

**Scheme of**  
**B.Sc. Physical Science-(Statistics)**  
**AND**  
**B.A. Multidisciplinary-(Statistics)**

**(Scheme UG A2: Undergraduate Programmes)**

**Semester 1**

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
<b>Core Course(s)</b>														
CC-A1	Descriptive Statistics	240/STAT/C C101	3	--	2	3	-	1	4	25	50	5	20	100

**Semester 2**

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
<b>Core Course(s)</b>														
CC-A2	Probability Theory	240/STAT/C C201	3	--	2	3	-	1	4	25	50	5	20	100

**Semester 3**

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
<b>Core Course(s)</b>														
CC-A3	Correlation and Regression	240/STAT/C C301	3	--	2	3	-	1	4	25	50	5	20	100

**Semester 4**

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
<b>Core Course(s)</b>														
CC-A4	Probability Distributions	240/STAT/C C401	3	--	2	3	-	1	4	25	50	5	20	100

**Semester 5**

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
<b>Core Course(s)</b>														
CC-A5	Elementary Inference	240/STAT/C C501	3	--	2	3	-	1	4	25	50	5	20	100

**Semester 6**

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
<b>Core Course(s)</b>														
CC-A6	Operations Research	240/STAT/C C601	3	--	2	3	-	1	4	25	50	5	20	100

**UG-A1**  
**Semester-I**

<b>Session: 2024-25</b>			
<b>Part A – Introduction</b>			
<b>Subject</b>	Statistics		
<b>Semester</b>	I		
<b>Name of the Course</b>	Descriptive Statistics		
<b>Course Code</b>	CC-A1		
<b>Course ID</b>	240/STAT/CC/101		
<b>Course Type: (CC/MIC/MDC/ VOC/AEC/VA C/SEC)</b>	CC		
<b>Pre-requisite for the course (if any)</b>	Mathematics as a subject at 4.0 Level (Class-XII)		
<b>Course Learning Outcomes(CLOs)</b>	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Know Statistics as a subject, its origin and development stages.</li> <li>2. Understand types of data and apply methods of collection like how to construct a questionnaire and collect data for the problem under study (in hand).</li> <li>3. Compute and interpret measures of central tendency and spread of data.</li> <li>4. Construct and analyze graphical displays to summarize data and solve problems of finding association for qualitative data.</li> </ol>		
<b>Credits</b>	<b>Theory</b>	<b>Practical</b>	<b>Total</b>
	3	1	4
<b>Contact Hours</b>	3	2	5

<b>Internal Assessment Marks</b>	20	10	30
<b>End Term Assessment Marks</b>	50	20	70
<b>Examination Time</b>	3 Hours	3 Hours	100

### **Part B - Course Content**

**Instructions for Paper- Setter Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking Course Learning Outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.**

<b>Unit</b>	<b>Topic</b>	<b>Contact Hours</b>
<b>I</b>	Introduction of Statistics, Basic knowledge of various types of data, Collection, classification and tabulation of data. Presentation of data: histograms, frequency polygon, frequency curve and ogives. Stem-and- Leaf and Box plots.	<b>12</b>
<b>II</b>	Measures of Central Tendency and Location: Mean, median, mode, geometric mean, harmonic mean, partition values. Measures of Dispersion: Absolute and relative measures of range, quartile deviation, mean deviation, standard deviation ( $\sigma$ ), coefficient of variation.	<b>12</b>
<b>III</b>	Moments, Skewness and Kurtosis: Moments about mean and about any point and derivation of their relationships, effect of change of origin and scale on moments, Sheppard's correction for moments (without derivation), Charlier's checks.	<b>12</b>
<b>IV</b>	Theory of Attributes: Symbolic notation, dichotomy of data, class frequencies, order of class frequencies, consistency of data, independence and association of attributes, Yule's coefficient of association and coefficient of colligation.	<b>12</b>

### **Practical**

<b>The practical component of the course has two parts</b>	<b>30</b>
<b>(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:</b>	

1. Problems of collection, classification and tabulation of data.
2. Problems of presentation of data using histograms, frequency polygon, frequency curve and ogives.
3. Problems onevaluating mean, median and mode,.
4. Problem of determination of mean deviation, standard deviation ( $\sigma$ ), coefficient of variation of given data.
5. Problem of determination of moments about mean and about origin.
6. Problem of determination of measures of skewness and kurtosis.
7. Problem of determination of independence and association of attributes.
8. Problem of determination of Yule's coefficient of association and coefficient of colligation.

