>	-	2	1	3	-	3	12
<b>Non Scholastic</b>	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **DIGITAL ERA** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

**SEMESTER - III**

## SEMESTER – III

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST4	Core	DISCRETE PROBABILITY DISTRIBUTIONS	Lecture	5	5

### COURSE DESCRIPTION

The impart knowledge on discrete distributions and their applications in various fields. These distributions often involve statistical analyses of counts of an event occurs.

### COURSE OBJECTIVES

- To teach the Bernoulli-Binomial-Poisson-Geometric-Multinomial distribution
- To teach the M.G.F and C.G.F of Binomial- Negative Binomial distribution, Geometric-Hyper Geometric distribution,
- To teach the Poisson Approximation to Binomial distribution
- To teach the fitting a Binomial distribution
- To teach the fitting a Poisson distribution

### UNITS

#### Unit – I

(15Hrs)

Bernoulli – Binomial distribution – Moments Generating Function – Cumulants – Fitting a Binomial distribution - Simple Problems

#### Unit – II

(15Hrs)

Poisson distribution – Moments Generating Function – Cumulants – Poisson Approximation to Binomial –Fitting a Poisson distribution – Simple Problems

#### Unit – III

(15Hrs)

Negative Binomial distribution – Moment Generating Function – Cumulants – Poisson distribution limiting case of negative binomial distribution

#### Unit – IV

(15Hrs)

Geometric distribution –Lack of Memory – Moment Generating Function – Hyper-Geometric Distribution – Approximation to Binomial

#### Unit – V

(15Hrs)

Multinomial distribution – Moments – Applications - Power Series distribution – Moments – M.G.F. of PSD

### Text Books:

1. S. C. Gupta and V. K. Kapoor (2020): Fundamental of Mathematical Statistics, 12<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511]

Unit – I : Page No.: 8.3 – 8.12, 8.16 – 8.18, 8.21 – 8.23

Unit – II : Page No.: 8.30 – 8.36, 8.38 – 8.40, 8.47 – 8.49

Unit – III : Page No.: 8.52 – 8.59

Unit – IV : Page No.: 8.60 – 8.66

Unit – V : Page No.:8.67 – 8.73

2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers.[330.9]

**\* Students should be trained to Descriptive and Solved Problems Questions based on Text Book – 1**

**\* Students should be trained to Objective Type Questions based on Text Book – 2**

**Reference Book:**

1. S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi. [321]

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://www3.nd.edu/~rwilliam/stats1/x13.pdf>
2. <https://www.math.ntu.edu.tw/~hchen/teaching/StatInference/notes/lecture16.pdf>

**COURSE OUTCOMES**

CO. No	Course Outcomes	Knowledge Level
CO1	Define Bernoulli-Binomial-Poisson-Geometric-Multinomial distribution	K1
CO2	Compare the M.G.F and C.G.F of Binomial- Negative Binomial distribution, Geometric-Hyper Geometric distribution	K2
CO3	Make use of distributions in problem solving	K3
CO4	Examine Poisson Approximation to Binomial distribution	K4
CO5	Justify fitting a Binomial and Poisson distribution	K5
CO6	Estimate Power series distribution	K6

**CO-PO MAPPING (course articulation matrix):**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	3	3
CO3	9	3	3	3	3	1
CO4	3	9	3	1	1	3
CO5	9	1	1	3	3	3
CO6	3	1	3	3	3	1
Weightage	42	32	28	28	22	20
Weighted percentage of course contribution to PO's	77.77	59.25	51.85	51.85	40.74	37.03

Correlation between CO & PO 1: Low

3: Medium

9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **DISCRETE PROBABILITY DISTRIBUTIONS** course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – III & IV

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST5P	Core	COMPUTATIONAL LAB – I (USING R)	Practical	3	3

### COURSE DESCRIPTION

The learning objective of the computations of diagrammatic & graphical representations, frequency tabulation, measures of central tendency & dispersion and correlation coefficient is to provide students with important concept of fundamentals.

### COURSE OBJECTIVES

- To teach the construction of diagrammatic representations
- To teach the concept of measures of central tendency & dispersion,
- To teach the syntax of statistical analysis
- To teach the graphical representations and simple analysis tools
- To teach descriptive statistics and correlation coefficient

### CONTENT

#### 1. Diagrammatic & Graphical Representations

- ❖ Bar Diagram
- ❖ Line Diagram
- ❖ Pie Diagram
- ❖ Histogram

#### 2. Frequency Tabulation

#### 3. Measures of Central Tendency

#### 4. Measures of Dispersion

#### 5. Probability and Random Variables

#### 6. Binomial, Poisson and Normal Distributions

#### 7. Correlation and Regression Analysis

#### 8. Curve Fitting

### Text Book & Reference Book:

1. R Programming for Dummies, 2ed , Andrie de Vries (Author), Joris Meys (Author) –[390.1]
2. R Programming for Beginners, by Sandip Rakshit (Author) – [411]

### **DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://www.stats.ox.ac.uk/~evans/Rprog/LectureNotes.pdf>
2. [https://bmsce.ac.in/Content/MCA/R-UNIT\\_1.pdf](https://bmsce.ac.in/Content/MCA/R-UNIT_1.pdf)

## COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	List the construction of diagrammatic representations	K1
CO2	Infer the concept of measures of central tendency & dispersion	K2
CO3	Apply the syntax of statistical analysis	K3
CO4	Analyze of graphical representations and simple analysis tools	K4
CO5	Explain the concept of frequency tabulation and correlations	K5
CO6	Create the descriptive statistics and correlation coefficient	K6

### CO – PO MAPPING (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	3	9
CO3	9	9	3	3	3	3
CO4	9	3	3	3	3	3
CO5	9	3	1	1	1	1
CO6	3	1	1	1	1	1
Weightage	48	34	26	26	20	26
Weighted Percentage of Course contribution to PO's	88.90	63.00	48.15	48.15	37.00	48.15

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

### Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
Total	4	10	6	20	5	25	100%

The Cos and POs for the COMPUTATIONAL LAB – I (USING R) course in the B.Sc.STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – III

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ACST1	Allied	PROGRAMMING IN C	Lecture	4	4

### COURSE DESCRIPTION

To get knowledge on C-programming, character set, tokens, structures and arrays. To understand and coding the syntax in C.

### COURSE OBJECTIVES

- To teach the Character set, Tokens, Key words, Identifiers, constants, variables and data types
- To teach the concept of expressions, input and output operations, reading a character.,
- To teach the decision making, branching, simple IF statement, IF-ELSE statement, nesting of IF-ELSE statement.
- To teach the decision making, looping structure of loop control
- To teach the WHILE Statement Do Statement FOR Statement

### UNITS

#### Unit – I

(12 Hrs)

Introduction to C – Importance – Basic Structure – Character Set – C Tokens – Key words and Identifiers – Constants – Variables - Data types - Declarations of Variables

#### Unit – II

(12 Hrs)

Operators – Arithmetic – Relational – Logical – Assignment – Increment & Decrement – Conditional – Bitwise – Expressions

#### Unit – III

(12 Hrs)

Input and Output Operations – reading a character – writing a character – formatted input – formatted output

#### Unit – IV

(12 Hrs)

Decision Making and Branching - Simple IF Statement – IF-ELSE Statement –Nesting of IF-ELSE Statement – ELSE-IF Ladder - Switch Statement

#### Unit – V

(12 Hrs)

Decision Making and Looping – Structure of Loop Control – Sentinel Loops – WHILE Statement - Do Statement – FOR Statement – Array and Structure (Concept Only)

**\* Kindly avoid program based questions because they are done in practical**

### Text Book:

1. E. Balagurusamy (Reprint, 2019): Programming in ANSI C, 8<sup>th</sup> Ed., McGraw Hill Education (India) Pvt. Ltd.[517.0]

Unit – I : Page No.: 17 – 19, 28, 39 – 50

Unit – II : Page No.: 68 – 76 & 79

Unit – III : Page No.: 100 – 119

Unit – IV : Page No.: 131 – 148

**\* Students should be trained to Objective and Descriptive Type Questions based on Text Book Reference Book:**

1. The C Programming Language 2ed, Brian W. Kernighan / Dennis Ritchie (Author)

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. [https://www.unf.edu/~wkloster/2220/ppts/cprogramming\\_tutorial.pdf](https://www.unf.edu/~wkloster/2220/ppts/cprogramming_tutorial.pdf)

**COURSE OUTCOMES**

CO. No	Course Outcomes	Knowledge Level
CO1	Define the Character set, Tokens, Key words, Identifiers, constants, variables and data types	K1
CO2	Illustrate the expressions, input and output operations, reading a character.	K2
CO3	Build the decision making, branching, simple IF statement, IF-ELSE statement, nesting of IF-ELSE statement.	K3
CO4	Examine the decision making, looping structure of loop control, WHILE Statement Do Statement FOR Statement.	K4
CO5	Asses operators and array	K5
CO6	Develop decision making, branching and looping.	K6

**CO-PO MAPPING (course articulation matrix):**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	3
CO2	9	9	3	3	3	9
CO3	9	9	9	9	9	9
CO4	3	3	3	3	3	9
CO5	9	9	9	9	9	1
CO6	9	9	9	9	9	9
Weightage	48	48	42	42	42	40
Weighted percentage of course contribution to PO's	88.88	88.88	77.77	77.77	77.77	74.07

Correlation between CO & PO 1: Low

3: Medium

9: High

**Course Outcome mapped with Knowledge level ( Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **PROGRAMMING IN C** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – III & IV

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ACST2P	Allied	COMPUTATIONAL LAB – II (Using C & Java)	Practical	2	3

### COURSE DESCRIPTION

To learning the knowledge on writing a c-programming and create an own coding in C.

