Course Structure for F.Y.B.Com. Statistics
As per NEP 2.0 (2024 Pattern)

Sem.	Course Type	Course Code	Course Name	Theory / Practical	Credits
I	DSC-III (General)	COMBS-101-GEN	Business Statistics-I	Theory	04
I	Skill Enhancement Course (SEC)	COMBS-104-SEC	Business Statistics-I (Practical)	Practical	02
II	DSC-III (General)	COMBS-151-GEN	Business Statistics-II	Theory	04
II	Skill Enhancement Course (SEC)	COMBS-154-SEC	Business Statistics-II (Practical)	Practical	02

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

Name of the Programme	**:** B.Com.
B.Com Program Code	**:** UCBS
Class	**:** F.Y.B.Com
Semester	**:** I
Course Type	**:** DSC-III (General)
Course Name	**:** Business Statistics-I
Course Code	**:** COMBS-101-GEN
No. of Credits	**:** 4 credits
No. of Teaching Hours	**:** 60

Course Objectives:

1. The course aims to provide students with a solid understanding of the basic concepts, principles, and terminology used in 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. Acquire knowledge about the job sequencing.

Course Outcomes:

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

CO1. demonstrate statistical concepts and utilities it in real data analysis.

CO2. organize and summarize data using appropriate statistical measures. create and interpret data graphically.

CO3. apply statistical concepts and techniques to real-world scenarios and different disciplines.

CO4. familiar with various sampling techniques, their advantages, disadvantages, and applications.

CO5. understand the practical applications of statistical tools in various fields and be able to apply statistical methods to real-world problems.

CO6. cultivate critical thinking skills related to data analysis and interpretation.

CO7. understand the practical applications of job sequencing in real world.

Topics and Learning Points

Unit – 1 : Population and Sample (7 L)

Definition of Statistics, Scope of Statistics in Economics, Management Science and industry. Concept of population and sample with illustration. Methods of sampling –SRSWR, SRSWOR, Stratified, Systematic, (Description of sampling procedures only).

Unit –2 : Data condensation and representation (8 L)

Data: quantitative and qualitative, attributes, variables, scales of measurement: nominal, ordinal, interval and ratio. Classification of data, frequency distribution, cumulative frequency distribution, Graphical representations: Histogram, frequency polygon, frequency curve, ogive curves. Diagrammatical representations: simple, multiple, subdivided bar diagrams, stem-leaf chart and pie diagram, Examples and problems.

Unit – 3 : Measures of Central Tendency (12 L)

Mean median and mode for ungrouped and grouped data. Geometric mean: definition, merits and demerits. Harmonic mean: definition, merits and demerits. Choice of A.M., G.M. and H.M. Examples and problems.

Unit – 4 : Measures of Dispersion (10 L)

Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD Measures of relative dispersion: Coefficient of range, coefficient of variation.

Unit – 5 : Job Sequencing (8 L)

Introduction to Sequencing, Sequencing Problems, Solution to Sequencing Problem -Processing n-jobs through one machine, processing n-jobs through two machines. Example to determine the sequencing and total time required. Also, to find idle time of the machine.

Unit 6: Matrices and Determinants (up to order 3 only) (15 L)

Multivariable data, Definition of a Matrix, Types of Matrices, Algebra of Matrices, Determinants, Adjoint of a Matrix, Inverse of a Matrix via adjoint Matrix, Homogeneous System of Linear equations, Condition for Consistency of homogeneous system, Solution of Non-homogeneous System of Linear equations (not more than three variables). Problems.

References:

1. Goon A. M., Gupta, M. K. and Dasgupta, B. (1986): Fundamentals of Statistics, Vol. 2, World Press, Calcutta.

2. Goon, Gupta and Dasgupta, Fundamentals of Statistics, The world press private ltd, Kolkata.

3. Gupta S. C. and Kapoor V. K. (1987): Fundamentals of Applied Statistics, S. Chand and Sons, New Delhi.

4. Gupta S. C. and Kapoor V. K.: Fundamentals of Mathematical Statistic, Sultan Chand and Sons, Daryaganj, New Delhi 110002.

5. Gupta S. P.: Statistical Methods, Sultan Chand and Sons, 23, Daryaganj, New Delhi 110002.

6. Mukhopadhya Parimal (1999): Applied Statistics, New Central Book Agency, Pvt. Ltd. Calcutta.

7. S.C. Gupta, Fundamentals of Statistics, Sultan Chand & Sons, Delhi.

8. Sancheti and Kapoor, Statistics, Sultan Chand & Sons, Delhi

9. V. K. Kapoor, Business Mathematics, Sultan Chand & Sons, Delhi.

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	3	3	2	3	2	3				
CO2	3	3	2	3	3	3	3	2	3			2	
CO3	3	3	3	3	3	2	3	2	3	2			
CO4	2	2	2	3	3	2	3	2	3			2	
CO5	3	3	3	3	3	2	3	2	3				
CO6	3	2	2	3	3	2	3	3	3			2	
CO7	2	2	2	2	3	2	2	2	3	2		3	

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) – Demonstrating statistical concepts and using them in real data analysis contributes to a profound understanding of the field.

