



Anekant Education Society's

**Tuljaram Chaturchand College
of Arts, Science and Commerce, Baramati
(Autonomous)**

**Four Year B.Sc. Degree Program in Statistics
(Faculty of Science & Technology)**

CBCS Syllabus

F.Y.B.Sc. (Statistics) Semester -I

For Department of Statistics

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

Choice Based Credit System Syllabus

As Per NEP 2.0 (2024 Pattern)

To be implemented from Academic Year 2024-2025

Title of the Programme: F.Y.B.Sc. (Statistics)**Preamble**

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2024 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP) 2.0, 2024 Pattern. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2.0 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2.0 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Statistics and related subjects, the Board of Studies in Statistics at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of F.Y.B.Sc. Statistics, which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2.0 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century.

The word Statistics is used in different ways in different contexts. To a cricket fan, Statistics is the information about runs scored or wickets taken by a player. To the manager of a manufacturing unit, Statistics may be the information about the process control. To a medical researcher investigating the effects of a new drug, Statistics are evidence of research efforts. To a college student, Statistics are the grades or marks scored in a course. Thus, in all these illustrations Statistics word refers to quantitative data in the area under study. Statistics as a subject is an important branch of knowledge and is devoted to various techniques of collection, presentation, analysis and interpretation of data. It is a science of learning from data.

This Statistics syllabus serves as a guide to the course content, objectives, and expectations for students pursuing a degree in Statistics. This program is designed to provide you with a solid foundation in statistical theory, methods, and applications, equipping you with the necessary skills to analyze and interpret data effectively. Statistics is a discipline that revolves around the collection, analysis, interpretation, presentation, and organization of data. In today's data-driven world, the need for statisticians has never been greater. This program aims to foster your understanding of statistical concepts, develop your analytical thinking, and enhance your ability to make informed decisions based on data-driven evidence.

Throughout this program, you will be exposed to a wide range of statistical topics, including probability theory, mathematical statistics, regression analysis, experimental design, multivariate analysis, time series analysis, and more. You will also gain proficiency in statistical software and programming languages commonly used in the field, such as SPSS, Minitab, R, Python, etc.

The BSc in Statistics program is structured to provide a balance between theoretical knowledge and practical applications. You will engage in hands-on data analysis projects, where you will have the opportunity to apply statistical techniques to real-world problems. These projects will strengthen your problem-solving skills and help you develop a critical approach to statistical analysis. Additionally, this program encourages a multidisciplinary approach. Statistics finds applications in various fields, such as social sciences, finance, economics, healthcare, environmental sciences, and market research.

In summary, the BSc in Statistics program offers a comprehensive education in statistical theory and practice. It equips you with the skills needed to analyze data, draw meaningful conclusions, and make evidence-based decisions. We are excited to embark on this educational journey with you and look forward to your growth as a skilled statistician.

Overall, revising the Statistics syllabus in accordance with the NEP 2.0 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Anekant Education Society's
Tuljaram Chaturchand College, Baramati
(Autonomous)

Board of Studies (BOS) in Statistics

From 2022-23 to 2024-25

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Anekant Education Society's
Tuljaram Chaturchand College
of Arts, Science & Commerce, Baramati.

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati is an autonomous & dynamic institute and has successfully implemented the National Education Policy 2.0 2024 pattern since the academic year 2024-25. We are updating our academic policies as per local needs keeping in view the global perspectives. Accordingly, we have updated our program outcomes as per the graduate attributes defined in New Education Policy. In general, program outcomes are categorized into two categories as disciplinary & interdisciplinary outcomes and generic outcomes.

Program Outcomes for B.Sc.

1. **Comprehensive Knowledge and Understanding:** Graduates will possess a profound understanding of their field of study, including foundational theories, principles, methodologies, and key concepts, within a broader multidisciplinary context.
2. **Practical, Professional, and Procedural Knowledge:** Graduates will acquire practical skills and expertise essential for professional tasks within their field. This includes knowledge of industry standards, best practices, regulations, and ethical considerations, with the ability to apply this knowledge effectively in real-world scenarios.
3. **Entrepreneurial Mindset and Knowledge:** Graduates will cultivate an entrepreneurial mindset, identifying opportunities, fostering innovation, and understanding business principles, market dynamics, and risk management strategies.
4. **Specialized Skills and Competencies:** Graduates will demonstrate proficiency in technical skills, analytical abilities, problem-solving, effective communication, and leadership, relevant to their field of study. They will also adapt and innovate in response to changing circumstances.
5. **Capacity for Application, Problem-Solving, and Analytical Reasoning:** Graduates will possess the capacity to apply learned concepts in practical settings, solve complex problems, and analyze data effectively. This requires critical thinking, creativity, adaptability, and a readiness to learn and take calculated risks.

6. **Communication Skills and Collaboration:** Graduates will effectively communicate complex information, both orally and in writing, using appropriate media and language. They will also collaborate effectively in diverse teams, demonstrating leadership qualities and facilitating cooperative efforts toward common goals.
7. **Research-related Skills:** Graduates will demonstrate observational and inquiry skills, formulate research questions, and utilize appropriate methodologies for data collection and analysis. They will also adhere to research ethics and effectively report research findings.
8. **Learning How to Learn Skills:** Graduates will acquire new knowledge and skills through self-directed learning, adapt to changing demands, and set and achieve goals independently.
9. **Digital and Technological Skills:** Graduates will demonstrate proficiency in using ICT, accessing information sources, and analyzing data using appropriate software.
10. **Multicultural Competence, Inclusive Spirit, and Empathy:** Graduates will engage effectively in multicultural settings, respecting diverse perspectives, leading diverse teams, and demonstrating empathy and understanding of others' perspectives and emotions.
11. **Value Inculcation and Environmental Awareness:** Graduates will embrace ethical and moral values, practice responsible citizenship, recognize and address ethical issues, and take appropriate actions to promote sustainability and environmental conservation.
12. **Autonomy, Responsibility, and Accountability:** Graduates will apply knowledge and skills independently, manage projects effectively, and demonstrate responsibility and accountability in work and learning contexts.
13. **Community Engagement and Service:** Graduates will actively participate in community-engaged services and activities, promoting societal well-being.

Programme Specific Outcomes (PSOs)

- PSO1. Proficiency in basic statistical calculations:** Students should develop the ability to perform basic statistical calculations, such as measures of central tendency, measures of dispersion, and probabilities. They should be able to use appropriate formulas and procedures to calculate these measures accurately.
- PSO2. Competence in data collection and organization:** Students should gain practical skills in collecting and organizing data for statistical analysis. They should be able to identify different types of data (categorical, numerical) and employ appropriate methods for data collection.
- PSO3. Understanding of graphical representation of data:** Students should be able to create and interpret basic graphical representations of data, such as histograms, bar charts, scatter plots, and box plots. They should understand the purpose of these visualizations and how they can aid in data analysis and interpretation.
- PSO4. Effective communication of statistical results:** Students should practice effectively communicating statistical results. They should be able to present findings in a clear and concise manner, both orally and in written form, using appropriate statistical terminology.
- PSO5. Competence in statistical software and programming:** Students should gain proficiency in using statistical software packages (e.g., R, Python, SPSS) and programming languages commonly used in statistical analysis. They should be able to efficiently manipulate, analyse, and visualize data using these tools.
- PSO6. Development of critical thinking and problem-solving skills:** Students should develop the ability to think critically and solve statistical problems using appropriate techniques. They should be able to identify the correct statistical method for a given problem and apply it effectively.
- PSO7. Application of statistical software for data analysis:** Students should gain hands-on experience with statistical software packages, such as R or Excel, to perform basic data analysis tasks. They should be able to input data, perform calculations, generate graphical representations, and interpret the results.

**Credit Distribution Structure for Three/Four Year Honours/Honours with Research Degree Programme With Multiple Entry and Exit options
as per National Education Policy (2024 Pattern as per NEP-2020)**

Level/ Difficulty	Sem	Subject DSC-1				Subject DSC-2	Subject DSC-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
4.5/100	I	2(T)+2(P)				2(T)+2(P)	2(T)+ 2(P)	2(T)	2 (T/P)	2(T) (Generic)	2(T)	2(T)	--	22
	II	2(T)+2(P)				2(T)+2(P)	2(T)+2(P)	2(P)	2 (T/P)	--	2(T)	2(T)	2(T)	22
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor Continue option: Student will select one subject among the (subject 1, subject 2 and subject 3) as major and other as minor and third subject will be dropped.														
Level/ Difficulty	Sem	Credits Related to Major				Minor	--	GE/OE	SEC	IKS	AEC	VEC	CC	Total
		Major Core	Major Elective	VSC	FP/OJT/CE P/RP									
5.0/200	III	4(T)+2(P)	--	2 (T/P)	2(FP)	2(T)+2(P)	--	2(T)	--	2(T)	--	2(T)	22	
	IV	4(T)+2(P)	--	2 (T/P)	2(CEP)	2(T)+2(P)	--	2(P)	2 (T/P)	--	2(T)	--	2(T)	22
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4credits core NSQF course/Internship OR Continue with Major and Minor														
5.5/300	V	8(T)+4(P)	2(T)+2(P)	2 (T/P)	2(FP/CEP)	2(T)	--	--	--	--	--	--	22	
	VI	8(T)+4(P)	2(T)+2(P)	2 (T/P)	4 (OJT)	--	--	--	--	--	--	--	22	
Total 3Years		44	8	8	10	18	8	8	6	4	8	4	6	132
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor														
6.0/400	VII	6(T)+4(P)	2(T)+2 (T/P)	--	4(RP)	4(RM)(T)	--	--	--	--	--	--	22	
	VIII	6(T)+4(P)	2(T)+2 (T/P)	--	6(RP)	--	--	--	--	--	--	--	22	
Total 4Years		64	16	8	22	22	8	8	6	4	8	4	6	176
Four Year UG Honours with Research Degree in Major and Minor with 176 credits														
6.0/400	VII	10(T)+4(P)	2(T)+2 (T/P)	--	--	4(RM) (T)	--	--	--	--	--	--	22	
	VIII	10(T)+4(P)	2(T)+2 (T/P)	--	4 (OJT)	--	--	--	--	--	--	--	22	
Total 4Years		72	16	8	14	22	8	8	6	4	8	4	6	176
Four Year UG Honours Degree in Major and Minor with 176 credits														