### COURSE OBJECTIVES

- To teach the basic terminology of C programming
- To teach the concept average and standard deviation with using C & Java,
- To teach the decision making of branching and looping concept
- To teach the basic terminology of Java
- To teach the correlation coefficient using java

### CONTENT

#### C-Programming

1. Compute simple and compound interest
2. Whether a given number is odd or even
3. Compute the Gross Salary for Employer
4. Compute an Average
5. Compute Correlation Coefficient
6. Whether a given number is Palindrome or not

#### Java Programming

7. Factors of a Positive and Negative Number
8. Calculate Average Using Arrays
9. Sum of Natural Numbers using for and while loop
10. Calculate Standard Deviation
11. Add Two Matrices
12. Find Transpose of a Matrix

### COURSE OUTCOMES

CO. No	Course Outcomes	Knowledge Level
CO1	Recall the basic terminology of C programming	K1
CO2	Demonstrate the average and standard deviation	K2
CO3	Develop the decision making of branching and looping concept	K3
CO4	Analyze the correlation coefficient	K4
CO5	Interpret the array concept, declaration and initialization	K5
CO6	Adapt the statistical tools oriented programs	K6

**CO-PO MAPPING (course articulation matrix):**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	3
CO2	9	3	3	3	3	9
CO3	9	9	9	9	9	9
CO4	3	3	3	3	3	9
CO5	9	9	9	9	9	1
CO6	9	9	9	9	9	9
Weightage	48	42	42	42	42	40
Weighted percentage of course contribution to PO's	88.88	77.77	77.77	77.77	77.77	74.07

Correlation between CO &amp; PO 1: Low

3: Medium

9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the COMPUTATIONAL LAB – II (Using C & Java) course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – III

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25STSBE2	Skill Based	INTRODUCTION TO STATISTICAL SOFTWARE'S	Lecture	2	2

### COURSE DESCRIPTION

The learning objective of the Excel, Power BI, SPSS, R and Python packages, working of dataset, functions, graphs and measures of central tendency, association and correlations is to provide students with important concept of fundamentals.

### COURSE OBJECTIVES

- To teach the basic ideas of Excel,
- To teach the basic BI and R
- To teach the concept of formulas
- To teach the syntax of graphs and analysis tools
- To teach the concept of Build in functions

### UNITS

#### UNIT – I

(6 Hrs)

Excel: Introduction – Create Worksheet – Basic Excel Formulas – Creating Formulas – Arithmetic Operators – Build in Functions – Charts

#### UNIT – II

(6 Hrs)

Power BI: Introduction to BI – Components – Applications – Advantages and Disadvantages – Basic Fundamentals and Structure of Power BI – Data Sources

#### UNIT – III

(6 Hrs)

SPSS: Introduction – Import Data – Data Editor – Compute Variable – Missing Values – Measurement – Descriptive Statistics

#### UNIT – IV

(6 Hrs)

R: Introduction – Installing R – Working with R – Features – Basic Syntax – Data Types – Variables

#### UNIT – V

(6 Hrs)

Python: Introduction – Installing Python – Interactive Window – Editor Window – Errors – Create a Variable – Merits and Demerits

### Study Materials:

1. [https://www.tutorialspoint.com/excel/excel\\_entering\\_values.htm](https://www.tutorialspoint.com/excel/excel_entering_values.htm) (Unit I)
2. <https://www.geeksforgeeks.org/power-bi-tutorial/> (Unit II)
3. <https://www.statisticshowto.com/probability-and-statistics/spss-tutorial-beginners/> (Unit III)
4. [https://www.tutorialspoint.com/r/r\\_tutorial.pdf](https://www.tutorialspoint.com/r/r_tutorial.pdf) (Unit IV)
5. <https://static.realpython.com/python-basics-sample-chapters.pdf> (Unit V)

**\* Students should be trained to Objective and Descriptive Type Questions based on Study Materials**

## COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	Relate the introduction of Excel, BI and R	K1
CO2	Outline the concept of formulas	K2
CO3	Develop the syntax of graphs and analysis tools	K3
CO4	Function of Charts	K4
CO5	Interpret the concept of Build in functions	K5
CO6	Construct the Arithmetic Operators, Syntax and Descriptive Statistics	K6

### CO – PO MAPPING (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	3	3	3	3
CO2	9	3	9	9	9	9
CO3	9	9	9	9	9	9
CO4	3	3	9	9	9	9
CO5	9	9	1	1	1	1
CO6	9	9	9	9	9	9
Weightage	48	42	40	40	40	40
Weighted Percentage of Course contribution to PO's	88.88	77.77	74.07	74.07	74.07	74.07

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

### Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
Total	4	10	6	20	5	25	100%

The Cos and POs for the INTRODUCTION TO STATISTICAL SOFTWARE'S course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – III

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25STSBE3P	Skill Based	STATISTICAL ANALYSIS USING MICROSOFT EXCEL	Practical	2	2

### COURSE DESCRIPTION

The learning objectives of this expose the students to the statistical analysis of data using excel

### COURSE OBJECTIVES

- To teach the construction of diagrammatic representations
- To teach the concept of measures of central tendency & dispersion using Excel,
- To Make use of the formula of statistical analysis
- To teach the curve fitting
- To teach the regression analysis

### CONTENT

#### 1. Diagrammatic Representations

- ❖ Bar Diagram: Simple and Multiple
- ❖ Line Diagram: Simple and Multiple
- ❖ Pie Diagram

#### 2. Graphical Representations

- ❖ Histogram
- ❖ Curve Fitting

#### 3. Measures of Central Tendency

#### 4. Measures of Dispersion

#### 5. Correlation Analysis

#### 6. Regression Analysis

### Study Materials:

1. [https://www.tutorialspoint.com/excel/excel\\_entering\\_values.htm](https://www.tutorialspoint.com/excel/excel_entering_values.htm) (Unit I)
2. <https://www.geeksforgeeks.org/power-bi-tutorial/> (Unit II)
3. <https://www.statisticshowto.com/probability-and-statistics/spss-tutorial-beginners/> (Unit III)
4. [https://www.tutorialspoint.com/r/r\\_tutorial.pdf](https://www.tutorialspoint.com/r/r_tutorial.pdf) (Unit IV)
5. <https://static.realpython.com/python-basics-sample-chapters.pdf> (Unit V)

## COURSE OUTCOMES

CO. No	Course Outcomes	Knowledge Level
CO1	Recall the construction of diagrammatic representations	K1
CO2	Explain the concept of measures of central tendency & dispersion	K2
CO3	Make use of the formula of statistical analysis	K3
CO4	Theme of graphical representations and simple analysis tools	K4
CO5	Inference the concept of correlation and regression	K5
CO6	Estimate the curve fitting and regression analysis	K6

### CO-PO MAPPING (course articulation matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	9	3
CO3	9	3	3	3	3	3
CO4	9	3	3	3	3	3
CO5	3	3	3	1	1	1
CO6	3	1	1	1	1	1
Weightage	42	28	28	26	26	20
Weightage of course contribution to PO's	77.78	51.90	51.85	48.15	48.15	37.00

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

### Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
Total	4	10	6	20	5	25	100%

The Cos and POs for the STATISTICAL ANALYSIS USING MICROSOFT EXCEL course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

**SEMESTER - IV**

## SEMESTER – IV

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST6	Core	CONTINUOUS PROBABILITY DISTRIBUTIONS	Lecture	5	5

### COURSE DESCRIPTION

Continuous probability distribution used in large number of applications, widely used in large sample theory where normality is involved

### COURSE OBJECTIVES

- To teach the Normal, Log Normal, Beta and Uniform distributions
- To teach the concept of Normal distribution limiting case of Binomial distribution,
- To teach the continuous distribution to solve the problem
- To teach the MGF and CGF of Normal distribution
- To teach Mean, Variance and Moments of Exponential distribution

### UNITS

#### Unit – I

(15 Hrs)

Normal distribution – Definition – Normal distribution limiting case of Binomial distribution – Characteristics of Normal curve — Median – Mode - Moment Generating Function – Cumulants

#### Unit – II

(15 Hrs)

Importance of Normal distribution – Fitting a Normal distribution – Simple Problem Only – Log-Normal Distribution (Concept Only)

#### Unit – III

(15 Hrs)

Uniform Distribution – Moments - Simple Problem Only – Triangular Distribution (Concept Only) – Gamma Distribution – Cumulant Generating Functions – Limiting form of Gamma – Additive Property

#### Unit – IV

(15 Hrs)

Beta Distribution – First and Second kind – Mean and Variance – Exponential Distribution – Definition – Moment Generating Function

#### Unit – V

(15 Hrs)

Central Limit Theorem – Applications – De-Moivre's Theorem – Lindeberg Theorem – Levy Theorem – Liapounoff's Theorem – Cramer's Theorem (without proof)

### Text Books:

1. S. C. Gupta and V. K. Kapoor (2020): Fundamental of Mathematical Statistics, 12<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511]

Unit – I : Page No.: 9.4 – 9.14

Unit – II : Page No.: 9.16 – 9.22 & 9.29

Unit – III : Page No.: 9.30 – 9.40

Unit – IV : Page No.: 9.42 – 9.47, 9.53 – 9.58

Unit – V : Page No.: 9.79 – 9.84, 9.87 – 9.90

2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers.  
Page No.: 140 – 160[330.9]