- **CO2: 3** (Strongly Related) – Organizing, summarizing, and interpreting data requires foundational statistical theories and concepts.
- **CO3: 3** (Strongly Related) – Applying statistical concepts to real-world scenarios reflects comprehensive knowledge and understanding.
- **CO4: 2** (Moderately Related) – Understanding various sampling techniques involves foundational methodological knowledge.
- **CO5: 3** (Strongly Related) – Practical applications of statistical tools in various fields require deep understanding.
- **CO6: 3** (Strongly Related) – Critical thinking in data analysis is built on foundational statistical principles.
- **CO7: 2** (Moderately Related) – Practical applications of job sequencing require understanding relevant methodologies and concepts.

PO2: Practical, Professional, and Procedural Knowledge
- **CO1: 2** (Moderately Related) – Using statistical concepts in real data analysis is a practical skill.
- **CO2: 3** (Strongly Related) – Organizing and summarizing data using statistical measures is essential for professional tasks.
- **CO3: 3** (Strongly Related) – Applying statistical concepts to real-world scenarios demonstrates practical knowledge.
- **CO4: 2** (Moderately Related) – Knowledge of sampling techniques is practical and procedural.
- **CO5: 3** (Strongly Related) – Applying statistical methods to real-world problems is essential for professional competence.
- **CO6: 2** (Moderately Related) – Critical thinking in data analysis supports practical decision-making.
- **CO7: 2** (Moderately Related) – Job sequencing in real-world applications is a practical skill.

PO3: Entrepreneurial Mindset and Knowledge
- **CO1: 1** (Partially Related) – Statistical analysis can help identify business opportunities.
- **CO2: 2** (Moderately Related) – Summarizing data graphically can aid in business presentations and decision-making.
- **CO3: 3** (Strongly Related) – Applying statistical concepts to various disciplines can foster innovation.
- **CO4: 2** (Moderately Related) – Understanding sampling techniques helps in market research.

- **CO5: 3** (Strongly Related) – Applying statistical tools in different fields can support entrepreneurial ventures.
- **CO6: 2** (Moderately Related) – Critical thinking in data analysis is valuable for entrepreneurial decision-making.
- **CO7: 2** (Moderately Related) – Job sequencing can be useful in managing entrepreneurial projects.

PO4: Specialized Skills and Competencies

- **CO1: 3** (Strongly Related) – Statistical data analysis is a specialized skill.
- **CO2: 3** (Strongly Related) – Organizing and summarizing data using statistical measures demonstrates specialized competencies.
- **CO3: 3** (Strongly Related) – Applying statistical concepts showcases technical proficiency.
- **CO4: 3** (Strongly Related) – Understanding and applying sampling techniques demonstrates specialized knowledge.
- **CO5: 3** (Strongly Related) – Applying statistical methods in various fields shows technical skills.
- **CO6: 3** (Strongly Related) – Critical thinking in data analysis is a specialized competency.
- **CO7: 2** (Moderately Related) – Practical applications of job sequencing involve specialized knowledge.

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

- **CO1: 3** (Strongly Related) – Applying statistical concepts to data analysis enhances problem-solving skills.
- **CO2: 3** (Strongly Related) – Summarizing and interpreting data requires analytical reasoning.
- **CO3: 3** (Strongly Related) – Applying statistical techniques to real-world scenarios involves problem-solving.
- **CO4: 3** (Strongly Related) – Understanding sampling techniques aids in problem-solving and analysis.
- **CO5: 3** (Strongly Related) – Practical application of statistical tools requires problem-solving skills.
- **CO6: 3** (Strongly Related) – Critical thinking in data analysis enhances analytical reasoning.
- **CO7: 3** (Strongly Related) – Job sequencing applications involve analytical problem-solving.

PO6: Communication Skills and Collaboration

- **CO1: 2** (Moderately Related) – Statistical data analysis aids in communicating complex information.
- **CO2: 3** (Strongly Related) – Summarizing data graphically is crucial for effective communication.
- **CO3: 2** (Moderately Related) – Applying statistical concepts in various scenarios can improve collaborative efforts.
- **CO5: 2** (Moderately Related) – Applying statistical methods requires clear communication.
- **CO6: 2** (Moderately Related) – Critical thinking skills in data analysis can enhance collaborative problem-solving.
- **CO7: 2** (Moderately Related) – Practical applications of job sequencing can improve teamwork and communication.

PO7: Research-related Skills

- **CO1: 3** (Strongly Related) – Statistical data analysis is fundamental for research.
- **CO2: 3** (Strongly Related) – Summarizing data is essential for research reporting.
- **CO3: 3** (Strongly Related) – Applying statistical concepts to real-world scenarios supports research activities.
- **CO4: 3** (Strongly Related) – Understanding sampling techniques is crucial for research methodology.
- **CO5: 3** (Strongly Related) – Applying statistical tools in various fields supports research.
- **CO6: 3** (Strongly Related) – Critical thinking in data analysis is essential for research interpretation.
- **CO7: 2** (Moderately Related) – Job sequencing can be applied in research project management.