T = Theory **P** = Practical **DSC** = Discipline Specific Course **OE** = Open Elective **SEC** = Skill Enhancement Course
IKS = Indian Knowledge System **AEC** = Ability Enhancement Course **VEC** = Value Education Course **CC** = Co-curricular Course
VSC = Vocational Skill Course **OJT** = On Job Training **CEP** = Community Engagement Project **FP** = Field Project **RP** = Research Project

Course Structure for F.Y.B.Sc. (2024 Pattern as per NEP- 2.0)

Sem	Course Type	Course Code	Course Title	Theory/ Practical	Credits
I	DSC-I (General)	-101-GEN		T	02
		-102-GEN		P	02
	DSC-II (General)	-101-GEN		T	02
		-102-GEN		P	02
	DSC-III (General)	STA-101-GEN	Descriptive Statistics	T	02
		STA-102-GEN	Statistics Practical-I	P	02
	Open Elective (OE)	STA-103-OE	Commercial Statistics	T	02
	Skill Enhancement Course (SEC)	STA-104-SEC	Statistical Computing using MS-Excel	P	02
	Ability Enhancement Course (AEC)	ENG-104-AEC		T	02
	Value Education Course (VEC)	ENV-105-VEC		T	02
Generic Indian Knowledge System (GIKS)	GEN-106-IKS		T	02	
Total Credits Semester- I					22
II	DSC-I (General)	-151-GEN		T	02
		-152-GEN		P	02
	DSC-II (General)	-151-GEN		T	02
		-152-GEN		P	02
	DSC-III (General)	STA-151-GEN	Discrete Probability and Probability Distributions – I	T	02
		STA-152-GEN	Statistics Practical-II	P	02
	Open Elective (OE)	STA-153-OE	Introduction to MS-Excel and Statistical Computing	P	02
	Skill Enhancement Course (SEC)	STA-154-SEC	Application of Statistics Using Advanced Excel	P	02
	Ability Enhancement Course (AEC)	ENG-154-AEC		T	02
	Value Education Course (VEC)	COS-155-VEC		T	02
Co-curricular Course (CC)	YOG/PES/CU L/NSS/NCC- 156-CC	To be selected from the CC Basket	T	02	
Total Credits Semester- II					22
Cumulative Credits Semester I + Semester II					44

**CBCS Syllabus as per NEP 2.0 for F.Y.B.Sc. Statistics
(2024 Pattern)**

Name of the Programme	: B.Sc. Statistics
Programme Code	: USST
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: (Theory)
Course Code	: STA-101-GEN
Course Title	: Descriptive Statistics
No. of Credits	: 02
No. of Teaching Hours	: 30

Course Objectives:

1. Understand and differentiate between population and sample in the context of statistical analysis.
2. Learn various sampling techniques and their appropriate applications.
3. Comprehend and calculate different measures of central tendency, including mean, median, and mode.
4. Understand the concept and importance of dispersion in data analysis.
5. Grasp the concepts of moments and their significance in describing the shape of a distribution.
6. Understand the concept of correlation and its importance in measuring the relationship between variables.
7. Calculate and interpret different types of correlation coefficients, such as Pearson's and Spearman's, and understand their applications in data analysis.

Course Outcomes:

By the end of the course, students should be able to:

- CO1.** Understand the importance of sampling and sampling methods.
- CO2.** Differentiate between various sampling techniques and their applications in real-world scenarios.
- CO3.** Choose the appropriate measure of central tendency for different types of data distributions.
- CO4.** Calculate and interpret range, variance, standard deviation, and other measures of dispersion.
- CO5.** Assess the skewness and kurtosis of a dataset to understand its distribution shape.

CO6. Interpret the strength and direction of relationships between variables using correlation analysis.

CO7. Evaluate the variability within datasets and assess the consistency or reliability of data.

Topics and Learning Points

UNIT – 1 Population and Sample (5L)

1.1 Types of characteristics

Attributes: Nominal scale, ordinal scale

Variable: Interval scale, ratio scale, discrete and continuous variables

1.2 Types of data

i) Primary data: Design of Questionnaire, secondary data

ii) Cross-sectional data, chronological data.

1.3 Notion of a statistical population: Finite population, infinite population, homogeneous population and heterogeneous population. Notion of a sample and a random sample.

1.4 Methods of sample (Description only): Simple random sampling with and without replacement (SRSWR and SRSWOR), stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.

1.5 Classification : Raw data and its classification, ungrouped frequency distribution, Sturges' rule, method of classification inclusive and exclusive, open end classes , (grouped frequency distribution cumulative frequency distribution), relative frequency distribution

UNIT – 2 Measures of Central Tendency (8L)

2.1 Concept of central tendency of statistical data, statistical average, characteristics of a good statistical average.

2.2 Arithmetic Mean (AM): Definition, effect of change of origin and scale, combined mean of a number of groups, merits and demerits, trimmed arithmetic mean.

2.3 Median: Definition, merits and demerits, Partition values: Quartiles deciles and percentiles (for ungrouped and grouped data).

2.4 Mode: Definition, merits and demerits, empirical relation between mean, median and mode (without proof)

2.5 Geometric Mean (GM): Definition, formula, merits and demerits Harmonic Mean (HM): Definition, formula, merits and demerits Relation between H.M., G.M. and A.M.

UNIT – 3 Measures of Dispersion (7L)

- 3.1** Concept of dispersion, characteristics of good measures of dispersion. Range, semi-interquartile range (quartile deviation): Definition, merits and demerits. Mean deviation.
- 3.2** Definition, merits and demerits, minimality property (without proof).
- 3.3** Variance and standard deviation: Definition merits and demerits, effect of change of origin and scale, combined variance for n groups (derivation for two groups).
- 3.4** Mean squared deviation: Definition, minimality property of mean squared deviation (without proof), merits and demerits measures of dispersion for comparison: coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation (CV)

UNIT – 4 Moments, Skewness and Kurtosis (5L)

- 4.1** Raw moments μ'_r ; $r = 1, 2, 3, 4$ for ungrouped and grouped data.
- 4.2** Central moments μ_r ; $r = 1, 2, 3, 4$ for ungrouped and grouped data, effect of change of origin and scale.
- 4.3** Relations between central moments and raw moments, up to 4th order.
- 4.4** Concept of skewness of frequency distribution: Definition, type of skewness, measures of skewness;
 - i)** Karl Pearson coefficient of skewness
 - ii)** Pearsonian coefficient of skewness
 - iii)** Bowley's coefficient of skewness
- 4.5** Bowley's coefficient of skewness lies between -1 to 1 Interpretation using box plot.
- 4.6** Concept of kurtosis of frequency distribution: Definition, types of kurtosis, measure of kurtosis based on moments and partition values.
- 4.7** Examples and problem.

UNIT – 5 Correlation (5L)

- 5.1** Bivariate data, bivariate frequency distribution.
- 5.2** Concept of correlation between two variables, positive correlation, negative correlation, no correlation. Interpretation of correlation.
- 5.3** Scatter diagram, interpretation of the type of correlation from scatter diagram.
- 5.4** Covariance between two variables: Definition, computation, the effect of change of origin, and scale.

5.5 Karl Pearson's coefficient of correlation (r): Definition, computation for ungrouped data, and interpretation. Properties:

(i) $-1 \leq r \leq 1$

(ii) Effect of change of origin and scale .

5.6 Spearman's rank correlation coefficient: Definition, derivation of formula, computation, and interpretation (without ties). In case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)

References:

1. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol.II, World Press, Calcutta.
2. Gupta and Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
3. Sharma K. V. S. (2001) Statistics made it simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
4. Gupta and Kapoor : Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
5. B. L. Agarwal : Programmed Statistics, New Age International Publishers, New Delhi.
6. David Freedman, Robert Pisani, Roger Purves: Statistics
7. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye: Probability & Statistics for Engineers & Scientists.

Programme Outcomes and Course Outcomes Mapping:

Here's the mapping table:

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	1	2	3	1	2	2	2	1	1	2	1
CO2	3	2	1	2	3	1	2	2	2	1	1	2	1
CO3	3	2	1	2	3	1	2	2	2	1	1	2	1
CO4	3	2	1	2	3	1	2	2	2	1	1	2	1
CO5	3	2	1	2	3	1	2	2	2	1	1	2	1
CO6	3	2	1	2	3	1	2	2	2	1	1	2	1
CO7	3	2	1	2	3	1	2	2	2	1	1	2	1

Justifications are based on how each CO aligns with the descriptions and objectives of each PO.

PO1: Comprehensive Knowledge and Understanding

- **CO1 to CO7:** Each CO provides a strong foundation in statistical concepts, methods, and their applications. This aligns well with the need for a profound understanding of the field of study, ensuring students have a comprehensive grasp of key statistical theories and principles.

Weightage: 3 (Strongly Related)

PO2: Practical, Professional, and Procedural Knowledge

- **CO1 to CO7:** Understanding and applying statistical methods and measures are essential for professional tasks within the field. Students will gain practical skills such as sampling techniques, data analysis, and interpretation of statistical results.

Weightage: 2 (Moderately Related)

PO3: Entrepreneurial Mindset and Knowledge

- **CO1 to CO7:** The course fosters an entrepreneurial mindset by enabling students to identify and leverage statistical insights for decision-making and risk management. Though this is a minor aspect, it still plays a role.

Weightage: 1 (Partially Related)

PO4: Specialized Skills and Competencies

- **CO1 to CO7:** The course outcomes focus on developing technical skills and analytical abilities, which are crucial for problem-solving and effective communication in the field of statistics.

Weightage: 2 (Moderately Related)

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO1 to CO7:** Students will learn to apply statistical concepts in practical settings, solve complex problems, and analyze data effectively. This aligns directly with the course outcomes.

Weightage: 3 (Strongly Related)

PO6: Communication Skills and Collaboration

- **CO1 to CO7:** The ability to interpret and communicate statistical findings is part of the course, although collaboration is less emphasized.

Weightage: 1 (Partially Related)

PO7: Research-related Skills

- **CO1 to CO7:** The course outcomes include skills such as data collection, analysis, and interpretation, which are fundamental to conducting research.

Weightage: 2 (Moderately Related)

PO8: Learning How to Learn Skills

- **CO1 to CO7:** The course encourages continuous learning and adaptation to new statistical methods and tools, fostering self-directed learning.

Weightage: 2 (Moderately Related)

PO9: Digital and Technological Skills

- **CO1 to CO7:** Proficiency in using statistical software and tools is implicitly included, as it is essential for data analysis and interpretation.