\* Students should be trained to Descriptive and Solved Problems Questions based on Text Book – 1

\* Students should be trained to Objective Type Questions based on Text Book – 2s

**Reference Book:**

S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[321]

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://byjus.com/maths/normal-distribution/>
2. [https://en.wikipedia.org/wiki/Beta\\_distribution](https://en.wikipedia.org/wiki/Beta_distribution)

**COURSE OUTCOMES**

CO. No	Course Outcomes	Knowledge Level
CO1	Define Normal, Log Normal, Beta and Uniform distributions	K1
CO2	Relate Normal distribution limiting case of Binomial distribution	K2
CO3	Make use of continuous distribution to solve the problem	K3
CO4	Discover MGF and CGF of Normal distribution	K4
CO5	Prove De-Moivre’s, Lindenberg and Levy, Liapounoff’s and Cramer’s Theorems	K5
CO6	Develop Mean, Variance and Moments of Exponential distribution	K6

**CO-PO MAPPING** (course articulation matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	9	9
CO3	9	3	9	9	3	3
CO4	3	9	3	3	3	3
CO5	9	3	3	3	1	1
CO6	9	3	1	1	1	1
Weightage	48	36	34	34	26	26
Weightage of course contribution to PO's	88.88	66.66	63.00	63.00	48.15	48.15

Correlation between CO & PO 1: Low 3: Medium 9: High

**Course Outcome mapped with Knowledge level (Revised Bloom’s Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
<b>K1</b>	1	1	1	3	-	3	12
<b>K2</b>	1	1	1	3	-	3	12
<b>K3</b>	1	2	1	4	-	4	16
<b>K4</b>	1	2	1	4	-	4	16
<b>K5</b>	-	2	1	3	-	3	12
<b>K6</b>	-	2	1	3	-	3	12
<b>Non Scholastic</b>	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **CONTINUOUS PROBABILITY DISTRIBUTIONS** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – IV

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ACST3	Allied	PROGRAMMING WITH JAVA	Lecture	4	4

### COURSE DESCRIPTION

To get knowledge on JAVA programming, tokens, structures and constructors. To understand and coding the syntax in Java

### COURSE OBJECTIVES

- To teach the basic Tokens, Key words, Identifiers and Constants
- To teach the concept of Constants and Statements,
- To teach the Data Types, Arrays, Strings
- To teach the concept of Program Structure , Classes and Objects
- To teach Constructors and Vectors

### UNITS

#### **Unit – I** (12 Hrs)

Java – History – Features – Differs from C– Java and Internet – Java Environment

#### **Unit – II** (12 Hrs)

Program Structure – Tokens – Character – Set – Key Words – Identifiers – Separators – Statements

#### **Unit – III** (12 Hrs)

Constants – Variables – Data Types – Declaration of Variables – Scope of Variables – Symbolic Constants – Type Casting

#### **Unit – IV** (12 Hrs)

Classes and Objects – Defining a Class – Fields Declaration – Methods Declaration – Creating Objects – Accessing Class Members – Constructors – Methods Overloading – Inheritance

#### **Unit – V** (12 Hrs)

Arrays – Introduction – One-dimensional – Creating – Initialization – Two-dimensional – Strings – Methods – Vectors

**\* Kindly avoid program based questions because they are done in practical**

### Text Book:

E. Balagurusamy (2007): Programming with Java a Primer, 3<sup>rd</sup> Ed., McGraw Hill Education (India) Pvt. Ltd.[371.1]

Unit – I : Page No.: 11 – 22

Unit – II : Page No.: 25 – 38

Unit – III : Page No.: 43 – 53

Unit – IV : Page No.: 126 – 141

Unit – V : Page No.: 153 – 166

**\* Students should be trained to Objective and Descriptive Type Questions based on Text Book**  
**DIGITAL OPEN EDUCATIONAL RESOURCES**

1. <https://www.geeksforgeeks.org/java/>

## COURSE OUTCOMES

CO. No	Course Outcomes	Knowledge Level
CO1	Define the Tokens, Key words, Identifiers and Constants	K1
CO2	Illustrate the Constants and Statements	K2
CO3	Build the Data Types	K3
CO4	Examine Arrays, Strings	K4
CO5	Asses Program Structure , Classes and Objects	K5
CO6	Develop Constructors and Vectors	K6

### CO-PO MAPPING (course articulation matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	1	9	3	9	9
CO2	9	9	3	9	9	9
CO3	9	9	9	9	1	1
CO4	3	9	3	9	3	3
CO5	9	9	9	1	9	9
CO6	9	9	9	9	9	9
Weightage	48	46	42	40	40	40
Weighted percentage of course contribution to PO's	88.88	85.18	77.77	74.07	74.07	74.07

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level ( Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

### Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
Total	4	10	6	20	5	25	100%

The Cos and POs for the PROGRAMMING WITH JAVA course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

**SEMESTER - V**

## SEMESTER – V

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST7	Core	STATISTICAL INFERENCE – I	Lecture	6	5

### COURSE DESCRIPTION

Statistical inference is the process of making conclusion by statistical techniques. This technique applied for various field like education, industries, marketing etc.

### COURSE OBJECTIVES

- To teach the Estimate, Estimation, Estimators, Parameters, Statistic, Parameters Space
- To teach the Characteristics of Estimators, Minimum variance unbiased Estimators,
- To teach the Maximum Likelihood Estimators and its properties
- To teach Method of minimum variance – Method of moments – Method of least squares
- To teach Confidence interval and Confidence limits for large and small sample

### UNITS

#### Unit-I (22 Hrs)

Introduction – Characteristics of estimators – Invariance property of consistent estimators – Sufficient conditions for consistency – Efficient estimators – Simple problem

#### Unit-II (22 Hrs)

Minimum Variance Unbiased Estimators – Sufficiency – Factorization theorem (statement only) – Cramer-Rao inequality – Rao-Blackwell theorem – Simple problem

#### Unit-III (18 Hrs)

Methods of Estimation – method of maximum likelihood estimation – Properties of maximum likelihood estimators – Theorems (statement only) – Simple problem

#### Unit-IV (14 Hrs)

Method of minimum variance – Method of moments – Method of least squares – Simple problem

#### Unit-V (14 Hrs)

Confidence Interval – Confidence Limits – Simple problem

### Text Books:

1. S. C. Gupta and V. K. Kapoor (2020): Fundamental of Mathematical Statistics, 12<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511]

Unit – I : Page No.: 17.3 – 17.10

Unit – II : Page No.: 17.10 – 17.30

Unit – III : Page No.: 17.31 – 17.42

Unit – IV : Page No.: 17.43 – 17.47

Unit – V : Page No.: 17.48 – 17.53

2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers.[330.9]

\* Students should be trained to Descriptive and Solved Problems Questions based on Text Book – 1

\* Students should be trained to Objective Type Questions based on Text Book – 2

**Reference Book:**

S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[321]

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://www.geeksforgeeks.org/properties-of-estimators/>
2. <https://biostat.jhsph.edu/~iruczins/teaching/materials/notes/n.cin.pdf>

**COURSE OUTCOMES**

CO. No	Course Outcomes	Knowledge Level
CO1	Tell the Estimate, Estimation, Estimators, Parameters, Statistic, Parameters Space	K1
CO2	Understand the Characteristics of Estimators, Minimum variance unbiased Estimators	K2
CO3	Utilize the Maximum Likelihood Estimators and its properties	K3
CO4	Analyze the Method of minimum variance – Method of moments – Method of least squares.	K4
CO5	Prove the Cramer- Rao- Inequality theorem and Rao-Blackwell theorem	K5
CO6	Test for Confidence interval and Confidence limits for large and small sample	K6

**CO-PO MAPPING (course articulation matrix)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	3
CO2	9	9	9	3	9	9
CO3	9	3	3	9	1	1
CO4	3	3	1	9	9	3
CO5	9	9	9	3	9	9
CO6	9	9	9	9	9	9
Weightage	48	40	40	42	46	34
Weighted percentage of course contribution to PO's	88.88	74.07	74.07	77.77	85.18	62.96

Correlation between CO & PO 1: Low

3: Medium

9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **STASTICAL INFERENCE – I** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – V

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST8	Core	APPLIED STATISTICS	Lecture	6	5

### COURSE DESCRIPTION

To get knowledge on index numbers, time series, psychology statistics and their applications in various fields. This application should be apply for various fields for framing policies.