PO8: Learning How to Learn Skills

- **CO1: 2** (Moderately Related) – Learning statistical analysis supports self-directed learning.
- **CO2: 2** (Moderately Related) – Learning to summarize and interpret data promotes independent learning.
- **CO3: 2** (Moderately Related) – Applying statistical concepts fosters continuous learning.
- **CO4: 2** (Moderately Related) – Understanding sampling techniques supports learning new methodologies.
- **CO5: 2** (Moderately Related) – Applying statistical tools encourages ongoing learning.
- **CO6: 3** (Strongly Related) – Critical thinking in data analysis supports lifelong learning skills.

- **CO7: 2** (Moderately Related) – Job sequencing applications promote independent problem-solving and learning.

PO9: Digital and Technological Skills

- **CO1: 3** (Strongly Related) – Statistical data analysis often involves using digital tools.
- **CO2: 3** (Strongly Related) – Organizing and summarizing data requires proficiency in digital tools.
- **CO3: 3** (Strongly Related) – Applying statistical concepts often involves digital technologies.
- **CO4: 3** (Strongly Related) – Understanding sampling techniques can involve digital tools for data collection.
- **CO5: 3** (Strongly Related) – Applying statistical methods often requires digital competencies.
- **CO6: 3** (Strongly Related) – Critical thinking in data analysis is enhanced by using digital tools.
- **CO7: 3** (Strongly Related) – Job sequencing can involve using digital project management tools.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO3: 2** (Moderately Related) – Applying statistical concepts to different disciplines can involve understanding diverse contexts.
- **CO7: 2** (Moderately Related) – Job sequencing in real-world scenarios can involve working in multicultural teams.

PO11: Value Inculcation and Environmental Awareness

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

PO12: Autonomy, Responsibility, and Accountability

- **CO2: 2** (Moderately Related) – Summarizing data requires responsibility for accuracy.
- **CO4: 2** (Moderately Related) – Understanding sampling techniques involves accountability for data collection.
- **CO6: 2** (Moderately Related) – Critical thinking in data analysis promotes responsible decision-making.
- **CO7: 3** (Strongly Related) – Job sequencing applications require accountability in project management.

PO13: Community Engagement and Service

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

CBCS Syllabus as per NEP 2.0 for F.Y.B.Com. Statistics (2024 Pattern)	
Name of the Programme	: B.Com.
Programme Code	: UCBS
Class	: F.Y.B.Com.
Semester	: I
Course Type	: SEC Practical
Course Code	: COMBS-104-SEC
Course Title	: Business Statistics-I (Practical)
No. of Credits	: 02
No. of Teaching Hours	: 30

Course Objectives:

1) Students will develop a strong foundation to analyze and interpret data in various fields.

2) Compute various measures of central tendency and dispersion.

3) Summarize data using frequency distributions and graphical representations.

4) Acquire proficiency in calculating and interpreting various quantiles.

5) Understand the concept of sample spaces, events, probability, conditional probability including Bayes' theorem and independence of events.

6) Calculating and interpreting measures of central tendency (mean, median, mode) and dispersion (variance, standard deviation) for discrete random variables.

7) Computation of probabilities to solve real-world problems.

Course Outcome:

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

CO1. understand the fundamental concepts of descriptive statistics, including measures of central tendency and measures of dispersion.

CO2. utilize appropriate graphical representations and descriptive statistics measures to present and interpret data.

CO3. utilize probability and discrete probability distributions to solve practical problems.

CO4. utilize probability distributions to calculate probabilities of outcomes.

CO5. to perform data analysis, generate summary statistics, and visualize data by using R software.

CO6. apply critical thinking and problem-solving skills to real-world scenarios by effectively applying descriptive statistics and probability concepts.

CO7. apply knowledge and skills gained from the course to solve practical problems and make informed decisions.

Sr. No.	Title of Experiment
1	Use of Random Number Tables to Draw SRSWOR, SRSWR, Stratified Sample and Systematic Sample
2	Diagrammatic Representation of Statistical Data (Simple and Subdivided Bar Diagrams, Multiple Bar Diagram, Percentage Bar Diagram, Pie Diagram)
3	Graphical Representation of Statistical Data (Histogram, Frequency Curve and Ogive Curves, Determination of Mode and Median Graphically)
4	Measures of Central Tendency
5	Measures of Dispersion
6	Job Sequencing
7	Matrices and Determinants

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				3			2					
CO2	2	3		3	2	2			2				
CO3	2		2		3		2						
CO4	2				3		2						
CO5		3		3	2		2	3	3			2	
CO6		2	2	3	3							2	
CO7					3	2							

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

PO1: Comprehensive Knowledge and Understanding

- **CO1: 3** (Strongly Related) – Fundamental concepts of descriptive statistics are essential for a deep understanding of foundational theories and principles in the field.

- **CO2: 2** (Moderately Related) – Presenting and interpreting data using descriptive statistics measures shows a broader understanding.
- **CO3: 2** (Moderately Related) – Understanding probability and discrete probability distributions contributes to a comprehensive knowledge base.
- **CO4: 2** (Moderately Related) – Utilizing probability distributions to calculate probabilities deepens foundational understanding.