Weightage: 2 (Moderately Related)

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO1 to CO7:** While statistical analysis is universally applicable and can be used in multicultural settings, this is a minor focus of the course.

Weightage: 1 (Partially Related)

PO11: Value Inculcation and Environmental Awareness

- **CO1 to CO7:** Ethical considerations in data collection and analysis are implicitly covered, but environmental aspects are less emphasized.

Weightage: 1 (Partially Related)

PO12: Autonomy, Responsibility, and Accountability

- **CO1 to CO7:** The course fosters independence in learning and applying statistical methods, with an emphasis on accurate and responsible data analysis.

Weightage: 2 (Moderately Related)

PO13: Community Engagement and Service

- **CO1 to CO7:** Statistical skills can be applied in community projects and service, though this is a minor focus.

Weightage: 1 (Partially Related)

**CBCS Syllabus as per NEP 2.0 for F.Y.B.Sc. Statistics
(2024 Pattern)**

Name of the Programme	: B.Sc. Statistics
Programme Code	: USST
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: DSC (General) (Practical)
Course Code	: STA-102-GEN
Course Title	: Statistics Practical-I
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

- 1) Introduce the use of random number tables to draw SRSWOR, SRSWR, stratified and systematic sampling.
- 2) Teach students how to create and interpret various types of diagrams and graphs to understand data distribution.
- 3) Develop proficiency in calculating and interpreting measures of central tendency, including mean, median, and mode, using various data types.
- 4) Introduce the concepts of moments, skewness, and kurtosis, and their significance in describing data distribution.
- 5) Introduce basic concepts of demography, including measures of fertility, mortality, and migration, along with the construction and interpretation of life tables.
- 6) To calculate and interpret correlation coefficients to understand the strength and direction of relationships between variables.
- 7) Explain the theory of attributes, including the methods of classification and tabulation of qualitative data.

Course Outcome:

By the end of the course, students should be able to:

- CO1.** calculate and interpret measures of central tendency (mean, median, and mode) using different types of data distributions.
- CO2.** utilize appropriate graphical representations and descriptive statistics measures to present and interpret data.
- CO3.** compute and interpret measures of dispersion (range, variance, and standard

deviation) to assess the variability of data.

CO4. use of concepts of demography, including measures of fertility, mortality, and migration, along with the construction and interpretation of life tables.

CO5. compute coefficients of skewness and kurtosis to understand data symmetry and peakedness.

CO6. calculate correlation coefficients to assess the strength and direction of relationships between variables.

CO7. classify and tabulate qualitative data using the theory of attributes.

Sr. No.	Title of Experiment
1	Use of Scientific Calculator
2	Use of Random Number Tables to Draw SRSWOR, SRSWR, Stratified Sample and Systematic Sample
3	Diagrammatic Representation of Statistical Data (Simple and Subdivided Bar Diagrams, Multiple Bar Diagram, Percentage Bar Diagram, Pie Diagram)
4	Graphical Representation of Statistical Data (Histogram, Frequency Curve and Ogive Curves, Determination of Mode and Median Graphically)
5	Measures of Central Tendency – I
6	Measures of Central Tendency – II
7	Measures of Dispersion – I
8	Measures of Dispersion – II
9	Moments , Skewness and Kurtosis
10	Theory of Attributes-I
11	Theory of Attributes-II
12	Demography-I
13	Demography-II
14	Life Tables
15	Correlation

Note:

1. Every practical is equivalent to four hours per batch per week
2. Practical batch should be of 15 students
3. Students must complete all the practicals to the satisfaction of the teacher concerned.
4. Students must produce at the time of practical examination, the laboratory journal along with the completion certificate signed by the Head of the Department.

Here's the mapping table:

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	1	2	3	2	1	2	1	1	1	2	1
CO2	3	2	1	2	3	2	1	2	1	1	1	2	1
CO3	3	2	1	2	3	2	1	2	1	1	1	2	1
CO4			1	2	3	2	1	2	1	1	1	2	1
CO5			1	2	3	2	1	2	1	1	1	2	1
CO6			1	2	3	2	1	2	1	1	1	2	1
CO7			1	2	3	2	1	2	1	1	1	2	1

Justifications are based on how each CO aligns with the descriptions and objectives of each PO.

PO1: Comprehensive Knowledge and Understanding

- **CO1:** Calculating measures of central tendency requires a deep understanding of statistical principles and methodologies.
- **CO2:** Graphical representations and descriptive statistics contribute to a broader understanding of data interpretation.
- **CO3:** Understanding measures of dispersion complements foundational theories in statistics.

Weightage: 3 (Strongly Related)

PO2: Practical, Professional, and Procedural Knowledge

- **CO1:** Practical application of central tendency measures is essential for professional data analysis.
- **CO2:** Graphical representations and descriptive statistics are directly applicable in real-world scenarios.
- **CO3:** Proficiency in measures of dispersion supports practical skills in data variability assessment.

Weightage: 2 (Moderately Related)

PO3: Entrepreneurial Mindset and Knowledge

- **CO1 to CO7:** While statistical skills are foundational, their direct link to entrepreneurial mindset and business principles is minimal.

Weightage: 1 (Partially Related)

PO4: Specialized Skills and Competencies

- **CO1 to CO7:** Mastery of statistical techniques contributes significantly to technical skills and problem-solving abilities.
- **Weightage:** 2 (Moderately Related)

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO1 to CO7:** Application of statistical concepts in practical settings and complex problem-solving scenarios is a primary focus.

Weightage: 3 (Strongly Related)

PO6: Communication Skills and Collaboration

- **CO1 to CO7:** Effective communication of statistical findings and collaboration in data analysis are indirectly supported.

Weightage: 2 (Moderately Related)

PO7: Research-related Skills

- **CO1 to CO7:** Research skills in data collection, analysis methodologies, and reporting findings are directly aligned.
- **Weightage:** 1 (Partially Related)

PO8: Learning How to Learn Skills

- **CO1 to CO7:** Acquisition of statistical knowledge through self-directed learning is supported, enhancing adaptability.

Weightage: 2 (Moderately Related)

PO9: Digital and Technological Skills

- **CO1 to CO7:** Proficiency in using ICT and data analysis software is fundamental to statistical analysis.

Weightage: 1 (Partially Related)

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO1 to CO7:** Statistical analysis skills have limited direct connection to multicultural competence and empathy.

Weightage: 1 (Partially Related)

PO11: Value Inculcation and Environmental Awareness

- **CO1 to CO7:** Ethical considerations in data analysis and reporting are implicitly supported.

Weightage: 1 (Partially Related)

PO12: Autonomy, Responsibility, and Accountability

- **CO1 to CO7:** Independent application of statistical skills and project management align well with autonomy and responsibility.

Weightage: 2 (Moderately Related)

PO13: Community Engagement and Service

- **CO1 to CO7:** Statistical skills can contribute to community-engaged services through data-driven initiatives.

Weightage: 1 (Partially Related)

**CBCS Syllabus as per NEP 2.0 for F.Y.B.Sc. Statistics
(2024 Pattern)**

Name of the Programme	: B.Sc. Statistics
Programme Code	: USST
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: OE Theory
Course Code	: STA-103-OE
Course Title	: Commercial Statistics
No. of Credits	: 02
No. of Teaching Hours	: 30

Course Objectives:

1. Inculcate awareness and appreciation for data and Statistics
2. Familiarize students with essential statistical terms and concepts.
3. Introduce various methods of collection and sampling techniques.
4. Develop skills in creating and interpreting data graphically.
5. Introduction of statistical measures for summarizing data.
6. Discuss different sampling methods and their implications.
7. To develop students' ability to think critically about data and statistical analyses.

Course Outcomes:

Students should be able to

- CO1.** demonstrate understanding of statistical concepts and utilize it in real life data analysis.
- CO2.** organize and summarize data using appropriate statistical measures.
- CO3.** create and interpret data graphically.
- CO4.** apply statistical concepts and techniques to real-world scenarios.
- CO5.** Familiarize with various sampling techniques, it's advantages, disadvantages, and applications.
- CO6.** understand the practical applications of statistics in various fields and be able to apply statistical methods to real-world problems.
- CO7.** cultivate critical thinking skills related to data analysis and interpretation.
- CO8.** use and communicate statistical information accurately and responsibly, recognizing the potential impact of statistical misinterpretation.

Topics and Learning Points**UNIT 1: Introduction to Statistics (4L)**

Definitions, need and importance, scope of Statistics.

UNIT 2: Data condensation and representation (8L)

2.1 Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio.

2.2 Classification of data, frequency distribution, cumulative frequency distribution

2.3 Graphical representations: Histogram, frequency polygon, frequency curve, ogive curves.

2.4 Diagrammatical representations: simple, multiple, subdivided bar diagrams, stem-leaf chart and pie diagram

2.5 Examples and problems.

UNIT 3: Population and Sample (8L)

3.1 Concept of statistical population with illustrations, concept of sample with illustrations.

3.2 Census and sampling, Advantages of sampling over census.

3.3 Design of Questionnaire.

3.4 Methods of sampling: Probability Sampling Techniques: Simple Random Sampling and Stratified Random Sampling, Systematic, Cluster sampling and Non-Probability Sampling Techniques: Convenience sampling, Purposive sampling, Snowball sampling, Quota sampling.

3.5 Examples and problems.

UNIT 4: Measures of Central Tendency (Averages) (10L)

4.1 Concept of central tendency, criteria for good measures of central tendency.

4.2 Arithmetic mean: Definition, computation for ungrouped and grouped data, combined mean, weighted mean, trimmed mean, merits and demerits.

4.3 Median: Definition, computation for ungrouped and grouped data, graphical method, merits and demerits.

4.4 Mode: Definition, computation for ungrouped and grouped data, graphical method, merits and demerits, empirical relation.

4.5 Examples and problems.

References:

1. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.

2. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
4. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
5. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
6. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1996): Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
7. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

Programme Outcomes and Course Outcomes Mapping:

CO-PO Mapping Table

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3				2		2						
CO2		3		3		2			3				
CO3				3		3			3				
CO4		3	2		3		2		2				
CO5	2	3					3						
CO6	3		2	3				3				2	
CO7				3	3	2	2	3					
CO8		2	1			3		2			1	2	

This mapping table and the justifications show how each Course Outcome (CO) aligns with the Program Outcomes (POs) and the extent of their relationship.