### COURSE OBJECTIVES

- To teach the index numbers, times series and Psychology Statistics
- To teach the Laspeyres , Paasche's , Bowley's ,Fisher's, Marshall index numbers.,
- To teach the Unit test, Time reversal test, Factor reversal test and Scaling procedures
- To teach the Ratio to trend method, Ratio to moving average method and Z-scores
- To teach the different types of index numbers and different types of trend

### UNITS

#### Unit – I

(20 Hrs)

Index Numbers- Definition - Uses - Classification – Methods of Constructing Index Numbers – Unweighted Index Numbers – Simple Aggregative Method – Price Relatives Method – Simple Problems

#### Unit – II

(20 Hrs)

Weighted Index Numbers – Laspeyre's – Paasche's – Bowley – Fisher's – Marshall – Tests of Adequacy – Unit test – Time reversal test – Factor reversal test – Simple Problems

#### Unit – III

(20 Hrs)

Times Series – Definition – Uses – Components – Measurement of trend – Graphic method – Semi-average method – Moving average method – Simple Problems

#### Unit – IV

(15 Hrs)

Measurement of seasonal variations – Method of simple averages – Ratio to trend method – Ratio to moving average method – Simple Problems

#### Unit – V

(15 Hrs)

Psychology Statistics – Introduction – Scaling Procedures – Z-scores – Standard scores – Normalized scores – T-scores – Percentiles scores – Simple Problems

### Text books:

1. S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[321]

Unit – I : Page No.: 13.2 – 13.13    Unit – II : Page No.: 13.14 – 13.26

Unit – III : Page No.: 14.2 – 14.20    Unit – IV : Page No.: 14.38 – 14.48

2. S. C. Gupta and V. K. Kapoor (2021): Fundamentals of Applied Statistics, 4<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511.0]

Unit – V : Page No.: 8.2, 8.7 – 8.13

3. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers.[330.9]

\* Students should be trained to Descriptive and Solved Problems Questions based on Text Book – 1&2

\* Students should be trained to Objective Type Questions based on Text Book – 3

**Reference Book:**

S. C. Gupta and V. K. Kapoor (2021): Fundamentals of Applied Statistics, 4<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511.0]

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://www.geeksforgeeks.org/properties-of-estimators/>
2. <https://biostat.jhsph.edu/~iruczins/teaching/materials/notes/n.cin.pdf>

**COURSE OUTCOMES**

CO. No	Course Outcomes	Knowledge Level
CO1	<b>Remembering</b> the index numbers, times series and Psychology Statistics	<b>K1</b>
CO2	<b>Understanding</b> the Laspeyres , Paasche’s , Bowley’s ,Fisher’s, Marshall index numbers.	<b>K2</b>
CO3	<b>Applying</b> the Unit test, Time reversal test, Factor reversal test and Scaling procedures	<b>K3</b>
CO4	<b>Analyzing</b> the Measurement of trend, Graphic method, Semi-average method, Moving average method and T-scores	<b>K4</b>
CO5	<b>Evaluating the</b> Ratio to trend method, Ratio to moving average method and Z-scores	<b>K5</b>
CO6	<b>Creating</b> the different types of index numbers and different types of trend	<b>K6</b>

**CO-PO MAPPING (course articulation matrix)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	3	3	3
CO2	3	9	3	9	9	9
CO3	9	9	9	9	9	9
CO4	9	3	3	9	9	9
CO5	9	9	9	1	1	1
CO6	9	9	9	9	9	9
<b>Weightage</b>	<b>48</b>	<b>48</b>	<b>42</b>	<b>40</b>	<b>40</b>	<b>40</b>
<b>Weighted percentage of course contribution to PO's</b>	<b>88.88</b>	<b>88.88</b>	<b>77.77</b>	<b>74.07</b>	<b>74.07</b>	<b>74.07</b>

Correlation between CO & PO 1: Low 3: Medium 9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the APPLIED STATISTICS course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – V

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST9	Core	SAMPLING TECHNIQUES	Lecture	6	5

### COURSE DESCRIPTION

To get erudition of random selection, allowing students to make strong statistical inference about the whole group. To get erudition the sampling theory and it's applied in various departments.

### COURSE OBJECTIVES

- To teach the basic ideas partial fractions and binomial series
- To teach the concept of population, sample, sample size, standard error, sampling, non-sampling error.
- To teach the simple random sampling, stratified random sampling and systematic random sampling
- To teach the allocation, optimum allocation, proportional allocation, Neyman-allocation.
- To teach ratio estimation, regression estimation and difference estimation.

### UNITS

#### Unit - I

(18 Hrs)

Population – Sample – Sample Size – Sampling Distribution – Standard Error – Standard Error of Statistic – Principles of Sample Survey – Sampling and Non-Sampling Errors – Census – Limitations of Sampling – Types of Sampling

#### Unit - II

(18 Hrs)

Simple Random Sampling - Procedures of selecting a random sample – Merits and Demerits – Attributes - Simple Problems – Estimation of Population Parameters and Proportion – Estimation of Sample Size

#### Unit - III

(18 Hrs)

Stratified Random Sampling - Advantages – Estimation of Variance - Allocation of Sample Size – Proportional Allocation – Optimum Allocation – Equal Allocation – Neyman's Allocation - Optimum Allocation and Proportional Allocation - Relative Precision of Stratified Random Sampling with Simple Random Sampling

#### Unit - IV

(18 Hrs)

Systematic Random Sampling – Some important theorems – Merits and Demerits – Circular Systematic sampling – Comparison of Simple Random Sampling and Stratified Random Sampling with Systematic Sampling – Cluster and Quota Sampling

#### Unit - V

(18 Hrs)

Ratio Estimation – Definition - Bias of ratio estimation - comparison of the ratio estimation with the mean per unit-Regression estimation – Difference Estimators - Comparison with the Mean per unit and Ratio estimators

### Text Books:

1. D. Singh and F. S. Chaudhary (2018): Theory and Analysis of Sample Survey Design, 1<sup>st</sup> Ed, New Age International Publishers.[431.0]

Unit – I : Page No.: 1 – 18

Unit – II : Page No.: 19 – 47

Unit – III : Page No.: 48 – 58

Unit – IV : Page No.: 81 – 109

Unit – V : Page No.: 147 – 178

2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers.[330.9]

\* Students should be trained to Descriptive Type Questions based on Text Book – 1

\* Students should be trained to Objective Type Questions based on Text Book – 2

**Reference Book:**

S. C. Gupta and V. K. Kapoor (2021): Fundamentals of Applied Statistics, 4<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511.0]

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://www.questionpro.com/blog/simple-random-sampling/>
2. [https://en.wikipedia.org/wiki/Ratio\\_estimator](https://en.wikipedia.org/wiki/Ratio_estimator)

**COURSE OUTCOMES**

CO. No	Course Outcomes	Knowledge Level
CO1	Name the population, sample, sample size, standard error, sampling, non-sampling error.	K1
CO2	Illustrate the simple random sampling, stratified random sampling and systematic random sampling.	K2
CO3	Identify the estimation of population parameter and proportion, estimation of sample size, principles of sample survey.	K3
CO4	Categorize the allocation, optimum allocation, proportional allocation, Neyman-allocation.	K4
CO5	Determine the ratio estimation means per unit, comparison with the mean per unit and ratio estimator.	K5
CO6	Tests the ratio estimation, regression estimation and difference estimation.	K6

**CO-PO MAPPING (course articulation matrix)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	9	9	9	9	9
CO2	9	1	1	9	9	9
CO3	9	9	9	9	3	9
CO4	9	9	9	9	1	9
CO5	9	9	9	3	9	1
CO6	9	9	9	3	9	1
Weightage	48	46	46	42	40	38
Weighted percentage of course contribution to PO's	88.88	85.18	85.18	77.77	74.07	70.37

3. Correlation between CO & PO 1: Low 3: Medium 9: High

**Course Outcome mapped with Knowledge level ( Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **SAMPLING TECHNIQUES** course in the **B.Sc. STATISTICS Programme** is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – V

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST10P	Core	COMPUTATIONAL LAB – III (USING PYTHON)	Practical	3	2

### COURSE DESCRIPTION

The learning objective of the computation's measures of central tendency, dispersion and correlation coefficient is to provide students with important concept of fundamentals.

### COURSE OBJECTIVES

- To teach the basic construction of arithmetical operations
- To teach the concept Odd or Even
- To teach the LCM, Number is Positive, Negative or Zero
- To teach the descriptive statistics and correlation coefficient

### CONTENT

1. Arithmetical operations
2. Generate a random number
3. Check if a Number is Positive, Negative or Zero
4. Check if a Number is Odd or Even
5. Descriptive statistics
6. Correlation Coefficient
7. Regression Analysis
8. Probability Distributions (Binomial & Poisson)
9. Curve fitting
10. Time Series Analysis (Moving Average)

#### Text Book:

1.E. Balagurusamy (2007): Programming with Java a Primer, 3<sup>rd</sup> Ed., McGraw Hill Education (India) Pvt. Ltd.[371.1]

Unit – I : Page No.: 11 – 22

Unit – II : Page No.: 25 – 38

Unit – III : Page No.: 43 – 53

Unit – IV : Page No.: 126 – 141

Unit – V : Page No.: 153 – 166

**\* Students should be trained to Objective and Descriptive Type Questions based on Text Book**

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://docs.python.org/3/tutorial/index.html>

## COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	List the construction of arithmetical operations	K1
CO2	Infer Odd or Even	K2
CO3	Apply Regression Analysis	K3
CO4	Analyze LCM, Number is Positive, Negative or Zero	K4
CO5	Explain the concept of Curve fitting and Regression	K5
CO6	Create the descriptive statistics and correlation coefficient	K6

### CO – PO MAPPING (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	3	9
CO3	9	9	3	3	3	3
CO4	9	3	3	3	3	3
CO5	9	3	1	1	1	1
CO6	3	1	1	1	1	1
Weightage	48	34	26	26	20	26
Weighted Percentage of Course contribution to PO's	88.90	63.00	48.15	48.15	37.00	48.15

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

<b>K Levels</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>Total Scholastic Marks</b>	<b>Non Scholastic Marks C4</b>	<b>CIA Total</b>	<b>% of Assessment</b>
	<b>T1 4 Marks</b>	<b>T2 10 Marks</b>	<b>Assignment 6 Marks</b>	<b>20 Marks</b>	<b>Attendance 5 Marks</b>	<b>25 Marks</b>	
<b>K1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>K2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>K3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>16</b>
<b>K4</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>16</b>
<b>K5</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>K6</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>Non Scholastic</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>5</b>	<b>5</b>	<b>20</b>
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **COMPUTATIONAL LAB – III (USING PYTHON)** course in the **B.Sc.STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

**SEMESTER - VI**

## SEMESTER – VI

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST12	Core	STATISTICAL INFERENCE – II	Lecture	5	5

### COURSE DESCRIPTION

To understand the testing of significance, compare the small sample and large sample test. To estimate the statistical analysis is to draw inferences.