PO2: Practical, Professional, and Procedural Knowledge

- **CO2: 3** (Strongly Related) – Utilizing graphical representations and descriptive statistics measures to present and interpret data is crucial for practical and professional tasks.
- **CO5: 3** (Strongly Related) – Performing data analysis and visualizing data using R software demonstrates practical skills essential for professional tasks.
- **CO6: 2** (Moderately Related) – Applying descriptive statistics and probability concepts in real-world scenarios shows practical application.

PO3: Entrepreneurial Mindset and Knowledge

- **CO3: 2** (Moderately Related) – Solving practical problems using probability distributions helps identify opportunities and foster innovation.
- **CO6: 2** (Moderately Related) – Critical thinking and problem-solving skills are essential for an entrepreneurial mindset.

PO4: Specialized Skills and Competencies

- **CO2: 3** (Strongly Related) – Utilizing appropriate graphical representations and descriptive statistics measures showcases specialized technical skills.
- **CO5: 3** (Strongly Related) – Data analysis, summary statistics generation, and data visualization using R software demonstrate specialized competencies.
- **CO6: 3** (Strongly Related) – Applying critical thinking and problem-solving skills to real-world scenarios shows specialized skills.

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

- **CO1: 3** (Strongly Related) – Understanding fundamental concepts is necessary for applying learned concepts in practical settings.
- **CO3: 3** (Strongly Related) – Solving practical problems using probability distributions demonstrates strong problem-solving and analytical reasoning.
- **CO6: 3** (Strongly Related) – Applying descriptive statistics and probability concepts to real-world scenarios shows high capacity for application and problem-solving.

PO6: Communication Skills and Collaboration

- **CO2: 2** (Moderately Related) – Presenting and interpreting data effectively requires strong communication skills.
- **CO7: 2** (Moderately Related) – Solving practical problems and making informed decisions involve communicating results clearly.

PO7: Research-related Skills

- **CO3: 2** (Moderately Related) – Utilizing probability distributions for practical problems involves research-related skills.
- **CO5: 2** (Moderately Related) – Performing data analysis and generating summary statistics demonstrates research competencies.

PO8: Learning How to Learn Skills

- **CO1: 2** (Moderately Related) – Understanding fundamental concepts promotes continuous learning.
- **CO5: 3** (Strongly Related) – Learning to use R software for data analysis and visualization is an essential skill for self-directed learning.

PO9: Digital and Technological Skills

- **CO2: 2** (Moderately Related) – Using appropriate graphical representations involves digital skills.
- **CO5: 3** (Strongly Related) – Performing data analysis and visualization using R software demonstrates strong digital and technological proficiency.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO7: 1** (Partially Related) – Making informed decisions can involve considering diverse perspectives.

PO11: Value Inculcation and Environmental Awareness

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

PO12: Autonomy, Responsibility, and Accountability

- **CO5: 2** (Moderately Related) – Performing data analysis independently shows autonomy and responsibility.
- **CO6: 2** (Moderately Related) – Applying critical thinking and problem-solving skills demonstrates accountability.

PO13: Community Engagement and Service

- **CO7: 1** (Partially Related) – Applying knowledge to solve practical problems can support community projects.

Name of the Programme	: B.Com.
B.Com Program Code	: UCBS
Class	: F.Y.B.Com.
Semester	: II
Course Type	: DSC-III (General)
Course Name	: Business Statistics – II
Course Code	: COMBS-151-GEN
No. of Credits	: 4 credits
No. of Teaching Hours	: 60

Course Objectives:

1. To compute moments, various measures of skewness and kurtosis.

2. To understand theory of probability and its applications in real life problems.

3. To compute and interpret with various types of Index numbers.

4. To make aware the students about the applications of various forms of Linear programming problems.

5. To understand the concept of sample spaces, events, probability, conditional probability including Bayes' theorem and independence of events.

6. To understand the basic concepts of correlation and regression analysis, ensuring they can differentiate between these statistical techniques.

7. To computation of correlation coefficients, Regression coefficients and their interpretation.

Course Outcomes:

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

CO1. compute the correlation coefficient for bivariate data and interpret it.

CO2. understand the basic concept of linear regression and fit linear regression model to the bivariate data, interpretation of coefficients, and prediction of outcomes.

CO3. random experiment, the difference between deterministic and nondeterministic experiments, sample space, an event, probability of an event, and the conditional probability of an event.

CO4. apply correlation and regression in real life .

CO5. judge economy with the help of Index numbers.

CO6. handle problems involving maximizing the profit and minimizing the cost with linear

constraints.

CO7. apply the techniques of LPP to solve real world problems.

Unit 1: Moment, Skewness and Kurtosis (11 L)

Concept of Raw and central moments: Formulae for ungrouped and grouped data (only first four moments), the relation between central and raw moments up to fourth order. (Without proof), Measures of Skewness: Types of skewness, Pearson's and Bowley's coefficient of skewness, Measure of skewness based on moments. Measure of Kurtosis: Types of kurtosis, Measure of kurtosis based on moments.