Justification for Mapping PO and CO

PO1: Comprehensive Knowledge and Understanding

- **CO1: 3** (Strongly Related) – Understanding statistical concepts and their real-life application contributes significantly to comprehensive knowledge in the field.
- **CO5: 2** (Moderately Related) – Familiarity with various sampling techniques supports foundational theories and methodologies.

- **CO6: 3** (Strongly Related) – Practical applications of statistics in various fields enhance multidisciplinary understanding.

PO2: Practical, Professional, and Procedural Knowledge

- **CO2: 3** (Strongly Related) – Organizing and summarizing data using statistical measures is essential for professional tasks.
- **CO4: 3** (Strongly Related) – Applying statistical concepts to real-world scenarios demonstrates practical knowledge.
- **CO5: 3** (Strongly Related) – Understanding sampling techniques and their applications is crucial for professional expertise.
- **CO8: 2** (Moderately Related) – Communicating statistical information accurately is part of professional knowledge.

PO3: Entrepreneurial Mindset and Knowledge

- **CO4: 2** (Moderately Related) – Applying statistical concepts to real-world scenarios aids in identifying opportunities and fostering innovation.
- **CO6: 2** (Moderately Related) – Practical applications of statistics contribute to understanding market dynamics and risk management.
- **CO8: 1** (Partially Related) – Recognizing the impact of statistical misinterpretation is valuable for entrepreneurial decision-making.

PO4: Specialized Skills and Competencies

- **CO2: 3** (Strongly Related) – Summarizing data using appropriate statistical measures shows proficiency in analytical skills.
- **CO3: 3** (Strongly Related) – Creating and interpreting data graphically requires technical skills.
- **CO6: 3** (Strongly Related) – Applying statistical methods to real-world problems showcases problem-solving competencies.
- **CO7: 3** (Strongly Related) – Critical thinking skills related to data analysis are key specialized competencies.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO1: 2** (Moderately Related) – Utilizing statistical concepts in real-life data analysis demonstrates the application of learned concepts.
- **CO4: 3** (Strongly Related) – Applying statistical techniques to real-world scenarios shows problem-solving and analytical reasoning.
- **CO7: 3** (Strongly Related) – Critical thinking in data analysis is essential for complex problem-solving.

PO6: Communication Skills and Collaboration

- **CO3: 3** (Strongly Related) – Creating and interpreting data graphically enhances communication skills.
- **CO8: 3** (Strongly Related) – Communicating statistical information accurately is crucial for effective communication.
- **CO2: 2** (Moderately Related) – Summarizing data using statistical measures aids in communication.
- **CO7: 2** (Moderately Related) – Critical thinking and interpretation require collaboration and communication.

PO7: Research-related Skills

- **CO1: 2** (Moderately Related) – Understanding statistical concepts is foundational for research skills.
- **CO4: 2** (Moderately Related) – Applying statistical techniques supports research methodology.
- **CO5: 3** (Strongly Related) – Familiarity with sampling techniques is critical for research data collection.
- **CO7: 2** (Moderately Related) – Critical thinking in data analysis is important for formulating research questions.

PO8: Learning How to Learn Skills

- **CO6: 3** (Strongly Related) – Practical applications of statistics promote self-directed learning.

- **CO7: 3** (Strongly Related) – Developing critical thinking skills supports lifelong learning.
- **CO8: 2** (Moderately Related) – Communicating statistical information responsibly enhances learning adaptability.

PO9: Digital and Technological Skills

- **CO2: 3** (Strongly Related) – Organizing and summarizing data requires digital skills.
- **CO3: 3** (Strongly Related) – Creating and interpreting data graphically involves technological proficiency.
- **CO4: 2** (Moderately Related) – Applying statistical techniques often requires digital tools.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **Not directly related** to any specific COs.

PO11: Value Inculcation and Environmental Awareness

- **CO8: 1** (Partially Related) – Recognizing the impact of statistical misinterpretation has ethical implications.

PO12: Autonomy, Responsibility, and Accountability

- **CO6: 2** (Moderately Related) – Applying statistical methods independently shows autonomy and responsibility.
- **CO8: 2** (Moderately Related) – Communicating statistical information responsibly demonstrates accountability.

PO13: Community Engagement and Service

- **Not directly related** to any specific COs.

**CBCS Syllabus as per NEP 2.0 for F.Y.B.Sc. Statistics
(2024 Pattern)**

Name of the Programme	: B.Sc. Statistics
Programme Code	: USST
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: SEC Practical
Course Code	: STA-104-SEC
Course Title	: Statistical Computing Using MS-Excel
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

1. To provide students with the fundamental skills and knowledge necessary to effectively utilize Microsoft Excel for data analysis and management.
2. Introduce the essential spread sheet concepts and terminology and develop proficiency in creating and formatting worksheets.
3. Introduce basic concepts, formulas, functions, and tools within Excel, enabling students to create, edit, format, and analyse data and perform calculations.
4. Use MS-Excel's statistical functions to compute descriptive statistics, such as mean, median, mode, standard deviation, and variance etc.
5. Create visually appealing charts and graphs to represent data effectively.
6. Introduce regression analysis techniques to analyze relationships between variables.
7. Develop skills in managing and organizing large datasets through hands-on exercises and projects.

Course Outcomes:

Student will be able to

- CO1.** demonstrate the basic mechanics and navigation of an Excel.
- CO2.** proficient in basic functionalities, creating and formatting worksheets.
- CO3.** use and utilize functions and formulas in Excel.
- CO4.** summaries data using various statistical measures.
- CO5.** create charts and graphs student can easily explain complex information or data.
- CO6.** apply regression analysis techniques to analyze relationships between variables.

CO7. manage and organize real datasets through hands-on exercises and projects

Topics and Learning Points

UNIT 1: Introduction to Excel:

- 1.1 Introduction to MS-Excel and its statistical capabilities.
- 1.2 Excel interface and navigation (Title Bar, Menu Bar, Ribbon, Formula Bar, Status Bar, Quick Access Bar)
- 1.3 Setting up Excel for statistical analysis.
- 1.4 Data entry and organization in Excel.
- 1.5 Creating and modifying tables
- 1.6 Inserting and deleting rows, columns, and cells
- 1.7 Entering and editing data, Copying, cutting, and pasting data
- 1.8 Using AutoFill and Flash
- 1.9 Fill to enter data series
- 1.10 Using find and replace, Basic mathematical operators
- 1.11 Common functions (SUM, AVERAGE, MAX, MIN, etc.)

UNIT 2: Descriptive Statistics

- 2.1 Measures of central tendency: mean, median, and mode
- 2.2 Measures of Dispersion: standard deviation, variance, and range
- 2.3 Skewness and Kurtosis
- 2.4 Computing Descriptive Statistics in Excel

UNIT 3: Data Visualization

- 3.1 Creating charts and graphs: Titles, legend, data labels, creating a New Chart, Formatting the Chart, Types of charts, Using Chart Templates.
Simple bar diagram, subdivided bar diagram, multiple bar diagram, percentage bar diagram, pie diagram, rod or spike plot, histogram, frequency curve and ogive curves, Pareto chart

List of Practicals:

Sr. No.	Title of Experiment
1	Introduction to MS-Excel – I
2	Introduction to MS-Excel – II
3	Basic Mathematical and Statistical Function
4	Diagrammatic Representation of Statistical Data (Simple and Subdivided Bar Diagrams, Multiple Bar Diagram, Percentage Bar Diagram, Pie Diagram)
5	Graphical Representation of Statistical Data (Histogram, Frequency Curve and Ogive Curves, Determination of Mode and Median Graphically)
6	Measures of Central Tendency – I
7	Measures of Central Tendency – II
8	Measures of Dispersion – I
9	Measures of Dispersion – II
10	Demography
11	Life Tables
12	Correlation

Note:

1. Each Unit is equivalent to four hours per batch per week.
2. Every practical is equivalent to four hours per batch per week.

References:

1. M. L. Humphrey, Excel for Beginners
2. S. C. Gupta, V.K. Kapoor, Fundamental of Mathematical Statistics
3. William Fischer, Excel: Quickstart Guide for Beginner to Expert
4. Michkel Alexander, Dick Kusleika, John Walkenbeach, Microsoft Excel 2019 BIBLE The Comprehensive Tutorial Resource, Wiley Publication.
5. Frag Curtis (2013). Step by Step Microsoft Excel 2013, MS Press
6. Frye Curtis D. (2007). Step by step Microsoft Office Excel 2007, Microsoft Press
7. Salkind Neil J. and Frey Bruce B (2021). Statistics for people who (Think They) Hate Statistics, Using MS- Excel, Sage Publications.

Programme Outcomes and Course Outcomes Mapping:

CO-PO Mapping Table

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	1							2	3				
CO2		3							3				
CO3	2			3	3								
CO4	2			2		2	2						
CO5		3	2			3			3				
CO6	2		2		3		3					2	
CO7		3		2	3	2	2	3				2	

This mapping table and the justifications show how each Course Outcome (CO) aligns with the Program Outcomes (POs) and the extent of their relationship.

PO1: Comprehensive Knowledge and Understanding

- **CO1: 1** (Partially Related) – Basic mechanics and navigation of Excel provide foundational understanding of data manipulation tools.
- **CO3: 2** (Moderately Related) – Using functions and formulas in Excel involves understanding key concepts in data analysis.
- **CO4: 2** (Moderately Related) – Summarizing data using statistical measures enhances comprehension of fundamental theories.
- **CO6: 2** (Moderately Related) – Applying regression analysis techniques involves foundational knowledge of statistical methodologies.

PO2: Practical, Professional, and Procedural Knowledge

- **CO2: 3** (Strongly Related) – Proficiency in basic functionalities and creating/formatting worksheets is essential for professional tasks.
- **CO5: 3** (Strongly Related) – Creating charts and graphs to explain complex information is crucial for practical data presentation.
- **CO7: 3** (Strongly Related) – Managing and organizing real datasets demonstrates practical skills and expertise in real-world scenarios.

PO3: Entrepreneurial Mindset and Knowledge

- **CO5: 2** (Moderately Related) – Creating charts and graphs to explain complex information can help in identifying opportunities and fostering innovation.

- **CO6: 2** (Moderately Related) – Applying regression analysis techniques contributes to understanding market dynamics and risk management strategies.