### COURSE OBJECTIVES

- To teach the testing of hypothesis, null, alternative hypothesis, types of errors and level of significance and Neyman – Pearson lemma
- To teach the procedure for solving testing of hypothesis, most powerful test, uniformly most powerful test
- To teach the likelihood ratio test, parameter space, test for the mean of a normal population
- To teach the test for Goodness off fit and independence of attributes

### UNITS

#### Unit – I

(15 Hrs)

Testing of Hypothesis – Null and Alternative Hypothesis – Types of Errors – Level of Significance – Procedure for solving testing of hypothesis – Most powerful test – Uniformly most powerful test – Neyman–Pearson lemma – Simple problems

#### Unit - II

(15 Hrs)

Likelihood Ratio test (L.R.T.) – Parameter Space – Properties of L.R.T. – Test for the Mean of a Normal Population – Test for the Variance of a Normal Population

#### Unit - III

(15 Hrs)

Large Sample: Test of significance for single Mean – Test of significance for difference Means – Test of significance for single and difference of Standard deviations – Simple problem

#### Unit – IV

(15 Hrs)

Small Sample: t-Test for Single and Difference Means – F-test for equality of Two Population Variances – Test for Goodness of Fit and Independence of Attributes – Simple problem

#### Unit – V

(15 Hrs)

Non-parametric Methods – Advantages – Run Test – Test for Randomness – Median Test – Sign Test – Mann-Whitney U test - Simple problem

### Textbook

1. S. C. Gupta and V. K. Kapoor (2020): Fundamental of Mathematical Statistics, 12<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511]

Unit – I : Page No.: 18.3 – 18.15      Unit – II : Page No.: 18.21 – 18.38

Unit – III : Page No.: 14.21 – 14.34      Unit – IV : Page No.: 16.13 – 16.23, 16.37 – 16.40 & 15.24 – 15.38

Unit – V : Page No.:18.39 – 18.50

2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers.[330.9]

\* Students should be trained to Descriptive and Solved Problems Questions based on Text Book – 1

\* Students should be trained to Objective Type Questions based on Text Book – 2

**Reference Book:**

S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[321]

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://www.geeksforgeeks.org/understanding-hypothesis-testing/>
2. <https://www.geeksforgeeks.org/difference-between-parametric-and-non-parametric-methods/>

**COURSE OUTCOMES**

CO. No	Course Outcomes	Knowledge Level
CO1	<b>Define</b> the testing of hypothesis, null, alternative hypothesis, types of errors and level of significance and Neyman –Pearson lemma.	<b>K1</b>
CO2	<b>Explain</b> the procedure for solving testing of hypothesis, most powerful test, uniformly most powerful test	<b>K2</b>
CO3	<b>Construct</b> the likelihood ratio test, parameter space, test for the mean of a normal population	<b>K3</b>
CO4	<b>Compare</b> the Small Sample: t-test for single and difference Means, F-test for equality of two population variances	<b>K4</b>
CO5	<b>Justify</b> test for Goodness off fit and independence of attributes	<b>K5</b>
CO6	<b>Estimate</b> test for the variance of a normal Population	<b>K6</b>

**CO-PO MAPPING (course articulation matrix)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	3	9	9
CO2	3	3	1	9	9	9
CO3	9	9	9	9	9	3
CO4	3	9	9	9	9	3
CO5	9	1	9	9	9	9
CO6	9	9	9	9	9	9
<b>Weightage</b>	<b>42</b>	<b>40</b>	<b>46</b>	<b>48</b>	<b>54</b>	<b>42</b>
<b>Weighted percentage of course contribution to PO's</b>	<b>77.77</b>	<b>74.07</b>	<b>85.18</b>	<b>88.88</b>	<b>100</b>	<b>77.77</b>

Correlation between CO & PO 1: Low

3: Medium

9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **STATISTICAL INFERENCE – II** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – VI

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST13	Core	DESIGN OF EXPERIMENTS	Lecture	5	5

### COURSE DESCRIPTION

To learning knowledge of the experimental design in agricultural field and to understand of the factorial experiments apply for laboratories, research and natural sciences.

### COURSE OBJECTIVES

- To teach the basic design of experiments, analysis of variance and its classifications.
- To teach the completely randomized design and estimation of One Missing Values in R.B.D.,
- To teach the  $2^2$  factorial design, Yates Method,  $2^3$  factorial design.
- To teach the concept of C.R.D, R.B.D,
- To teach the concept of L.S.D, B.I.B.D

### UNITS

#### UNIT – I

(15Hrs)

Design of Experiments – Introduction – Terminology in Experimental Design – Principles of Experimental Design – Analysis of variance – Assumptions – One-way classification – Two-way classification – Simple Problems

#### UNIT – II

(15Hrs)

Completely Randomized Design (C.R.D.) – Advantages and Disadvantages – Statistical Analysis of C.R.D. – Randomized Block Design (R.B.D.) – Advantages and Disadvantages – Latin Square Design (L.S.D.) –

#### UNIT – III

(15Hrs)

Factorial Experiments – Advantages –  $2^2$  Factorial Design – Main and Interaction Effects of  $2^2$  Design – Statistical Analysis of  $2^2$  Design – Yates Method –  $2^3$  Factorial Design – Statistical Analysis of  $2^3$  Design

#### UNIT – IV

(15Hrs)

Confounding in Factorial Design – Definition – Confounding in  $2^3$  Experiment – Partial Confounding in  $2^3$  Experiment – Split Plot Design

#### UNIT - V

(15Hrs)

Balanced Incomplete Block Design (B.I.B.D.) – Definition – Parameters – Incidence Matrix – Symmetric B.I.B.D. – Resolvable Design – Intra Block Analysis of B.I.B.D.

### Text books:

1. S. C. Gupta and V. K. Kapoor (2021): Fundamentals of Applied Statistics, 4<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511.0]

Unit – I : Page No.: 6.2 – 6.9, 5.2 – 5.9, 5.18 – 5.29 & 5.37 – 5.41

Unit – II : Page No.: 6.10 – 6.12, 6.17 – 6.20 & 6.30 – 6.33

Unit – III : Page No.: 6.83 – 6.95 Unit – IV : Page No.: 6.100 – 6.104, 6.117 – 6.118 & 6.126 – 6.127

Unit – V : Page No.: 6.128 – 6.135

2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers. [330.9]

\* Students should be trained to Descriptive and Solved Problems Questions based on Text Book – 1

\* Students should be trained to Objective Type Questions based on Text Book – 2

**Reference book:**D. C. Montgomery (2013): Design and Analysis of Experiments, 8<sup>th</sup> Ed. John Wiley & Sons, Inc.[451.0]**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://home.iitk.ac.in/~shalab/anova/chapter4-anova-experimental-design-analysis.pdf>
2. <https://online.stat.psu.edu/stat503/lesson/4/4.7>

**COURSE OUTCOMES**

CO. No	Course Outcomes	Knowledge Level
CO1	<b>Recall</b> the design of experiments, analysis of variance and its classifications.	<b>K1</b>
CO2	<b>Relate</b> the completely randomized design, Randomized Block Design, Latin Square Design, Estimation of One Missing Values in R.B.D.	<b>K2</b>
CO3	<b>Experiment</b> of 2 <sup>2</sup> factorial design, Yates Method, 2 <sup>3</sup> factorial design.	<b>K3</b>
CO4	<b>Distinguish</b> the confounding in factorial design, confounding in 2 <sup>3</sup> experiment partial confounding in 2 <sup>3</sup> experiments, split plot design.	<b>K4</b>
CO5	<b>Choose</b> the C.R.D, R.B.D, L.S.D, B.I.B.D	<b>K5</b>
CO6	<b>Design</b> the experiments and apply the any one of the randomized designs in which the degree of uncertainty with which the inference is drawn.	<b>K6</b>

**CO-PO MAPPING (course articulation matrix):**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	3
CO2	9	9	1	9	9	9
CO3	9	9	9	9	9	9
CO4	9	9	3	9	9	9
CO5	3	3	9	1	1	3
CO6	9	3	9	1	1	3
<b>Weightage</b>	<b>48</b>	<b>42</b>	<b>40</b>	<b>38</b>	<b>38</b>	<b>36</b>
<b>Weighted percentage of course contribution to PO's</b>	<b>88.88</b>	<b>77.77</b>	<b>74.07</b>	<b>70.37</b>	<b>70.37</b>	<b>66.66</b>

Correlation between CO &amp; PO 1: Low

3: Medium

9: High

**Course Outcome mapped with Knowledge level ( Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the DESIGN OF EXPERIMENTS course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – VI

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST14	Core	STATISTICAL QUALITY CONTROL	Lecture	5	5

### COURSE DESCRIPTION

The learning knowledge of statistical quality control and the different kinds of charts are used. Create a chart using the quality all along the arrival of materials through each of their processing to the final delivery of goods.