Unit 2: Sample Space, Events and Probability (12 L)

Permutations of 'n' dissimilar objects taken 'r' at a time (with or without repetition) $^{n}P_r = \frac{n!}{(n-r)!}$ (without proof). Combinations of 'r' objects taken from 'n' objects $^{n}C_r = \frac{n!}{r!\,(n-r)!}$ (Without proof) problems, Experiments and random experiments. Ideas of deterministic and nondeterministic experiments. Definition of – sample space, discrete sample space, events. Types of events, Union and intersections of two or more events, mutually exclusive events. Complementary event, Exhaustive event. Simple examples, Classical definition of probability, Addition theorem of probability without proof (upto three events are expected). Definition of Conditional probability Definition of independence of two events simple numerical problems.

Unit 3: Correlation and Regression (12 L)

Concept and type of correlation scatter diagram, interpretation with respect to magnitude and direction of relationship. Karl Pearson's coefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. Concept of regression. Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof).

Unit 4: Index numbers (10 L)

Concept of index number, price index number, price relatives. Problems in construction of index number. Construction of price index number: Weighted index Number, Laspeyre's, Paasche's and Fishers method. Cost of living / consumer price index number: Definition and problems in construction. Methods of construction: Family budget and aggregate expenditure. Inflation Uses of index numbers, commonly used index numbers.

Unit 5: Linear Programming Problems (LPP)   (15 L)

Statement of the linear Programming Problem (LPP), (minimization and maximization). Formulation of problem as LPP. Solution of L.P.P. by Graphical method. Definition of (i) A slack variable and (ii) Surplus Variable, (iii) a solution (iv) basic and non-basic variables (v) a feasible solution (vi) a basic feasible solution, and (vii) an optimal solution. Solution of L.P.P by Simplex Method: Obtaining Initial Basic Feasible Solution (IBFS), criteria for deciding whether obtained solution is optimal.

References:

1. Gupta S. C. and Kapoor V. K.: Fundamentals of Mathematical Statistic, Sultan Chand and Sons, 23, Daryaganj, New Delhi 110002.

2. Gupta S. P.: Statistical Methods, Sultan Chand and Sons, 23, Daryaganj, New Delhi 110002.

3. Mukhopadhya Parimal (1999): Applied Statistics, New Central Book Agency, Pvt. Ltd. Calcutta. 11.

4. Goon A. M., Gupta, M. K. and Dasgupta, B. (1986): Fundamentals of Statistics, Vol. 2, World Press, Calcutta.

5. Gupta S. C. and Kapoor V. K. (1987): Fundamentals of Applied Statistics, S. Chand and Sons, New Delhi.

6. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye: Probability & Statistics for Engineers & Scientists

7. Moore D. S., Norz W. I, Flinger M. A., (2013), The Basic Practice of Statistics, Sith Edition, Freeman and Company New York

8. Brase C.H. and Brase C. P, (2018), Understandable Statistics, Twelfth Edition, Cengage Learning

9. Biston Feedman D., Pisani R., Purves R. (2007), Statistics, Fourth Edition, W. W. Nortan and Company, New York.

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	3	3	2	3	2	2				
CO2	3	3	2	3	3	2	3	2	2			2	
CO3	3	2	2	3	3		3	2	2	1			
CO4	3	3	2	3	3	2	3	2	2	1		2	
CO5	2	3	2	3	3	2	3	2	2				
CO6	3	3	2	3	3	2	3	2	3		2	2	
CO7	3	3	3	3	3	2	3	2	3	2		3	

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) – Computing and interpreting the correlation coefficient involves understanding foundational statistical theories and principles.

- **CO2: 3** (Strongly Related) – Understanding linear regression and interpreting its coefficients require a deep understanding of statistical concepts.

- **CO3: 3** (Strongly Related) – Understanding probability, sample space, and events involves foundational knowledge in statistics.

- **CO4: 3** (Strongly Related) – Applying correlation and regression in real life reflects comprehensive understanding.

- **CO5: 2** (Moderately Related) – Judging economy using index numbers involves understanding key concepts and methodologies in economics.

- **CO6: 3** (Strongly Related) – Handling optimization problems requires understanding of linear programming principles.

- **CO7: 3** (Strongly Related) – Applying LPP techniques to solve real-world problems demonstrates deep understanding of these concepts.

PO2: Practical, Professional, and Procedural Knowledge

- **CO1: 2** (Moderately Related) – Computing the correlation coefficient has practical applications in data analysis.

- **CO2: 3** (Strongly Related) – Fitting and interpreting linear regression models is essential for professional statistical tasks.
- **CO3: 2** (Moderately Related) – Understanding and applying probability concepts has practical relevance.
- **CO4: 3** (Strongly Related) – Applying correlation and regression to real-life scenarios demonstrates practical knowledge.
- **CO5: 3** (Strongly Related) – Using index numbers to judge economy is a practical and professional skill in economics.
- **CO6: 3** (Strongly Related) – Solving optimization problems is essential in various professional contexts.
- **CO7: 3** (Strongly Related) – Applying LPP techniques to real-world problems shows practical and professional competence.