PO4: Specialized Skills and Competencies

- **CO3: 3** (Strongly Related) – Using functions and formulas in Excel showcases specialized technical skills and analytical abilities.
- **CO5: 2** (Moderately Related) – Creating charts and graphs requires effective communication skills.
- **CO6: 3** (Strongly Related) – Applying regression analysis techniques demonstrates advanced problem-solving and analytical competencies.
- **CO7: 2** (Moderately Related) – Managing and organizing datasets through hands-on exercises shows adaptation and innovation in response to changing circumstances.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO3: 3** (Strongly Related) – Utilizing functions and formulas in Excel is essential for solving complex problems.
- **CO6: 3** (Strongly Related) – Regression analysis techniques are key for analytical reasoning and solving practical problems.
- **CO7: 3** (Strongly Related) – Managing and organizing real datasets demonstrates the capacity to apply learned concepts in practical settings.

PO6: Communication Skills and Collaboration

- **CO5: 3** (Strongly Related) – Creating charts and graphs to explain complex information enhances communication skills.
- **CO4: 2** (Moderately Related) – Summarizing data using statistical measures helps in effectively communicating data insights.
- **CO7: 2** (Moderately Related) – Managing and organizing datasets often requires collaboration and communication.

PO7: Research-related Skills

- **CO4: 2** (Moderately Related) – Summarizing data using statistical measures is important for research and data analysis.
- **CO6: 3** (Strongly Related) – Applying regression analysis techniques involves research-related skills like data collection and analysis.
- **CO7: 2** (Moderately Related) – Managing real datasets through hands-on exercises is a crucial aspect of research skills.

PO8: Learning How to Learn Skills

- **CO1: 2** (Moderately Related) – Understanding the basic mechanics and navigation of Excel promotes self-directed learning.
- **CO7: 3** (Strongly Related) – Managing and organizing datasets through projects enhances learning how to learn skills.

PO9: Digital and Technological Skills

- **CO1: 3** (Strongly Related) – Demonstrating the basic mechanics and navigation of Excel is a key digital skill.
- **CO2: 3** (Strongly Related) – Proficiency in basic functionalities and creating/formatting worksheets in Excel showcases technological proficiency.
- **CO5: 3** (Strongly Related) – Creating charts and graphs in Excel demonstrates strong digital and technological skills.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **Not directly related** to any specific COs.

PO11: Value Inculcation and Environmental Awareness

- **Not directly related** to any specific COs.

PO12: Autonomy, Responsibility, and Accountability

- **CO7: 2** (Moderately Related) – Managing and organizing real datasets independently demonstrates autonomy and responsibility.
- **CO6: 2** (Moderately Related) – Applying regression analysis techniques shows accountability in conducting data analysis.

PO13: Community Engagement and Service

- **Not directly related** to any specific COs.

**CBCS Syllabus as per NEP 2.0 for F.Y.B.Sc. Statistics
(2024 Pattern)**

Name of the Programme	: B.Sc. Statistics
Programme Code	: USST
Class	: F.Y.B.Sc.
Semester	: II
Course Type	: DSC (General) (Theory)
Course Code	: STA-151-GEN
Course Title	: Discrete Probability and Probability Distributions – I
No. of Credits	: 02
No. of Teaching Hours	: 30

Course Objectives:

1. Understand the concept of sample spaces, events, probability, conditional probability including Bayes' theorem and independence of events.
2. Learn the concepts of random variables and probability distributions.
3. Understand and apply the properties of probability distributions, such as the probability mass function (PMF), cumulative distribution function (CDF), and expected value.
4. Calculating and interpreting measures of central tendency (mean, median, mode) and dispersion (variance, standard deviation) for discrete random variables.
5. Computation of probabilities to solve real-world problems.
6. Develop problem-solving skills related to discrete probability distributions.
7. Communicate and present probability concepts and findings effectively through written reports and oral presentations.
8. Identify real life situations where Binomial and Hyper-geometric distribution can be applied, and compute the probabilities of the given event.

Course Outcomes:

The students will acquire knowledge about the,

- CO1.** Computation of probabilities in case of nondeterministic experiments.
- CO2.** Application of the Bayes' theorem in real-life situations problems.
- CO3.** Univariate random variable, univariate discrete random variable and its probability distribution.

- CO4.** The Concepts of mean, median, and mode of a univariate discrete random variable
- CO5.** Find the probabilities of various events.
- CO6.** Obtain probability distribution of univariate discrete random variables.
- CO7.** apply binomial and Hyper-geometric distribution in different real life situations.

Topics and Learning Points

Unit – 1 Sample space and Events: (4L)

- 1.1** Concepts of experiments, deterministic and nondeterministic experiments.
- 1.2** Definitions: Sample space, Types of sample space, Event, Types of Events: Elementary event, Complementary event, sure event, impossible event.
- 1.3** Concept of occurrence of an event, Equally-likely events
- 1.4** Algebra of events (Union, Intersection, Complementation).
- 1.5** Definitions of Mutually exclusive events, Exhaustive events.
- 1.6** Algebra of events and its representation of events in set theory notation:
Occurrence of the following events:
- i)** at least one of the given events
 - ii)** none of the given events
 - iii)** all of the given events
 - iv)** mutually exclusive events
 - v)** mutually exhaustive events
 - vi)** exactly one event out of the given events.
- 1.7** Illustrative examples.

Unit – 2 Probability: (6L)

- 2.1** Concept of Permutations and Combinations
Equiprobable and non-equiprobable sample space, Classical definition of probability, examples. Probability model, probability of an event, examples.
The axiomatic approach of probability.
- 2.2** Important results and their proofs of the results:
- i)** $P(\Phi) = 0$,
 - ii)** $P(A^c) = 1 - P(A)$,

iii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (Addition theorem of probability)

and its generalization (Statement only).

iv) If $A \subset B$, $P(A) \leq P(B)$

v) $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$.

vi) $(A \cup B) \leq (A) + P(B)$ (Boole's Inequality) and its generalization (Statement only).

2.3 Interpretation of probability in terms of odds ratio.

2.4 Illustrative examples.

Unit – 3 Conditional Probability and Independence of events: (5L)

3.1 Definition of the conditional probability of an event.

3.2 Multiplication theorem for two and three events.

3.3 Partition of sample space.

3.4 Idea of Posterior probability, Statement, and proof of Bayes' theorem, examples on Bayes' theorem.

3.5 Sensitivity and specificity

3.6 Concept of Independence of two events.

3.7 Proof of the result that if events A and B are independent then,

i) A and B^c ,

ii) A^c and B

iii) A^c and B^c are independent.

3.8 Pairwise and Mutual Independence for three events.

3.9 Illustrative examples.

Unit – 4 Univariate Probability Distributions (Finite Sample Space): (8L)

4.1 Definition of a discrete random variable and Probability mass function (p.m.f.)

4.2 Probability distribution of a function of a random variable.

4.3 Cumulative distribution function (c.d.f.) of a discrete random variable, Properties of c.d.f. (statements only), Median and Mode of a univariate discrete probability distribution.

4.4 Definition of expectation of a random variable, the expectation of a function of a random variable.

4.5 Definition of variance, standard deviation (s.d.), Effect of change of origin and scale on mean, variance, and s.d. of random variable.

4.6 Definition of raw, central moments of univariate probability distributions and their interrelations.

4.7 Definition of moment generating function (m.g.f.), deduction of moments from m.g.f. and properties of m.g.f.: i) $M_x(0) = 1$ ii) Effect of change of origin and

scale on m.g.f. iii) Additive property of m.g.f.

- 4.8** Nature of probability distribution by using Pearsonian Coefficient of skewness and kurtosis.

Unit – 5 Standard Discrete Probability Distribution (Finite Sample Space) (7L)

- 5.1** Review of a random variable based on finite sample space.
- 5.2** Degenerate Distribution:
- 5.3** Discrete Uniform Distribution: p.m.f., mean and variance.
- 5.4** Bernoulli distribution: p.m.f., mean, variance, distribution of the sum of independent and identically distributed Bernoulli variables.
- 5.5** Binomial Distribution: Binomial random variable, p.m.f. with parameters (n, p), Recurrence relation for successive probabilities, Computation of probabilities of different events, mean and variance, mode, skewness, m.g.f., deduction of moments from m.g.f. Additive property of binomial variables. Examples. The conditional distribution of X given (X+Y) for Binomial distributions.
- 5.6** Hypergeometric Distribution: p.m.f. with parameters (N, M, n), Computation of probability of different events, Recurrence relation for successive probabilities, mean and variance of distribution assuming $n \leq N - M \leq M$, approximation of Hypergeometric to Binomial.

References:

1. Bhat B. R., Srivenkatramana T and Madhava Rao K. S. (1997): Statistics: a Beginner's Text, Vol. II, New Age International (P) Ltd.
2. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol.II, World Press, Calcutta.
3. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
4. Gupta and Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
5. Meyer P.L.(1970): Introductory Probability and Statistical Applications, Edition Wesley.
6. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia)
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9. Wayne W. Daniel : Biostatistics
10. Brase C. H. and Brase C. P., (2018), Understandable Statistics, Twelfth Edition, Cengage Learning.
11. Biston Moore D. S., Notz W. I., Flinger M. A., (2013), The Basic Practice of Statistics, Sixth Edition, Freeman and Company New York

Programme Outcomes and Course Outcomes Mapping:

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2		2	3		3	3	2	1	1	3	1
CO2	3	2	1	2	3	2	3	3	2	1	1	3	1
CO3	3				3			3	2	1		3	
CO4	3	2		2	3			3				3	
CO5	3			2	3			3				3	
CO6	3	2	1	2	3	2		3				3	
CO7	3	2		2	3	2	3	3				3	1

PO1: Comprehensive Knowledge and Understanding

- **CO1 to CO7:** Probability theory and its applications are foundational to understanding uncertainties and making informed decisions across various disciplines. This aligns with the profound understanding required in the field of study.

Weightage: 3 (Strongly Related)

PO2: Practical, Professional, and Procedural Knowledge

- **CO1, CO2, CO4, CO6, CO7:** Practical application of probability, including Bayes' theorem and distributions, prepares students for real-world decision-making and problem-solving tasks.

Weightage: 2 (Moderately Related)

PO3: Entrepreneurial Mindset and Knowledge

- **CO2, CO6:** Understanding probabilities and their applications fosters innovation and risk management strategies, though this is a minor aspect.

Weightage: 1 (Partially Related)

PO4: Specialized Skills and Competencies

- **CO1, CO2, CO4, CO5, CO6, CO7:** Mastery of technical skills in probability calculations and analysis enhances analytical abilities and problem-solving skills.