### COURSE OBJECTIVES

- To teach the basic statistical quality control, definition, process and product control, control charts, tools for S.Q.C,
- To teach the concept of control charts for variables, average ( $\bar{X}$ ) chart, range (R) chart, standard deviation ( $\sigma$ ) chart.,
- To teach the chart for fraction defective
- To teach the chart for number of defectives
- To teach the chart for number of defects per unit.

### UNITS

#### UNIT – I

(15 Hrs)

Statistical Quality Control (S.Q.C.) – Basis – Definition – Benefits – Process and Product Control – Control Charts – Tools for S.Q.C

#### UNIT – II

(15 Hrs)

Control Charts for Variables – Average ( $\bar{X}$ ) Chart – Range (R) Chart – Standard Deviation ( $\sigma$ ) Chart – Simple Problem

#### UNIT – III

(15 Hrs)

Control Charts for Attributes – Chart for Fraction Defective (p – chart) – Chart for Number of Defectives (d – chart) – Chart for Number of Defects per Unit (c – chart) – Simple Problem

#### UNIT – IV

(15 Hrs)

Operating Characteristic (OC) Curve – Average Sample Number (ASN) – Average amount of Total Inspection (ATI) – Acceptance Sampling Inspection Plans – Single Sampling Plan – determination of n and c, AOQL, OC Curve - Double Sampling Plan

#### UNIT – V

(15 Hrs)

Sequential Sampling Plan - Sequential Probability Ratio Test (S.P.R.T.) – OC and ASN Function of Sequential Sampling Plan

#### Text Books:

S. C. Gupta and V. K. Kapoor (2021): Fundamentals of Applied Statistics, 4<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi. Unit - I to V: Page No.: 1.2 – 1.69 [511.0]

**\* Students should be trained to Objective, Descriptive and Solved Problems Questions based on Text Book**

**Reference Book:**

Montgomery D. C. (2013): Introduction to Statistical Quality Control, 7<sup>th</sup> Ed. John Wiley & Sons, Inc.[531.1]

**DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://www.slideshare.net/slideshow/statistical-quality-control-lecture-notespdf/251826045>

**COURSE OUTCOMES**

CO. No	Course Outcomes	Knowledge Level
CO1	<b>Define</b> the statistical quality control, definition, process and product control, control charts, tools for S.Q.C,	<b>K1</b>
CO2	<b>Explain</b> the control charts for variables, average ( $\bar{X}$ ) chart, range (R) chart, standard deviation ( $\sigma$ ) chart.	<b>K2</b>
CO3	<b>Build</b> the control charts for attributes, chart for fraction defective, chart for number of defectives, chart for number of defects per unit.	<b>K3</b>
CO4	<b>Classify</b> the operating characteristic curve, averages sample number, average amount of total inspection, acceptance sampling inspection plans.	<b>K4</b>
CO5	<b>Compare</b> the sequential sampling plan, sequential probability ratio test, OC curve and average sample number.	<b>K5</b>
CO6	<b>Creation</b> and development of a product quality evaluation through improved inspection procedure.	<b>K6</b>

**CO-PO MAPPING (course articulation matrix):**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	3	9	9
CO2	9	9	3	9	9	9
CO3	9	9	9	9	9	3
CO4	9	9	3	9	9	1
CO5	3	3	9	9	1	3
CO6	9	9	9	1	1	9
<b>Weightage</b>	<b>48</b>	<b>48</b>	<b>42</b>	<b>40</b>	<b>38</b>	<b>34</b>
<b>Weighted percentage of course contribution to PO's</b>	<b>88.88</b>	<b>88.88</b>	<b>77.77</b>	<b>74.07</b>	<b>70.37</b>	<b>62.96</b>

Correlation between CO & PO 1: Low

3: Medium

9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **STATISTICAL QUALITY CONTROL** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – VI

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST15P	Core	COMPUTATIONAL LAB – IV (Using SPSS)	Practical	3	3

### COURSE DESCRIPTION

To learn knowledge about SPSS and statistical analysis on dataset

### COURSE OBJECTIVES

- To teach the basic graphical representations
- To teach the measures of central tendency & dispersion,
- To teach the diagrammatic and parametric test analysis
- To teach the bivariate analysis
- To teach the p-value of the given data set

### CONTENT

#### 1. Diagrammatic & Graphical Representations

- ❖ Bar Diagram: Simple and Multiple
- ❖ Line Diagram: Simple and Multiple
- ❖ Pie Chart
- ❖ Histogram

#### 2. Measures of Central Tendency

#### 3. Measures of Dispersion

#### 4. Correlation Analysis

#### 5. Regression Analysis

#### 6. Parametric Test

- ❖ One sample t-test
- ❖ Paired t-test
- ❖ Independent t-test
- ❖ One-way ANOVA test

#### 7. Chi – square Test

#### 8. Non – Parametric Test

- ❖ Wilcoxon Signed-Rank test
- ❖ Mann-Whitney U test

## DIGITAL OPEN EDUCATIONAL RESOURCES:

1. [https://students.shu.ac.uk/lits/it/documents/pdf/analysing\\_data\\_using\\_spss.pdf](https://students.shu.ac.uk/lits/it/documents/pdf/analysing_data_using_spss.pdf)
2. <https://www.slideshare.net/slideshow/spss-lecture-notes/27031253>

## COURSE OUTCOMES

CO. No	Course Outcomes	Knowledge Level
CO1	Relate the basic idea of graphical representations	K1
CO2	Illustrate the measures of central tendency & dispersion	K2
CO3	Construct the diagrammatic and parametric test analysis	K3
CO4	Function of the bivariate analysis	K4
CO5	Explain the non-parametric test analysis	K5
CO6	Predict the p-value of the given data set	K6

## CO-PO MAPPING (course articulation matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	1	1	1	3
CO2	9	9	9	9	9	9
CO3	9	9	9	9	9	9
CO4	3	3	9	9	9	9
CO5	9	9	9	9	9	1
CO6	9	9	9	9	9	9
Weightage	48	48	46	46	46	40
Weighted percentage of course contribution to PO's	88.88	88.88	85.18	85.18	85.18	74.07

Correlation between CO & PO 1: Low 3: Medium 9: High

## Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
<b>K1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>K2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>K3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>16</b>
<b>K4</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>-</b>	<b>4</b>	<b>16</b>
<b>K5</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>K6</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>12</b>
<b>Non Scholastic</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>5</b>	<b>5</b>	<b>20</b>
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **COMPUTATIONAL LAB – IV (Using SPSS)** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – VI

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST17P	Core	GROUP PROJECT	Project	6	5

### COURSE DESCRIPTION

To enable the students to apply the statistical techniques for solving real-life problems.

### COURSE OBJECTIVES

A good project goes a long way in providing practical training to the students. They get an opportunity through the project to apply some of the vital theoretical concepts and techniques that had learnt in the previous Semesters.

On most of the occasions, socio-economic survey and market research surveys are periodically conducted by government agencies, NGO's and private organizations. So, it is proposed to offer good project topics to the students in these practical areas. The students will be thoroughly trained through the project not only in scientific selection of sample for data collection, but also in identifying and applying approximate statistical techniques in their projects.

### COURSE OUTCOMES

CO. No	Course Outcomes	Knowledge Level
CO1	Relate the basic idea of graphical representations	K1
CO2	Illustrate the measures of central tendency & dispersion	K2
CO3	Construct the diagrammatic and parametric test analysis	K3
CO4	Function of the bivariate analysis	K4
CO5	Explain the non-parametric test analysis	K5
CO6	Predict the p-value of the given data set	K6

### CO-PO MAPPING (course articulation matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	1	1	1	3
CO2	9	9	9	9	9	9
CO3	9	9	9	9	9	9
CO4	3	3	9	9	9	9
CO5	9	9	9	9	9	1
CO6	9	9	9	9	9	9
Weightage	48	48	46	46	46	40
Weighted percentage of course contribution to PO's	88.88	88.88	85.18	85.18	85.18	74.07

Correlation between CO & PO 1: Low

3: Medium

9: High

**Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs**

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

**Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure**

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the **GROUP PROJECT** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – V

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST11E1	Elective	OPERATIONS RESEARCH	Lecture	5	4

### COURSE DESCRIPTION

Operations research is an analytical method of problem-solving and decision-making and finding optimal solutions.