PO3: Entrepreneurial Mindset and Knowledge

- **CO1: 1** (Partially Related) – Statistical analysis can help identify business opportunities.
- **CO2: 2** (Moderately Related) – Linear regression models can be used in market analysis and business predictions.
- **CO4: 2** (Moderately Related) – Applying statistical techniques in real-life scenarios can foster innovation.
- **CO5: 2** (Moderately Related) – Using index numbers to judge economic conditions can aid in business decision-making.
- **CO6: 2** (Moderately Related) – Optimization techniques are useful in resource management and business planning.
- **CO7: 3** (Strongly Related) – LPP techniques are valuable for entrepreneurial decision-making and business strategy.

PO4: Specialized Skills and Competencies

- **CO1: 3** (Strongly Related) – Computing correlation coefficients requires specialized statistical skills.
- **CO2: 3** (Strongly Related) – Fitting and interpreting regression models demonstrates technical proficiency.
- **CO3: 3** (Strongly Related) – Understanding probability concepts involves specialized statistical knowledge.

- **CO4: 3** (Strongly Related) – Applying statistical techniques shows technical and analytical proficiency.
- **CO5: 3** (Strongly Related) – Using index numbers demonstrates specialized skills in economic analysis.
- **CO6: 3** (Strongly Related) – Solving optimization problems requires specialized competencies.
- **CO7: 3** (Strongly Related) – Applying LPP techniques demonstrates proficiency in optimization methods.

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

- **CO1: 3** (Strongly Related) – Applying correlation analysis involves problem-solving and analytical reasoning.
- **CO2: 3** (Strongly Related) – Interpreting regression models requires analytical reasoning.
- **CO3: 3** (Strongly Related) – Understanding and applying probability concepts involves problem-solving skills.
- **CO4: 3** (Strongly Related) – Using statistical techniques in real-life scenarios involves problem-solving.
- **CO5: 3** (Strongly Related) – Judging economy using index numbers involves analytical reasoning.
- **CO6: 3** (Strongly Related) – Solving optimization problems demonstrates problem-solving and analytical skills.
- **CO7: 3** (Strongly Related) – Applying LPP techniques involves analytical problem-solving.

PO6: Communication Skills and Collaboration

- **CO1: 2** (Moderately Related) – Interpreting correlation coefficients can aid in communicating data analysis results.
- **CO2: 2** (Moderately Related) – Explaining regression models requires clear communication.
- **CO4: 2** (Moderately Related) – Applying statistical techniques involves communicating findings.
- **CO5: 2** (Moderately Related) – Presenting economic analysis using index numbers requires effective communication.
- **CO6: 2** (Moderately Related) – Explaining optimization problems and solutions involves clear communication.

- **CO7: 2** (Moderately Related) – Communicating LPP techniques and solutions requires collaboration and clear communication.

PO7: Research-related Skills

- **CO1: 3** (Strongly Related) – Correlation analysis is fundamental in research methodologies.
- **CO2: 3** (Strongly Related) – Regression analysis is a key research technique.
- **CO3: 3** (Strongly Related) – Probability concepts are essential for research design and analysis.
- **CO4: 3** (Strongly Related) – Applying statistical techniques is critical in research contexts.
- **CO5: 3** (Strongly Related) – Using index numbers is important for economic research.
- **CO6: 3** (Strongly Related) – Optimization techniques are valuable for research in various fields.
- **CO7: 3** (Strongly Related) – Applying LPP techniques is essential in research for solving complex problems.

PO8: Learning How to Learn Skills

- **CO1: 2** (Moderately Related) – Learning to compute and interpret correlation coefficients supports independent learning.
- **CO2: 2** (Moderately Related) – Understanding regression models fosters continuous learning.
- **CO3: 2** (Moderately Related) – Learning probability concepts supports ongoing education.
- **CO4: 2** (Moderately Related) – Applying statistical techniques encourages lifelong learning.
- **CO5: 2** (Moderately Related) – Understanding and using index numbers promotes independent learning.
- **CO6: 2** (Moderately Related) – Solving optimization problems supports learning how to learn.
- **CO7: 2** (Moderately Related) – Applying LPP techniques fosters continuous education and self-learning.

PO9: Digital and Technological Skills

- **CO1: 2** (Moderately Related) – Computing correlation coefficients often involves using statistical software.
- **CO2: 2** (Moderately Related) – Fitting regression models requires proficiency with digital tools.
- **CO3: 2** (Moderately Related) – Probability analysis can involve digital technologies.
- **CO4: 2** (Moderately Related) – Applying statistical techniques involves using digital tools.
- **CO5: 2** (Moderately Related) – Using index numbers can involve digital data analysis.
- **CO6: 3** (Strongly Related) – Optimization problems often require digital tools.
- **CO7: 3** (Strongly Related) – Applying LPP techniques involves using digital technologies.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO3: 1** (Partially Related) – Understanding probability concepts can involve diverse perspectives in data interpretation.
- **CO4: 1** (Partially Related) – Applying statistical techniques in diverse contexts can involve multicultural understanding.
- **CO7: 2** (Moderately Related) – LPP techniques can be applied in diverse cultural contexts, promoting inclusive solutions.