Weightage: 2 (Moderately Related)

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO1 to CO7:** Probability theory requires critical thinking, creativity, adaptability, and the ability to analyze data effectively, directly correlating with this outcome.

Weightage: 3 (Strongly Related)

PO6: Communication Skills and Collaboration

- **CO2, CO6, CO7:** Effectively communicating probabilistic findings and collaborating on research projects are essential skills for professionals in various fields.

Weightage: 2 (Moderately Related)

PO7: Research-related Skills

- **CO1, CO2, CO7:** Probability theory underpins research methodologies, requiring observational skills, formulation of research questions, and adherence to ethical standards in data analysis and reporting.

Weightage: 3 (Strongly Related)

PO8: Learning How to Learn Skills

- **CO1 to CO7:** Probability theory involves continuous learning, adaptation to new methodologies, and achieving goals independently through self-directed learning.

Weightage: 3 (Strongly Related)

PO9: Digital and Technological Skills

- **CO1, CO2, CO7:** Proficiency in using ICT for probability calculations and data analysis is integral to this outcome.

Weightage: 2 (Moderately Related)

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO1, CO2, CO7:** Probability theory is universally applicable, though specific aspects like cultural sensitivity are less emphasized.

Weightage: 1 (Partially Related)

PO11: Value Inculcation and Environmental Awareness

- **CO1, CO2:** Ethical considerations in probability theory align with promoting responsible citizenship, though environmental aspects are not directly addressed.

Weightage: 1 (Partially Related)

PO12: Autonomy, Responsibility, and Accountability

- **CO1 to CO7:** Probability theory requires independent application, project management skills, and accountability in decision-making and analysis.

Weightage: 3 (Strongly Related)

PO13: Community Engagement and Service

- **CO1, CO2, CO7:** Probability applications can contribute to community service activities, although this is a minor focus.

Weightage: 1 (Partially Related)

**CBCS Syllabus as per NEP 2.0 for F.Y.B.Sc. Statistics
(2024 Pattern)**

Name of the Programme	: B.Sc. Statistics
Programme Code	: USST
Class	: F.Y.B.Sc.
Semester	: II
Course Type	: Major Mandatory (Practical)
Course Code	: STA-152-GEN
Course Title	: Statistics Practical – II
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

- 1) Learn techniques for transforming data into a suitable format for analysis.
- 2) Understand methods to detect and manage outliers to improve data quality and analysis accuracy.
- 3) Acquire skills to efficiently merge and join datasets from different sources to create comprehensive datasets for analysis.
- 4) Master the creation of diagrams to visually represent data for easy interpretation and analysis.
- 5) Learn to calculate and interpret measures of central tendency (mean, median, mode) for different types of data.
- 6) Perform practical exercises to compute range, variance, and standard deviation to understand data variability.
- 7) Acquire skills to measure and interpret skewness and kurtosis to understand the shape and characteristics of data distributions.
- 8) Gain a thorough understanding of basic probability concepts and their applications, including conditional probability.
- 9) Understand the practical applications of binomial and hypergeometric distributions in real-world scenarios.

Course Outcome:

By the end of the course, students should be able to:

- CO1.** to explore datasets to understand their structure, identify patterns, and summarize the main characteristics.

- CO2.** transforming data to prepare it for analysis.
- CO3.** develop skills to detect and handle outliers in datasets, understanding their impact on data analysis.
- CO4.** calculate and interpret measures of central tendency and measures of dispersion.
- CO5.** understand and apply basic probability and conditional probability concepts in data analysis.
- CO6.** analyze and apply univariate discrete probability distributions.
- CO7.** understand and apply the Binomial and Hypergeometric distributions to solve real-world problems.

Topics and Learning Points

Sr. No.	Title of Experiments
1	Data Exploration
2	Data Cleaning
3	Data Transformation
4	Handling Outliers
5	Merging and Joining Datasets
6	Diagrammatic representation of the Data
7	Graphical representation of the Data
8	Measuring Central Tendency for Categorical as well as continuous data
9	Measures of Dispersion: Practical Exercises on Range, Variance, and Standard Deviation.
10	Identifying Data Distribution Characteristics: Skewness and Kurtosis
11	Probability and Conditional Probability
12	Univariate Discrete Probability Distributions
13	Model sampling from Binomial distribution
14	Fitting of binomial distribution
15	Application of Binomial and Hypergeometric Distribution

Note:

- All Practical is expected to conduct using R Software.**
- Every practical is equivalent to four hours per batch per week.
- Practical batch should be of 15 students.
- Students must complete all the practicals to the satisfaction of the teacher concerned.

5. Students must produce at the time of practical examination, the laboratory journal along with the completion certificate signed by the Head of the Department.

Programme Outcomes and Course Outcomes Mapping:

CO-PO Mapping Table

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	1	2	3	1	1	2	2	1	1	2	1
CO2	3	2	1	2	3	1	1	2	2	1	1	2	1
CO3		2	1	2	3	1	1	2	2	1	1	2	1
CO4	3	2	1	2	3	1	1	2	2	1	1	2	1
CO5	3	2	1	2	3	1	1	2	2	1	1	2	1
CO6	3	2	1	2	3	1	1	2	2	1	1	2	1
CO7	3	2	1	2	3	1	1	2	2	1	1	2	1

This mapping table and the justifications show how each Course Outcome (CO) aligns with the Program Outcomes (POs) and the extent of their relationship.

Justification for Mapping PO and CO

PO1: Comprehensive Knowledge and Understanding

- **CO1, CO2, CO4, CO5, CO6, CO7 (Weightage: 3):** These COs require a deep understanding of data analysis, probability concepts, and statistical distributions, aligning strongly with PO1.

PO2: Practical, Professional, and Procedural Knowledge

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 2):** All COs involve practical data analysis and statistical procedures, thus moderately aligning with PO2.

PO3: Entrepreneurial Mindset and Knowledge

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 1):** While these COs can foster innovative problem-solving skills, their direct contribution to an entrepreneurial mindset is limited, thus partially aligning.

PO4: Specialized Skills and Competencies

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 2):** These COs develop specialized technical and analytical skills required in data analysis and statistics, aligning moderately with PO4.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 3):** Strong alignment with COs as they involve applying concepts, solving data-related problems, and performing analytical reasoning.

PO6: Communication Skills and Collaboration

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 1):** While these COs involve understanding and interpreting data, their contribution to communication skills and collaboration is partial.

PO7: Research-related Skills

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 1):** These COs can contribute to research skills by providing a foundation in data analysis and statistical techniques, though not the primary focus.

PO8: Learning How to Learn Skills

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 2):** Moderate alignment as students will need to adapt and learn new data analysis and statistical techniques independently.

PO9: Digital and Technological Skills

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 2):** These COs involve the use of statistical software and digital tools for data analysis, thus moderately aligning with PO9.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 1):** Limited alignment as these COs focus more on technical skills rather than multicultural competence and empathy.

PO11: Value Inculcation and Environmental Awareness

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 1):** Partial alignment as these COs do not directly address ethical issues or environmental awareness.

PO12: Autonomy, Responsibility, and Accountability

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 2):** Moderate alignment as students will develop skills in managing data analysis tasks independently and responsibly.

PO13: Community Engagement and Service

- **CO1, CO2, CO3, CO4, CO5, CO6, CO7 (Weightage: 1):** Partial alignment as these COs do not directly involve community engagement or service activities.

**CBCS Syllabus as per NEP 2.0 for F.Y.B.Sc. Statistics
(2024 Pattern)**

Name of the Programme	: B.Sc. Statistics
Programme Code	: USST
Class	: F.Y.B.Sc.
Semester	: II
Course Type	: OE Practical
Course Code	: STA-153-OE
Course Title	: Introduction to MS-Excel and Statistical Computing
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

1. To provide students with the fundamental skills and knowledge necessary to effectively utilize MS Excel for data analysis and management.
2. Familiarize students with the Excel interface and basic functionalities.
3. Introduce the essential spreadsheet concepts and terminology and develop proficiency in creating and formatting worksheets.
4. Provide an understanding of data entry and manipulation techniques.
5. Introduce basic concepts, formulas, functions, and tools within Excel, enabling students to create, edit, format, and analyze data and perform calculations.
6. Effectively utilize Microsoft Excel for Data visualization using charts and graphs
7. Explore advanced features such as conditional formatting and filtering.
8. Develop skills in managing and organizing large datasets through hands-on exercises and projects.

Course Outcomes:

Student will be able to

- CO1.** demonstrate the basic mechanics and navigation of an Excel.
- CO2.** proficient in basic functionalities, creating and formatting worksheets.
- CO3.** gain working knowledge of organizing and displaying raw data in structured format.
- CO4.** use and utilize functions and formulas in Excel.
- CO5.** create charts and graphs can easily explain complex information or data.
- CO6.** explore advanced features such as conditional formatting and filtering.
- CO7.** manage and organize real datasets through hands-on exercises and projects.

Topics and Learning Points**UNIT 1: Introduction to Excel:**

- 1.1 Introduction to importance of MS-Excel skills in various industries.
- 1.2 The Excel Environment: Cells, Rows, and Columns, Title Bar, Ribbon, Scroll Bars, Quick Access Toolbar, Formula Bar, Workbook View Buttons, Zoom Slider, Mini Toolbar, Keyboard Shortcuts, Formulas, Sheet Tabs, Page Margins, Page Orientation, Page Breaks and Printing.
- 1.3 Worksheets and Workbooks: Definition of Worksheets and Workbooks, creating and saving new worksheet, Naming of Worksheets, Adding and Deleting Worksheets, Hiding/ Unhiding Worksheets, Hiding Columns and Rows, Saving Workbooks, Saving an Existing File, Headers, and Footers, Inserting, Deleting, copy and Renaming of Worksheets. Conditional Formatting and cell styles, Basic file operations (open, save, rename, close)

UNIT 2: Data Entry and Manipulation

- 2.1 Import external data, Entering Data, create a table, Labels and Values, Copying Cells, Rows and Columns, Pasting Cells, Rows, and Columns, Paste an Item from the Clipboard
- 2.2 Inserting and Deleting Rows and Columns, Filling and Editing Cell Data, Find and Replace, Go to Cell Data, Locking Rows and Columns, Spell Check, AutoCorrect. Change Font Styles and Sizes, Adding Borders and Colors to Cells, change Column Width, change Row Height, Merge Cells, Applying Number Formats

UNIT 3: Inbuilt MS-Excel Functions

- 3.1 Basic mathematical operators: ABS, EXP, CEILING, FLOOR, INT, EVEN, ODD, COMBIN, COMBINA FACT, FACTDOUBLE, GCD, LCM, LN, LOG, LOG10, MOD, MULTINOMIAL, POWER PRODUCT, RAND, RANDARRAY, RANDBETWEEN, ROUND, SIGN, SORT, etc.
- 3.2 Logical: IF, AND, NOT, OR, LET, LAMBDA, TRUE, FALSE, SWITCH, etc. and Lookup: LOOKUP, HLOOKUP, VLOOKUP, XLOOKUP, etc. Other functions: Date and Time Functions, Text functions, sort, duplicate, Pivot table, Pivot chart

UNIT 4: Data Analysis and Visualization

- 4.1 Creating charts and graphs: Titles, legend, data labels, creating a New Chart, Formatting the Chat, Types of charts, Using Chart Templates.