### COURSE OBJECTIVES

- To teach the basic Operation Research and its applications
- To teach the concept of LPP and Mathematical formulation of LPP,
- To teach the simplex, transportation and assignment methods
- To teach the Sequencing problem
- To teach Networking Scheduling By PERT/CPM

### UNITS

#### Unit I (15 Hrs)

Operations Research (O.R.) – Origin and Development – Nature and Features – Scientific method – Applications – Linear Programming Problem (LPP) - Mathematical formulation of LPP – Graphical Solution

#### Unit II (15 Hrs)

Simplex method – Big M method – Two– phase method – Simple Problems

#### Unit III (15 Hrs)

Transportation problem – Initial Basic Feasible Solution – North–West Corner – Least Cost – Vogel’s Approximation – Assignment Problem – Balanced and Unbalanced – Hungarian Method – Simple Problems

#### Unit IV (15 Hrs)

Sequencing problem – Meaning – Processing n jobs through two machines – n jobs through k-machines – 2 jobs through k- machines – Simple Problems

#### Unit V (15 Hrs)

Network – Basic Components – Rules of Network Construction – Critical Path Analysis – Program Evaluation Review Technique – Simple Problems

#### Text Book:

Kanti Swarup, P. K. Gupta and Manmohan (Reprint 2021): Operations Research, 19<sup>th</sup> Ed, Sultan Chand & Sons- New Delhi[517.7]

Unit-I 25-64 Unit-II 87-128 Unit-III 247-293 Unit-IV 327-346 Unit-V 763-794

#### Reference Book:

H. A. Taha (2019): Operations Research: An Introduction, 10<sup>th</sup> Ed., Pearson[525.1]

#### **DIGITAL OPEN EDUCATIONAL RESOURCES:**

1. <https://cmpcollege.ac.in/wp-content/uploads/2020/05/Notes-On-Operation-Research-Part-1-for-IV-Semester-by-Gaurav-Srivastava.pdf>

## COURSE OUTCOMES

CO. No	Course Outcomes	Knowledge Level
CO1	What is Operation Research and its applications	K1
CO2	Classify LPP and Mathematical formulation of LPP	K2
CO3	Solve simplex, transportation and assignment methods	K3
CO4	Examine balanced and unbalanced assignment problem	K4
CO5	Assess the Sequencing problem	K5
CO6	Discuss Networking Scheduling By PERT/CPM	K6

### CO-PO MAPPING (course articulation matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	3	9	3	3	9
CO3	9	9	3	9	3	3
CO4	9	9	3	3	3	1
CO5	3	3	1	3	1	3
CO6	1	3	3	3	3	1
Weightage	40	36	28	30	22	26
Weighted percentage of course contribution to PO's	74.07	76.66	51.85	55.55	40.74	48.14

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

### Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
Total	4	10	6	20	5	25	100%

The Cos and POs for the **OPERATIONS RESEARCH** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – V

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST11E2	Elective	ACTUARIAL STATISTICS	Lecture	5	4

### COURSE DESCRIPTION

To learn about actuarial science and applied on insurance field.

### COURSE OBJECTIVES

- To teach the basic Simple interest, Compound interest, Perpetuity, Annuity
- To teach the concept of Immediate Annuity, Deferred Annuity, Accumulated Annuity,
- To teach the Profit- Loss, Ratio- Proportion,
- To teach the Time-Distance, Time-work
- To teach the effective rate of interest- Nominal rate of interest

### UNITS

#### Unit I

(15 Hrs)

Simple Interest – Compound Interest - Effective rate of interest - Nominal rate of interest - Varying rate of interest –effective rate corresponding to a nominal rate and vice-versa present value-accumulated value - discounts - Simple Problem

#### Unit II

(15 Hrs)

Annuities- immediate annuity – annuity - deferred annuity-accumulation and present values of annuities-increasing and decreasing annuities - Simple Problem

#### Unit III

(15 Hrs)

Perpetuity - Immediate perpetuity – perpetuity due-deferred perpetuity - accumulation and present values of perpetuity - Increasing and decreasing perpetuity - Simple Problem

#### Unit IV

(15 Hrs)

Problems on Numbers - Problems on Ages - Percentage

#### Unit V

(15 Hrs)

Profit and Loss – Ratio and Proportion – Time and Work - Time and Distance

### Text Books:

1. Mathematical basis of life assurance-IC-81, Insurance Institute of India [611.2]  
Unit – I: Page No.: 01 - 16, Unit - II & III: Page no.: 27 to 67
2. R. S. Aggarwal (2017): Quantitative Aptitude for Competitive Examinations, Sultan Chand & Sons, New Delhi.[278.0]  
Unit – IV: Page No.: 161 - 181, 182 - 194, 208 - 250, Unit – V: Page No.: 251 - 293, 294 - 310, 341 - 370, 384 - 404

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://www.pnw.edu/wp-content/uploads/2020/03/attendance7-1.pdf>
2. <https://www.pearson.com/content/dam/one-dot-com/one-dot-com/us/en/higher-ed/en/products-services/course-products/lial-applied-mathematics-info/pdf/LGR-Finite-Ch5.pdf>

## COURSE OUTCOMES

CO. No	Course Outcomes	Knowledge level
CO1	Define Simple interest, Compound interest, Perpetuity, Annuity	K1
CO2	Classify Immediate Annuity, Deferred Annuity, Accumulated Annuity	K2
CO3	Make use of Profit- Loss, Ratio- Proportion, Time-Distance, Time-work	K3
CO4	Analyze the effective rate of interest- Nominal rate of interest	K4
CO5	Estimate the accumulation and present values of perpetuity, Increasing and decreasing perpetuity	K5
CO6	Solve the Problems on ages, Problems on numbers and percentage.	K6

### CO-PO MAPPING (course articulation matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	3	3	1
CO3	9	9	9	9	9	9
CO4	3	3	3	3	1	1
CO5	3	9	3	1	1	1
CO6	9	9	9	3	3	3
<b>Weightage</b>	<b>42</b>	<b>48</b>	<b>42</b>	<b>28</b>	<b>26</b>	<b>24</b>
<b>Weighted percentage of course contribution of PO'S</b>	<b>77.77</b>	<b>88.88</b>	<b>77.77</b>	<b>51.85</b>	<b>48.14</b>	<b>44.44</b>

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

### Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the ACTUARIAL STATISTICS course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – VI

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST16E1	Elective	VITAL STATISTICS	Lecture	5	5

### COURSE DESCRIPTION

Vital Statistics is defined as the branch of biometry which deals with the data on live births, deaths, migration, foetal deaths, marriages and divorces.

### COURSE OBJECTIVES

- To teach the basic role of vital statistics, uses and types of rates
- To teach the concept of Fertility, Mortality, Migration,
- To teach the CDR, ASDR, CBR, ASFR, IMR
- To teach the concept of Construction of life table
- To teach population growth, NRR and GRR

### UNITS

#### Unit - I

(15 Hrs)

Introduction to Vital Statistics – Uses - Methods – Measurement of Population - Rates and Ratios of Vital Statistics

#### Unit - II

(15 Hrs)

Mortality – Crude Death Rate (C.D.R.) - Specific Death Rates (S.D.R.) – Age- Specific Death Rates (Age-S.D.R.) - Infant Mortality Rate (I.M.R.) - Standardized Death Rates – Simple Problem

#### Unit - III

(15 Hrs)

Life Table - Stationary and Stable Population – Central Mortality Rate - Force of Mortality – Assumptions, Description and Construction of Life Tables – Uses of Life Tables – Simple Problem

#### Unit - IV

(15 Hrs)

Fertility - Crude Birth Rate (C.B.R.) - General Fertility Rate (G.F.R.) - Specific Fertility Rate (S.F.R.) – Age-Specific Fertility Rate - Total Fertility rate (T.F.R.) – Simple Problem

#### Unit - V

(15 Hrs)

Population Growth – Crude Rate of Natural Increase - Pearl's Vital Index - Gross Reproduction Rate (G.R.R.) - Net Reproduction Rate (N.R.R.) – Simple Problem

### Text Books:

1. S. C. Gupta and V. K. Kapoor (2021): Fundamentals of Applied Statistics, 4<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511.0]

Unit – I to Unit - V: Page No.: 9.2 – 9.58

2. B. L. Agarwal (Reprint, 2018): Programmed Statistics, 3<sup>rd</sup> Ed., New Age International Publishers. Page No.: 542 – 548 [330.9]

\* Students should be trained to Descriptive and Solved Problems Questions based on Text Book – 1

\* Students should be trained to Objective Type Questions based on Text Book – 2

### Reference Book:

S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[321]

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://bpchalihacollege.org.in/online/attendance/classnotes/files/1625563973.pdf>

## COURSE OUTCOMES

CO. No	Course Outcomes	Knowledge Level
CO1	Recall the role of vital statistics, uses and types of rates	K1
CO2	Classify Fertility, Mortality, Migration	K2
CO3	Identify CDR , ASDR, CBR, ASFR, IMR	K3
CO4	Compare General Fertility Rate and Total Fertility Rate	K4
CO5	Rule on Construction of life table	K5
CO6	Evaluate the population growth, NRR and GRR	K6

## CO-PO MAPPING (course articulation matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	3	9	9
CO3	9	9	3	3	3	3
CO4	9	3	1	9	1	3
CO5	3	3	3	3	3	1
CO6	3	3	3	1	1	1
Weightage	42	36	28	28	26	26
Weightage percentage of course contribution to PO's	77.77	66.66	51.85	51.85	48.14	48.14

Correlation between CO & PO 1: Low 3: Medium 9: High

Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

## Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
<b>Total</b>	<b>4</b>	<b>10</b>	<b>6</b>	<b>20</b>	<b>5</b>	<b>25</b>	<b>100%</b>

The Cos and POs for the VITAL STATISTICS course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – VI

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25ST16E2	Elective	BIO-STATISTICS	Lecture	5	5

### COURSE DESCRIPTION

Biostatistics is the application of statistical techniques to scientific research in health-related fields, including medicine, biology, and public health, and the development of new tools to study these areas

### COURSE OBJECTIVES

- To teach the basic ideas Biostatistics
- To teach the concept of observational studies-experimental studies
- To teach the survival function
- To teach the variance using Kaplan Meier method – comparison of survival distribution –
- To teach the log rank test.