PO11: Value Inculcation and Environmental Awareness

- **CO6: 2** (Moderately Related) – Optimization techniques can be used to promote sustainable solutions and resource management.

PO12: Autonomy, Responsibility, and Accountability

- **CO2: 2** (Moderately Related) – Fitting and interpreting regression models requires responsibility for accuracy.
- **CO4: 2** (Moderately Related) – Applying statistical techniques involves accountability for results.
- **CO6: 2** (Moderately Related) – Solving optimization problems requires autonomy and responsibility.
- **CO7: 3** (Strongly Related) – Applying LPP techniques requires accountability and independent decision-making.

PO13: Community Engagement and Service

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

Name of the Programme	: B.Com.	
Program Code	**: UCBS**	
Class	: F.Y.B.Com.	
Semester	: II	
Course Type	: SEC Practical	
Course Name	: Business Statistics – II (Practical)	
Course Code	: COMBS-154-SEC	
No. of Credits	: 2 credits	
No. of Teaching Hours	: 30	

Course Objectives:

1. To compute various measures of moments, skewness and kurtosis.

2. To computation of probabilities in case of nondeterministic experiments.

3. To find the probabilities of various events.

4. To introduce basic concepts, formulas, functions, and tools within Excel, enabling students to create, edit, format, and analyze data and perform calculations.

5. To acquire knowledge about the skewness and kurtosis.

6. To understand the concept of Index number.

7. To find optimal solution of the LPP.

Course Outcomes:

Student will be able to

CO1. interpret the regression equation and predict the independent variable.

CO2. Understand the basic concept of linear regression and fit linear regression model to the bivariate data, interpretation of coefficients, and prediction of outcomes.

CO3. gain working knowledge of concept of index numbers.

CO4. formulate Linear programming Problem, and to obtain optimal solutions.

CO5. computation of probabilities in case of nondeterministic experiments

CO6. Identify the decision variables, objective function, and constraints of the LPP.

CO7. apply the techniques of LPP to solve real world problems

List of Practicals:

Sr. No.	Title of Experiment
1.	Measures of Skewness and Kurtosis
2.	Problems on Simple Probability, Conditional Probability
3.	Problems on Independence of Event
4.	Linear correlation and regression (use of scatter plot for explaining the linear relationship between two variables)
5.	Index Number
6.	Linear Programming Problems (LPP) (Graphical Method)
7.	Linear Programming Problems (LPP) (Simplex Method)

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	3	1	3	3	2	3	2	2				
CO2	3	3	2	3	3	2	3	2	2			2	
CO3	3	2	2	3	3	2	3	2	2	1			
CO4	3	3	2	3	3	2	3	2	3	1	2	2	
CO5	3	2	1	3	3	2	3	2	2				
CO6	3	3	2	3	3	2	3	2	3		2	2	
CO7	3	3	3	3	3	2	3	2	3	2		3	

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) – Interpreting the regression equation and predicting variables require a profound understanding of statistical theories.
- **CO2: 3** (Strongly Related) – Understanding and fitting linear regression models involves foundational concepts in statistics.

- **CO3: 3** (Strongly Related) – Understanding index numbers involves key concepts in economics and statistics.
- **CO4: 3** (Strongly Related) – Formulating and solving LPPs involves foundational mathematical and optimization principles.
- **CO5: 3** (Strongly Related) – Computing probabilities involves deep understanding of probability theory.
- **CO6: 3** (Strongly Related) – Identifying components of LPPs involves comprehensive knowledge of linear programming.
- **CO7: 3** (Strongly Related) – Applying LPP techniques to solve real-world problems requires a strong grasp of optimization principles.

PO2: Practical, Professional, and Procedural Knowledge

- **CO1: 3** (Strongly Related) – Interpreting regression equations and making predictions are essential professional skills in data analysis.
- **CO2: 3** (Strongly Related) – Fitting and interpreting linear regression models is crucial for professional statistical tasks.
- **CO3: 2** (Moderately Related) – Understanding index numbers has practical applications in economic analysis.
- **CO4: 3** (Strongly Related) – Formulating and solving LPPs is essential in various professional fields.
- **CO5: 2** (Moderately Related) – Computing probabilities is important in various real-world scenarios.
- **CO6: 3** (Strongly Related) – Identifying components of LPPs is crucial for practical problem-solving.
- **CO7: 3** (Strongly Related) – Applying LPP techniques to solve real-world problems is a practical and professional skill.

PO3: Entrepreneurial Mindset and Knowledge

- **CO1: 1** (Partially Related) – Understanding regression analysis can help identify business opportunities.
- **CO2: 2** (Moderately Related) – Linear regression models can be used in market analysis and business predictions.

- **CO3: 2** (Moderately Related) – Index numbers are useful for economic decision-making and business planning.
- **CO4: 2** (Moderately Related) – Formulating and solving LPPs can help optimize business operations.
- **CO5: 1** (Partially Related) – Probability computation can aid in risk management.
- **CO6: 2** (Moderately Related) – Identifying components of LPPs can help in strategic business decisions.
- **CO7: 3** (Strongly Related) – Applying LPP techniques is valuable for entrepreneurial decision-making.