4.2 Simple bar diagram, subdivided bar diagram, multiple bar diagram, percentage bar diagram, pie diagram, rod or spike plot, histogram, frequency curve and ogive curves, Pareto chart.

4.3 Analyzing and interpreting case studies from different fields

List of Practicals:

Sr.No.	Title of Experiment	No. of Experiment
1.	Introduction to MS-Excel	3
2.	Basic mathematical functions	1
3.	Conditional logic functions and lookup function	2
4.	Statistical functions in excel analysis tool pack.	1
5.	Diagrammatic representation	1
6.	Graphical representation	2
7.	Pivot Chart	1
8.	Pivot Table	1

Note:

1. Every practical is equivalent to four hours per batch per week

References:

1. M. L. Humphrey, Excel for Beginners
2. William Fischer, Excel: Quickstart Guide for Beginner to Expert
3. Michkel Alexander, Dick Kusleika, John Walkenbeach, Microsoft Excel 2019 Bible The Comprehensive Tutorial Resource, Wiley Publication
4. Frag Curtis (2013). Step by Step Microsoft Excel 2013, MS Press
5. Frye Curtis D. (2007). Step by step Microsoft Office Excel 2007, Microsoft Press,
6. John Walkenbach (2013), 101 Excel 2013 Tips, Tricks and Time savers, Wiley.
7. Kumar Bittu (2013). Microsoft Office 2010, V&S Publishers.
8. Salkind Neil J. and Frey Bruce B (2021). Statistics for people who (Think They) Hate Statistics, Using MS- Excel, Sage Publications.
9. Sanjay Saxen (2007). MS Office 2000 for everyone, Vikas Publishing House.

Programme Outcomes and Course Outcomes Mapping:

CO-PO Mapping Table

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	2	2		2		2		2	3				
CO2	2	3				2		2	3			2	
CO3	2	2	2	3	3		3		3				
CO4	2	3	2	3	3	2	3		3				
CO5	3	3	3	3	3	3	3		3				
CO6	2	3	2	3	2			2	3			2	
CO7	3	3	2	3	3	2	3	3	3			2	

Justification for Mapping PO and CO**PO1: Comprehensive Knowledge and Understanding**

- **CO1: 2** (Moderately Related) – Basic mechanics and navigation of Excel contribute to foundational knowledge in data handling.
- **CO2: 2** (Moderately Related) – Proficiency in basic functionalities and formatting worksheets supports comprehensive knowledge.
- **CO3: 2** (Moderately Related) – Organizing and displaying raw data in a structured format requires understanding foundational data organization principles.
- **CO4: 2** (Moderately Related) – Using functions and formulas in Excel involves foundational knowledge of their application.
- **CO5: 3** (Strongly Related) – Creating charts and graphs to explain complex information demonstrates comprehensive knowledge of data visualization.
- **CO6: 2** (Moderately Related) – Exploring advanced features like conditional formatting and filtering requires understanding the principles of data management.
- **CO7: 3** (Strongly Related) – Managing and organizing real datasets through hands-on exercises and projects requires comprehensive knowledge of data handling and analysis.

PO2: Practical, Professional, and Procedural Knowledge

- **CO1: 2** (Moderately Related) – Proficiency in Excel mechanics is a practical skill useful in professional environments.
- **CO2: 3** (Strongly Related) – Creating and formatting worksheets is essential for professional data management.
- **CO3: 2** (Moderately Related) – Organizing and displaying raw data in structured formats is a practical skill for data presentation.

- **CO4: 3** (Strongly Related) – Utilizing functions and formulas in Excel is a practical skill for efficient data manipulation.
- **CO5: 3** (Strongly Related) – Creating charts and graphs is essential for professional data visualization.
- **CO6: 3** (Strongly Related) – Advanced Excel features are vital for efficient data management in professional settings.
- **CO7: 3** (Strongly Related) – Hands-on exercises and projects with real datasets are practical experiences crucial for professional competence.

PO3: Entrepreneurial Mindset and Knowledge

- **CO3: 2** (Moderately Related) – Organizing and displaying data can help in identifying business opportunities and trends.
- **CO4: 2** (Moderately Related) – Using functions and formulas can aid in analyzing business data for decision-making.
- **CO5: 3** (Strongly Related) – Creating charts and graphs can identify business trends and opportunities.
- **CO6: 2** (Moderately Related) – Advanced Excel features can support innovative business analysis techniques.
- **CO7: 2** (Moderately Related) – Managing real datasets can identify business trends and opportunities through practical projects.

PO4: Specialized Skills and Competencies

- **CO1: 2** (Moderately Related) – Basic Excel skills are fundamental for technical data handling.
- **CO2: 3** (Strongly Related) – Proficiency in Excel functionalities is a specialized competency.
- **CO3: 3** (Strongly Related) – Organizing and displaying raw data demonstrates specialized skills.
- **CO4: 3** (Strongly Related) – Utilizing functions and formulas showcases technical analytical abilities.
- **CO5: 3** (Strongly Related) – Creating charts and graphs demonstrates specialized competencies.
- **CO6: 3** (Strongly Related) – Utilizing advanced features in Excel shows technical proficiency.
- **CO7: 3** (Strongly Related) – Managing and organizing datasets demonstrates specialized data management skills.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO3: 3** (Strongly Related) – Organizing and displaying data enhances problem-solving and analytical reasoning.
- **CO4: 3** (Strongly Related) – Using functions and formulas requires strong application and analytical reasoning skills.
- **CO5: 3** (Strongly Related) – Creating charts and graphs involves problem-solving and analytical reasoning.
- **CO6: 2** (Moderately Related) – Advanced Excel features support analytical reasoning for data interpretation.
- **CO7: 3** (Strongly Related) – Managing real datasets involves practical application and problem-solving skills.

PO6: Communication Skills and Collaboration

- **CO1: 2** (Moderately Related) – Basic Excel skills aid in clear communication of data.
- **CO2: 2** (Moderately Related) – Formatting worksheets enhances the clarity of information presented.
- **CO4: 2** (Moderately Related) – Explaining the use of functions and formulas involves effective communication.
- **CO5: 3** (Strongly Related) – Creating charts and graphs is crucial for visual communication of complex data.
- **CO7: 2** (Moderately Related) – Managing datasets for projects often involves teamwork and collaboration.

PO7: Research-related Skills

- **CO3: 3** (Strongly Related) – Organizing and displaying raw data is essential for research data management.
- **CO4: 3** (Strongly Related) – Using functions and formulas in Excel is a fundamental research methodology.
- **CO5: 3** (Strongly Related) – Creating charts and graphs is essential for research data visualization.
- **CO7: 3** (Strongly Related) – Managing real datasets is crucial for research data handling and analysis.

PO8: Learning How to Learn Skills

- **CO1: 2** (Moderately Related) – Learning Excel basics supports self-directed learning.
- **CO2: 2** (Moderately Related) – Learning to format worksheets enhances independent learning.
- **CO6: 2** (Moderately Related) – Exploring advanced features promotes continuous learning.

- **CO7: 3** (Strongly Related) – Managing datasets through projects encourages learning by doing.

PO9: Digital and Technological Skills

- **CO1: 3** (Strongly Related) – Excel proficiency is a key digital skill.
- **CO2: 3** (Strongly Related) – Creating and formatting worksheets involves essential digital skills.
- **CO3: 3** (Strongly Related) – Organizing and displaying data demonstrates technological proficiency.
- **CO4: 3** (Strongly Related) – Using functions and formulas in Excel is a crucial digital skill.
- **CO5: 3** (Strongly Related) – Creating charts and graphs in Excel is essential for digital data presentation.
- **CO6: 3** (Strongly Related) – Advanced Excel features are vital for digital data management.
- **CO7: 3** (Strongly Related) – Managing real datasets in Excel demonstrates advanced digital skills.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **Not directly related** to any specific COs.

PO11: Value Inculcation and Environmental Awareness

- **Not directly related** to any specific COs.

PO12: Autonomy, Responsibility, and Accountability

- **CO2: 2** (Moderately Related) – Creating and formatting worksheets requires responsibility and attention to detail.
- **CO6: 2** (Moderately Related) – Using advanced Excel features involves taking responsibility for data accuracy.
- **CO7: 2** (Moderately Related) – Managing real datasets involves accountability for data integrity.

PO13: Community Engagement and Service

- **Not directly related** to any specific COs.

**CBCS Syllabus as per NEP 2.0 for F.Y.B.Sc. Statistics
(2024 Pattern)**

Name of the Programme	: B.Sc. Statistics
Programme Code	: USST
Class	: F.Y.B.Sc.
Semester	: II
Course Type	: Skill Enhancement Course (SEC) Practical
Course Code	: STA-154-SEC
Course Title	: Application of Statistics Using Advanced Excel
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

1. To provide students with the fundamental skills and knowledge necessary to effectively utilize MS Excel for data analysis and management.
2. Introduce basic concepts, formulas, functions, and tools within Excel, enabling students to create, edit, format, and analyse data and perform calculations
3. Computation of correlation coefficients, and fitting of regression models using excel and their interpretation.
4. Use of MS-Excel for computation of probabilities and model sampling from some standard discrete probability distributions.
5. Effectively utilize Microsoft Excel for Data visualization using Pivot table and Pivot charts.
6. Explore advanced features such as conditional formatting and filtering.
7. Develop skills in managing and organizing large datasets through hands-on exercises and projects.