### UNITS

#### Unit - I

(15 Hrs)

Introduction to study designs-different types of observational studies-experimental studies-Epidemiology-odds-odds ratio-confidence interval for odds ratio-relative risk

#### Unit - II

(15 Hrs)

Chi-square test: -Diagnostic procedure with threshold model. Measuring the accuracy of diagnosis-sensitivity, specificity, Roc curve

#### Unit – III

(15 Hrs)

Clinical Trials-Introduction-different phases of clinical trials-purpose- duration cost-drug regulatory bodies

#### Unit - IV

(15 Hrs)

Survival time, survival distributions-Hazard function-exponential –gamma type I and type II censoring, progressive censoring-estimation of parameters with numerical examples

#### Unit - V

(15 Hrs)

Estimating survival function and variance using Kaplan Meier method – comparison of survival distribution - log rank test for comparing 2-groups

#### Text Books:

- 1 Dawson, Beth & Rebert, G-Basic & Clinical Bio-Statistics.
- 2 Ellise T. Lee-Statistical Methods for survival Data Analysis.

#### Book for Reference:

- 1 David G. Kleinbawn, Survival Analysis.

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. <https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture-notes/env-health-science-students/lb-biostat-hss-final.pdf>

## COURSE OUTCOMES

CO. No	Course Outcomes	Knowledge Level
CO1	Define Biostatistics	K1
CO2	Classify observational studies-experimental studies	K2
CO3	Solve survival function and variance using Kaplan Meier method – comparison of survival distribution - log rank test	K3
CO4	Examine Chi-square test: -Diagnostic procedure with threshold model	K4
CO5	Assess the odds ratio-confidence interval for odds ratio-relative risk	K5
CO6	Discuss different phases of clinical trials-purpose- duration cost-drug regulatory bodies	K6

## CO-PO MAPPING (course articulation matrix)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	3	9	3	3	9
CO3	9	9	3	9	3	3
CO4	9	9	3	3	3	1
CO5	3	3	1	3	1	3
CO6	1	3	3	3	3	1
Weightage	40	36	28	30	22	26
Weighted percentage of course contribution to PO's	74.07	76.66	51.85	55.55	40.74	48.14

Correlation between CO & PO 1: Low 3: Medium 9: High

## Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

## Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
Total	4	10	6	20	5	25	100%

The Cos and POs for the **BIO-STATISTICS** course in the **B.Sc. STATISTICS** Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – IV

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25STNME1	Non-Major	BASIC STATISTICS - I	Lecture	2	2

### COURSE DESCRIPTION

This is an introductory course in statistics designed to provide students with the basic concepts of statistics. It is used to describe the basic concept and analyze of a univariate data in a study.

### COURSE OBJECTIVES

- To teach the basic concept data, graphs, measures of central tendency and dispersion
- To teach the concept of data and average,
- To teach the nature of graphs
- To teach the discrete case of central tendency and dispersion
- To teach the concept of coefficient of variation

### UNITS

#### Unit I

(6 Hrs)

Statistics – Definition, Functions, Limitations and Applications – Data – Sources of Primary and Secondary Data

#### Unit II

(6 Hrs)

Diagrammatic and Graphs: Bar (simple & multiple) – Line – Pie – Simple Problems

#### Unit III

(6 Hrs)

Measures of Central Tendency: Mean (A.M.) – Median – Mode – Simple Problems (Individual and Discrete Series)

#### Unit IV

(6 Hrs)

Measures of Dispersion: Range – Quartile Deviation – Mean Deviation — Simple Problems (Individual and Discrete Series)

#### Unit V

(6 Hrs)

Standard Deviation – Variance - Coefficient of Variation – Simple Problems (Individual and Discrete Series)

### Text Book:

S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi. [321]

Unit – I : Page No.: 1.7 – 1.16, 3.2 – 3.7, 3.16 & 3.17

Unit – II : Page No.: 6.5 – 6.10, 6.16 – 6.19, 6.26 – 6.28

Unit – III : Page No.: 7.4 – 7.7, 7.16 – 7.18, 7.31 & 7.32

Unit – IV : Page No.: 8.5, 8.7 & 8.8, 8.10 – 8.12

Unit – V : Page No.: 8.15 – 8.18, 8.25 – 8.27

**\* Students should be trained to Solved Problems based on Text Book**

### Reference Book:

S. C. Gupta and V. K. Kapoor (2020): Fundamental of Mathematical Statistics, 12<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511]

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. [https://eoss.asu.edu/sites/default/files/Basic\\_Statistics.pdf](https://eoss.asu.edu/sites/default/files/Basic_Statistics.pdf)

## COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	Recall the basic concept data, graphs, measures of central tendency and dispersion	K1
CO2	Classify the data and average	K2
CO3	Apply the nature of graphs, discrete case of central tendency and dispersion	K3
CO4	Analyze the standard deviation and coefficient of variation	K4
CO5	Interpret the coefficient of variation	K5
CO6	Construct the diagrammatic and graphs	K6

### CO – PO MAPPING (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	3	3
CO3	9	9	9	9	9	9
CO4	3	3	3	3	3	3
CO5	9	3	3	3	1	1
CO6	9	9	9	9	3	3
Weightage	48	42	42	42	28	28
Weighted Percentage of Course contribution to PO's	88.88	77.77	77.77	77.77	51.85	51.85

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

### Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
Total	4	10	6	20	5	25	100%

The Cos and POs for the BASIC STATISTICS - I course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD

## SEMESTER – V

Programme Code	Course Code	Course Type	Course Title	Category	Hrs. / Week	Credits
STSUG2014	U25STNME2	Non-Major	BASIC STATISTICS - II	Lecture	2	2

### COURSE DESCRIPTION

This is an introductory course in statistics designed to provide students with the basic concepts of applied statistics. It is used to describe the basic concept and estimate of correlation, regression, association of attributes, index numbers and time series analysis.

### COURSE OBJECTIVES

- To teach the basic concept of association of attributes and index numbers
- To teach the concept of attributes
- To teach the components of time series,
- To teach correlation coefficient
- To teach regression equations X on Y & Y on X

### UNITS

#### Unit I

(8 Hrs)

Correlation Analysis: Definition - Karl Pearson's – Spearman's Rank Correlation – Simple Problems

#### Unit II

(6 Hrs)

Regression Analysis: Definition – Uses – Regression Equations (X on Y & Y on X) – Simple Problems

#### Unit III

(6 Hrs)

Association of Attributes: Class Frequencies – Consistency of Data – Yule's Coefficient of Association – Simple Problems

#### Unit IV

(5 Hrs)

Index Numbers: Uses of Index Numbers – Laspeyre's – Paasche's – Bowley's – Fisher's – Simple Problems

#### Unit V

(5 Hrs)

Time Series: Definition – Utility of Time Series Analysis – Components – Moving Average Method – Simple Problems

### Text Book:

S. P. Gupta (Reprint 2022): Statistical Methods, 46<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[321]

Unit – I : Page No.: 10.3 & 10.4, 10.8 – 10.11, 10.25 – 10.28

Unit – II : Page No.: 11.2 – 11.8

Unit – III : Page No.: 12.3 – 12.9

Unit – IV : Page No.: 13.3 & 13.4, 13.15 – 13.19

Unit – V : Page No.: 14.2 – 14.9, 14.16 – 14.18

\* Students should be trained to Solved Problems based on Text Book

### Reference Book:

S. C. Gupta and V. K. Kapoor (2020): Fundamental of Mathematical Statistics, 12<sup>th</sup> Rev. Ed., Sultan Chand & Sons, New Delhi.[511]

### DIGITAL OPEN EDUCATIONAL RESOURCES

1. [https://eoss.asu.edu/sites/default/files/Basic\\_Statistics.pdf](https://eoss.asu.edu/sites/default/files/Basic_Statistics.pdf)

## COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	Remember the basic concept of association of attributes and index numbers	K1
CO2	Classify the attributes and components of time series	K2
CO3	Apply the correlation coefficient	K3
CO4	Find the regression equations X on Y & Y on X	K4
CO5	Interpret the moving average method	K5
CO6	Illustrate the consistency of data and index numbers	K6

### CO – PO MAPPING (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	9	9	9	9	9
CO2	9	9	9	9	3	3
CO3	9	9	9	9	9	9
CO4	3	3	3	3	3	3
CO5	9	3	3	3	1	1
CO6	9	9	9	9	3	3
Weightage	48	42	42	42	28	28
Weighted Percentage of Course contribution to PO's	88.88	77.77	77.77	77.77	51.85	51.85

Correlation between CO & PO 1: Low 3: Medium 9: High

### Course Outcome mapped with Knowledge level (Revised Bloom's Taxonomy) and POs

Co/ K-Level	Level of Correlation			
	High	Medium	Low	Zero
CO1/K1/K2	PO1,PO3	PO2	-	PO4,PO5,PO6
CO2/K2/K3	PO1	PO2	PO3	PO4,PO5,PO6
CO3/K3/K4	PO1,PO2,PO4	PO3	PO5	PO6
CO4/K4/K5	PO1,PO2,PO4	PO2	PO6	PO5
CO5/K5/K6	PO1,PO2,PO4	PO5	PO6	-
CO6/K5/K6	PO1,PO2,PO4	PO3	PO5	PO6

### Course Outcome (CO) Attainment Assessment Tools & Evaluation Procedure

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	Attendance 5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3	-	3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
Non Scholastic	-	-	-	-	5	5	20
Total	4	10	6	20	5	25	100%

The Cos and POs for the BASIC STATISTICS - II course in the B.Sc. STATISTICS Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge

Signature of the HoD