**(B)The following practicals will be done using mathematical software (such as Python with libraries like NumPy, SciPy, and Matplotlib or R) and their record will be maintained in the practical note book:**

1. To collect, classify and tabulate some primary data using questionnaire and charts.
2. To construct frequency distribution using exclusive and inclusive methods and representation of data using Histogram, frequency curve and ogives, stem and leaf chart, box plot.
3. To represent data diagrammatically using bars, rectangles, circles and pie diagrams.
4. To compute various measures of central tendency and dispersion.
5. To find variance of combined series and coefficient of variations.
6. To obtain moments and apply Charlier's checks.
7. To find moments applying Sheppard's correction.
8. To obtain coefficients of skewness and kurtosis.
9. To discuss the association of attributes for 2x2 contingency table using Yule's coefficients of association and colligation.

### **Suggested Evaluation Methods**

#### **Internal Assessment:**

##### **➤ Theory 20**

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 5
- Mid-Term Exam: 10

##### **➤ Practicum 10**

- Seminar/Demonstration/Viva-voce/Lab records etc.: 10

#### **End Term Examination:**

##### **➤ Theory 50**

- Written Examination

##### **➤ Practicum 20**

- Lab record, viva-voce, write up and execution of the program

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**Part C-Learning Resources**

**Recommended Books:**

1. A.M. Goon, M.K. Gupta, and B. Das Gupta: Fundamentals of Statistics, Vol-I.
2. S. Bernstein and R. Bernstein, Elements of Statistics, Schaum's outline series, McGraw-Hill.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.

**Session: 2024-25****Part A – Introduction**

<b>Subject</b>	Statistics		
<b>Semester</b>	II		
<b>Name of the Course</b>	Probability Theory		
<b>Course Code</b>	CC- A2		
<b>Course ID</b>	240/STAT/CC/201		
<b>Course Type: (CC/ MIC/ MDC/VOC/ AEC/ VAC/SEC)</b>	CC		
<b>Pre-requisite for the course (if any)</b>	Mathematics as a subject at 4.0 Level (Class-XII)		
<b>Course Learning Outcomes(CLOs)</b>	After completing this course, the learner will be able to: <ol style="list-style-type: none"><li>1. Explain what probability is and how to express it numerically as a ratio, a decimal and a percentage.</li><li>2. Determine the probability of different experimental results.</li><li>3. Distinguish marginal and conditional probabilities and apply properties of expectation to various probabilistic problems.</li><li>4. Understand generating functions and its properties.</li></ol>		
<b>Credits</b>	<b>Theory</b>	<b>Practical</b>	<b>Total</b>
	3	1	4
<b>Contact Hours</b>	3	2	5
<b>Internal Assessment Marks</b>	20	10	30
<b>End Term Assessment Marks</b>	50	20	70
<b>Examination Time</b>	3 Hours	3 Hours	100

## Part B - Course Content

**Instructions for Paper- Setter Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking Course Learning Outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering the entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.**