PO4: Specialized Skills and Competencies

- **CO1: 3** (Strongly Related) – Interpreting regression equations requires specialized statistical skills.
- **CO2: 3** (Strongly Related) – Fitting and interpreting regression models demonstrates technical proficiency.
- **CO3: 3** (Strongly Related) – Understanding index numbers involves specialized economic skills.
- **CO4: 3** (Strongly Related) – Formulating and solving LPPs requires specialized mathematical skills.
- **CO5: 3** (Strongly Related) – Computing probabilities involves specialized statistical knowledge.
- **CO6: 3** (Strongly Related) – Identifying components of LPPs demonstrates specialized skills.
- **CO7: 3** (Strongly Related) – Applying LPP techniques shows proficiency in optimization methods.

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

- **CO1: 3** (Strongly Related) – Applying regression analysis involves problem-solving and analytical reasoning.
- **CO2: 3** (Strongly Related) – Interpreting regression models requires analytical reasoning.
- **CO3: 3** (Strongly Related) – Understanding and applying index numbers involves problem-solving skills.
- **CO4: 3** (Strongly Related) – Solving LPPs demonstrates problem-solving and analytical skills.
- **CO5: 3** (Strongly Related) – Computing probabilities involves analytical reasoning.
- **CO6: 3** (Strongly Related) – Identifying components of LPPs involves problem-solving.
- **CO7: 3** (Strongly Related) – Applying LPP techniques involves analytical problem-solving.

PO6: Communication Skills and Collaboration

- **CO1: 2** (Moderately Related) – Interpreting regression results can aid in communicating data analysis findings.
- **CO2: 2** (Moderately Related) – Explaining regression models requires clear communication.
- **CO3: 2** (Moderately Related) – Presenting economic analysis using index numbers requires effective communication.
- **CO4: 2** (Moderately Related) – Explaining LPP formulations and solutions involves clear communication.
- **CO5: 2** (Moderately Related) – Communicating probability concepts requires clear communication.
- **CO6: 2** (Moderately Related) – Explaining LPP components requires collaboration and clear communication.
- **CO7: 2** (Moderately Related) – Communicating LPP solutions requires collaboration and clear communication.

PO7: Research-related Skills

- **CO1: 3** (Strongly Related) – Regression analysis is fundamental in research methodologies.
- **CO2: 3** (Strongly Related) – Linear regression is a key research technique.
- **CO3: 3** (Strongly Related) – Index numbers are important for economic research.
- **CO4: 3** (Strongly Related) – LPP formulation and solutions are valuable in research.
- **CO5: 3** (Strongly Related) – Probability computation is essential for research design and analysis.
- **CO6: 3** (Strongly Related) – Identifying LPP components is crucial for research in optimization.
- **CO7: 3** (Strongly Related) – Applying LPP techniques is essential in research.

PO8: Learning How to Learn Skills

- **CO1: 2** (Moderately Related) – Learning to interpret regression equations supports independent learning.
- **CO2: 2** (Moderately Related) – Understanding regression models fosters continuous learning.
- **CO3: 2** (Moderately Related) – Understanding index numbers promotes independent learning.
- **CO4: 2** (Moderately Related) – Solving LPPs supports learning how to learn.
- **CO5: 2** (Moderately Related) – Computing probabilities fosters continuous education.
- **CO6: 2** (Moderately Related) – Identifying LPP components supports independent learning.

- **CO7: 2** (Moderately Related) – Applying LPP techniques fosters self-learning.

PO9: Digital and Technological Skills

- **CO1: 2** (Moderately Related) – Interpreting regression equations often involves using statistical software.
- **CO2: 2** (Moderately Related) – Fitting regression models requires proficiency with digital tools.
- **CO3: 2** (Moderately Related) – Using index numbers can involve digital data analysis.
- **CO4: 3** (Strongly Related) – Solving LPPs often requires digital tools.
- **CO5: 2** (Moderately Related) – Computing probabilities can involve digital technologies.
- **CO6: 3** (Strongly Related) – Identifying LPP components often requires digital tools.
- **CO7: 3** (Strongly Related) – Applying LPP techniques involves using digital technologies.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO3: 1** (Partially Related) – Understanding index numbers can involve diverse perspectives.
- **CO4: 1** (Partially Related) – Applying LPP techniques in diverse contexts can involve multicultural understanding.
- **CO7: 2** (Moderately Related) – LPP techniques can be applied in diverse cultural contexts.

PO11: Value Inculcation and Environmental Awareness

- **CO4: 2** (Moderately Related) – LPP techniques can be used to promote sustainable solutions.
- **CO6: 2** (Moderately Related) – Identifying LPP components can aid in creating sustainable solutions.

PO12: Autonomy, Responsibility, and Accountability

- **CO2: 2** (Moderately Related) – Interpreting regression models requires responsibility for accuracy.
- **CO4: 2** (Moderately Related) – Solving LPPs involves autonomy and responsibility.
- **CO6: 2** (Moderately Related) – Identifying LPP components requires responsibility.
- **CO7: 3** (Strongly Related) – Applying LPP techniques involves accountability and independent decision-making.

PO13: Community Engagement and Service

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