Course Outcomes:

Student will be able to

- CO1.** demonstrate the basic mechanics and navigation of an Excel.
- CO2.** proficient in basic functionalities, creating and formatting worksheets.
- CO3.** gain working knowledge use of MS-Excel for computation of probabilities and model sampling from some standard discrete probability distributions
- CO4.** apply regression analysis to model relationships between variables and make predictions or identify factors that influence an outcome.
- CO5.** summaries data using various statistical measures.
- CO6.** explore advanced features such as conditional formatting and filtering.
- CO7.** manage and organize real datasets through hands-on exercises and projects.

Topics and Learning Points

UNIT 1: Advanced Formulas and Functions:

- 1.2 Nested functions: Combining multiple functions within a formula.
- 1.3 Array formulas: Performing calculations on arrays of data.
- 1.4 Logical: IF, AND, NOT, OR, LET, LAMBDA, TRUE, FALSE, SWITCH, etc.
- 1.5 IF functions: Complex logical tests and multiple nested IF statements.
- 1.6 Advanced functions like SUMIF, COUNTIF, AVERAGEIF, COUNTIFS, SUMIFS, and AVERAGEIFS. Lookup functions: LOOKUP, VLOOKUP, HLOOKUP, XLOOKUP, INDEX, and MATCH for data retrieval, Conditional Formatting.

UNIT 2: Data Analysis and Visualization

- 2.3 PivotTables and Pivot Charts: Creating PivotTables for multidimensional data analysis. Customizing PivotTables with calculated fields and items. Building interactive Pivot Charts for visualizing data.

UNIT 3: Dashboards Excel

- **Define the Purpose and Audience:** Clearly understand the purpose of your dashboard and who your audience is. What key metrics or insights are you trying to convey?
- **Data Preparation:** Ensure your data is clean, structured, and up-to-date. Consider using Excel tables (also known as lists) to make data management easier.
- **Select the Visual Elements:** Choose the appropriate charts, graphs, and visuals to represent your data. Common options include bar charts, line charts, pie charts, and gauges.
- **Layout and Design:** Create a clean and organized layout for your dashboard. Use gridlines, shapes, and text boxes to arrange elements. Choose a consistent color scheme and fonts to enhance readability and aesthetics. Consider using Excel's built-in themes and styles for a professional look.
- **Interactive Elements:** Make your dashboard interactive by using features like dropdown lists, slicers, or form controls.

List of Practicals:

Sr. No.	Title of Experiment	No. of Experiment
1.	Logical functions	1
2.	Conditional formatting	1
3.	Lookup functions	1
4.	Pivot Table and Pivot Chart	1
5.	Scatter diagram, correlation coefficient (ungrouped data)	1
6.	Model sampling from some standard discrete probability distributions.	1
7.	Applications of Binomial and Hyper-geometric Distribution	1
8.	Fitting of Binomial distribution	1
9.	Dashboards in excel	4

Note:

1. Every unit is equivalent to four hours per batch per week
2. Every practical is equivalent to four hours per batch per week

References:

1. M. L. Humphrey, Excel for Beginners
2. William Fischer, Excel: Quick start Guide for Beginner to Expert
3. Michkel Alexander, Dick Kusleika, John Walkenbeach, Microsoft Excel 2019 Bible The Comprehensive Tutorial Resource, Wiley Publication
4. Frag Curtis (2013). Step by Step Microsoft Excel 2013, MS Press
5. Frye Curtis D. (2007). Step by step Microsoft Office Excel 2007, Microsoft Press,
6. John Walkenbach (2013), 101 Excel 2013 Tips, Tricks and Time savers, Wiley.
7. Kumar Bittu (2013). Microsoft Office 2010, V&S Publishers.
8. Salkind Neil J. and Frey Bruce B (2021). Statistics for people who (Think They) Hate Statistics, Using MS- Excel, Sage Publications.
9. Sanjay Saxen (2007). MS Office 2000 for everyone, Vikas Publishing House.
10. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol. II, World Press, Calcutta.

Programme Outcomes and Course Outcomes Mapping:

CO-PO Mapping Table

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	2	2		2		2		2	3				
CO2	2	3		3		2		2	3			2	
CO3		3	2	3	3		3		3				
CO4		3	3	3	3	2	3		3				
CO5		3		3	3	3	3		3				
CO6	2	3	2	3	3			2	3			2	
CO7		3	2	3	3	2	3	3	3			2	

This mapping table and the justifications show how each Course Outcome (CO) aligns with the Program Outcomes (POs) and the extent of their relationship.

Justification for Mapping PO and CO**PO1: Comprehensive Knowledge and Understanding**

- **CO1: 2** (Moderately Related) – Understanding the basic mechanics and navigation of Excel contributes to foundational knowledge in data handling.
- **CO2: 2** (Moderately Related) – Proficiency in basic functionalities and formatting worksheets supports comprehensive knowledge.
- **CO3: 3** (Strongly Related) – Using Excel for probability computation and model sampling from distributions involves fundamental statistical concepts.
- **CO4: 3** (Strongly Related) – Applying regression analysis to model relationships requires a deep understanding of statistical methodologies.
- **CO5: 3** (Strongly Related) – Summarizing data using various statistical measures demonstrates a comprehensive understanding of data analysis.
- **CO6: 2** (Moderately Related) – Exploring advanced features like conditional formatting and filtering requires understanding the principles of data management.
- **CO7: 3** (Strongly Related) – Managing and organizing real datasets requires comprehensive knowledge of data handling and analysis.

PO2: Practical, Professional, and Procedural Knowledge

- **CO1: 2** (Moderately Related) – Proficiency in Excel mechanics is a practical skill useful in professional environments.

- **CO2: 3** (Strongly Related) – Creating and formatting worksheets is essential for professional data management.
- **CO3: 3** (Strongly Related) – Using Excel for probability computations and model sampling is a practical skill for various professional tasks.
- **CO4: 3** (Strongly Related) – Regression analysis is a crucial professional skill for data analysis and prediction.
- **CO5: 3** (Strongly Related) – Summarizing data using statistical measures is essential for professional data presentation.
- **CO6: 3** (Strongly Related) – Advanced Excel features are vital for efficient data management in professional settings.
- **CO7: 3** (Strongly Related) – Hands-on exercises and projects with real datasets are practical experiences crucial for professional competence.

PO3: Entrepreneurial Mindset and Knowledge

- **CO3: 2** (Moderately Related) – Using Excel for probability and model sampling helps in analyzing business risks and opportunities.
- **CO4: 3** (Strongly Related) – Regression analysis can identify factors influencing business outcomes and opportunities.
- **CO5: 2** (Moderately Related) – Summarizing data can aid in understanding market trends and opportunities.
- **CO6: 2** (Moderately Related) – Advanced Excel features can support innovative business analysis techniques.
- **CO7: 2** (Moderately Related) – Managing real datasets can identify business trends and opportunities through practical projects.

PO4: Specialized Skills and Competencies

- **CO1: 2** (Moderately Related) – Basic Excel skills are fundamental for technical data handling.
- **CO2: 3** (Strongly Related) – Proficiency in Excel functionalities is a specialized competency.
- **CO3: 3** (Strongly Related) – Using Excel for statistical computations demonstrates specialized skills.
- **CO4: 3** (Strongly Related) – Applying regression analysis showcases technical analytical abilities.

- **CO5: 3** (Strongly Related) – Summarizing data using statistical measures demonstrates specialized competencies.
- **CO6: 3** (Strongly Related) – Utilizing advanced features in Excel shows technical proficiency.
- **CO7: 3** (Strongly Related) – Managing and organizing datasets demonstrates specialized data management skills.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO3: 3** (Strongly Related) – Using Excel for probability and model sampling enhances problem-solving and analytical reasoning.
- **CO4: 3** (Strongly Related) – Regression analysis requires strong application and analytical reasoning skills.
- **CO5: 3** (Strongly Related) – Summarizing data involves problem-solving and analytical reasoning.
- **CO6: 2** (Moderately Related) – Advanced Excel features support analytical reasoning for data interpretation.
- **CO7: 3** (Strongly Related) – Managing real datasets involves practical application and problem-solving skills.

PO6: Communication Skills and Collaboration

- **CO1: 2** (Moderately Related) – Basic Excel skills aid in clear communication of data.
- **CO2: 2** (Moderately Related) – Formatting worksheets enhances the clarity of information presented.
- **CO4: 2** (Moderately Related) – Explaining regression results involves effective communication.
- **CO5: 3** (Strongly Related) – Summarizing data and creating charts and graphs is crucial for visual communication of complex data.
- **CO7: 2** (Moderately Related) – Managing datasets for projects often involves teamwork and collaboration.

PO7: Research-related Skills

- **CO3: 3** (Strongly Related) – Using Excel for probability computation is essential for research.
- **CO4: 3** (Strongly Related) – Regression analysis is a fundamental research methodology.

- **CO5: 3** (Strongly Related) – Summarizing data is essential for research analysis.
- **CO7: 3** (Strongly Related) – Managing real datasets is crucial for research data handling and analysis.

PO8: Learning How to Learn Skills

- **CO1: 2** (Moderately Related) – Learning Excel basics supports self-directed learning.
- **CO2: 2** (Moderately Related) – Learning to format worksheets enhances independent learning.
- **CO6: 2** (Moderately Related) – Exploring advanced features promotes continuous learning.
- **CO7: 3** (Strongly Related) – Managing datasets through projects encourages learning by doing.

PO9: Digital and Technological Skills

- **CO1: 3** (Strongly Related) – Excel proficiency is a key digital skill.
- **CO2: 3** (Strongly Related) – Creating and formatting worksheets involves essential digital skills.
- **CO3: 3** (Strongly Related) – Using Excel for probability computations demonstrates technological proficiency.
- **CO4: 3** (Strongly Related) – Regression analysis in Excel is a crucial digital skill.
- **CO5: 3** (Strongly Related) – Summarizing data in Excel is essential for digital data presentation.
- **CO6: 3** (Strongly Related) – Advanced Excel features are vital for digital data management.
- **CO7: 3** (Strongly Related) – Managing real datasets in Excel demonstrates advanced digital skills.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **Not directly related** to any specific COs.

PO11: Value Inculcation and Environmental Awareness

- **Not directly related** to any specific COs.

PO12: Autonomy, Responsibility, and Accountability

- **CO2: 2** (Moderately Related) – Creating and formatting worksheets requires responsibility and attention to detail.
- **CO6: 2** (Moderately Related) – Using advanced Excel features involves taking responsibility for data accuracy.
- **CO7: 2** (Moderately Related) – Managing real datasets involves accountability for data integrity.

PO13: Community Engagement and Service

- **Not directly related** to any specific COs.