Unit	Topic	Contact Hours
<b>I</b>	Concepts in Probability: Random experiment, trial, sample point, sample space, operation of events, exhaustive, exclusive, equally likely and independent events; Definition of probability: classical, relative frequency, statistical and axiomatic approach: Addition and multiplication laws of probability and their extension to n events.	<b>12</b>
<b>II</b>	Boole's inequality; Bayes theorem and its applications. Random Variable and Probability Functions: Definition and properties of random variable, discrete and continuous random variable, probability mass and density functions, distribution functions.	<b>12</b>
<b>III</b>	Concepts of bivariate random variable: joint, marginal and conditional distributions. Mathematical Expectation: Definition and its properties-moments, measures of location, dispersion, skewness and kurtosis. Addition and multiplication theorem of expectation.	<b>12</b>
<b>IV</b>	Generating Functions: Moments generating function, cumulant generating function and probability generating function along with their properties.	<b>12</b>

### Practical

**The practical component of the course has two parts,**

**30**

**(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:**

1. Problems based on exclusive, exhaustive and independent event.
2. Problems related to addition and multiplication laws of probability
3. Problems of Bayes theorem and its applications.
4. Problem of discrete and continuous random variables.
5. Problem related to joint, marginal and conditional distributions

6. Problem of skewness and kurtosis by mathematical expectation.
7. Problem related to moments generating function.
8. Problem related to cumulant generating function.

**(B) The following practicals will be done using mathematical software (such as Python with libraries like NumPy, SciPy, and Matplotlib or R) and their record will be maintained in the practical note book:**

1. Coin Tossing Experiment (Random Experiment, Trial, Sample Point, Sample Space)
2. Dice Rolling Experiment (Operation of Events)
3. To visualize the significance of Bayes theorem.
4. To understand fundamental concepts of random variable.
5. Understand and compute the mathematical expectation (mean) moments (first four moments), measures of location (mean, median, mode), dispersion (variance, standard deviation), skewness and kurtosis
6. Addition and multiplication theorems of expectation To find variance of combined series and coefficient of variations.
7. To compute and visualize the moment generating function (MGF) and cumulant generating function (CGF) for a given probability distribution and to derive moments and cumulants from these functions.
8. To compute and visualize the probability generating function (PGF) for a given discrete probability distribution and to derive probabilities and moments from the PGF.

### Suggested Evaluation Methods

#### Internal Assessment:

##### ➤ Theory 20

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 5
- Mid-Term Exam: 10

##### ➤ Practicum 10

- Seminar/Demonstration/Viva-voce/Lab records etc.: 10

#### End Term Examination:

##### ➤ Theory 50

- Written Examination

##### ➤ Practicum 20

- Lab record, viva-voce, write up and execution of the program

### Part C-Learning Resources

#### Recommended Books:

1. A.M. Mood, F.A. Graybill and D.C. Boes, Introduction to the theory of Statistics, McGraw Hill, 1974.
2. Baisnab and M. Jas, Element of Probability and Statistics, Tata McGraw Hill.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.
4. P.L.Meyer, Introductory Probability and Statistical Applications, Addison-Wesley Publishing Company, 1970.

## Suggested Evaluation Methods

### Internal Assessment:

#### ➤ Theory 15

- Class Participation: 4
- Seminar/presentation/assignment/quiz/class test etc.: 4
- Mid-Term Exam: 7

#### ➤ Practicum 5

- Seminar/Demonstration/Viva-voce/Lab records etc.: 5

### End Term Examination:

#### ➤ Theory 35

Written Examination

#### ➤ Practicum 20

Lab record, viva- voce, write up.

## Part C-Learning Resources

### Recommended Books:

1. R. S. Aggarwal (2022). *Quantitative Aptitude*. S Chand & Company Limited, New Delhi.
2. A. Guha (2020). *Quantitative Aptitude* (7<sup>th</sup> Edition). McGraw Hill Publications.
3. V. Dyke, J. Rogers and H. Adams (2011). *Fundamentals of Mathematics*, Cengage learning.
4. A.S. Tussy, R. D. Gustafson and D. Koenig (2010). *Basic Mathematics for College Students*. Brooks Cole.
5. C. C. Pinter (2014). *A Book of Set Theory*. Dover Publications.
6. G. Klambauer (1986). *Aspects of calculus*. Springer-Verlag