Course Structure for T.Y.B.Sc. Statistics (CS) As per NEP 1.0 (2023 Pattern)

Sem.	Course Type	Course Code	Course Name	Theory / Practical	Credits
V	Minor	COS-311-MN(A)	Predictive Analytics	Theory	02
	Minor	COS-312-MN(A)	Practical based on Predictive Analytics	Practical	02
VI	Minor	COS-361-MN(A)	Machine Learning	Theory	02
	Minor	COS-362-MN(A)	Practical Based on Machine Learning	Practical	02

CBCS Syllabus as per NEP 2020 for B.Sc. Computer Science (2023 Pattern)

Name of the Programme	: B.Sc. Computer Science
Program Code	: COS
Class	: T.Y.B.Sc. (Computer Science)
Semester	: V
Course Type	: Minor (Theory)
Course Name	: Predictive Analytics
Course Code	: COS-311-MN (A)
No. of Credits	: 2
No. of Teaching Hours	: 30

Course Objectives:

Students successfully completing this course will be able to:

1. To understand the concepts of correlation, regression, and time series analysis and their applications.
2. To analyze relationships between variables using correlation techniques.
3. To learn and apply the least squares method for fitting linear, quadratic, and exponential models for predictive analytics.
4. To develop a strong foundation in regression modeling, including parameter estimation, residual analysis, and model evaluation.
5. To explore different time series components and apply appropriate smoothing and forecasting techniques.
6. To implement autoregressive models for real-world forecasting problems in finance, business, and environmental sciences.
7. To apply correlation, regression, and time series methods in Data Science applications like stock market prediction, sales forecasting, and anomaly detection.

Course Outcomes:

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

- **CO1.** Students will be able to compute and interpret correlation coefficients for understanding relationships in bivariate data.
- **CO2.** Students will be able to apply correlation techniques for feature selection, dimensionality reduction, and exploratory data analysis in machine learning.
- **CO3.** Students will be able to fit linear, quadratic, and exponential models using the least squares method for predictive analytics.
- **CO4.** Students will be able to estimate regression parameters, interpret coefficients, and validate models using residual analysis and R^2.
- **CO5.** Students will be able to analyze time series data, identify trends and seasonality, and apply appropriate smoothing techniques.
- **CO6.** Students will be able to implement autoregressive models and forecasting techniques for real-world time series applications.
- **CO7.** Students will be able to utilize statistical modeling techniques for data-driven decision-making across various domains in Data Science.

Topics and Learning Points

UNIT– 1 Correlation and Its Applications **(5L)**

Bivariate data, bivariate frequency distribution, Concept of correlation between two variables: positive correlation, negative correlation, no correlation, Importance of correlation in data science and machine learning, Interpretation of correlation in the context of feature selection and exploratory data analysis (EDA), Scatter diagram, interpretation of the type of correlation from a scatter diagram, Real-world applications of correlation in data-driven decision-making., Covariance between two variables: Definition, computation, the effect of change of origin and scale, Karl Pearson's coefficient of correlation (r): Definition, computation for ungrouped and grouped data, and interpretation.

Properties

(i) $-1 \leq r \leq 1$ (without proof).

(ii) Effect of change of origin and scale (without proof).

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, applications of correlation in Data Science

UNIT– 2 Regression Analysis **(12L)**

Understanding the concept of regression. Difference between regression and correlation. Concept of dependent (response) and independent (predictor) variables. Regression equation: $Y=\beta_0 + \beta_1 X+ \varepsilon$. Assumptions of simple linear regression. Estimation of Model Parameters. Concept of residuals, coefficient of determination R^2, Adjusted R^2. Hypothesis Testing in Simple Linear Regression: Testing for significance of regression coefficients, ANOVA for regression. Checking assumptions: Linearity, Homoscedasticity (constant variance of errors), and Normality of residuals. Introduction to multiple regression, Regression equation: $Y=\beta_0 + \beta_1 X_1+ \beta_2 X_2+ \beta_3 X_3+\ldots. \beta k X_k +\varepsilon$. Assumptions of simple linear regression. real-world applications. Non-linear regression: Second-degree curve $Y=a + bX + cX^2$, and exponential models $Y= ab^X$, $Y= aX^b$, Applications in predictive modeling

UNIT– 3 Logistic Regression **(05L)**

Understanding classification problems in data science Difference between linear and logistic regression. Concept of odds and log-odds, Logistic function and its interpretation. Applications of logistic regression in real-world scenarios. Extending logistic regression to multiple predictors. Evaluating model performance with classification metrics.

UNIT– 4 Time Series Analysis **(08L)**

Introduction, meaning, and importance of time series in Data Science, Definition, Components of Time Series: i) The Trend ii) Seasonal variation iii) Cyclical variation iv) Irregular variation, Additive and Multiplicative Model, Methods of trend estimation and smoothing: (i) moving average, (ii) curve fitting by least square principle, (iii) exponential smoothing.

References:

1. Gupta and Kapoor : Fundamentals of Mathematical Statistics, Sultan Chandand Sons, New Delhi.
2. Sharma K. V. S. (2001) Statistics made it simple: Do it yourself on PC. Prentce Hall of India, New Delhi.
3. Gupta S. C. and Kapoor V. K. (1987): Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
4. B. L. Agarwal : Programmed Statistics, New Age International Publishers, NewDelhi.
5. Gupta. S.P.: Statistical Methods,SultanChandandSons,23,Daryaganj,New Delhi
6. Mukhopadhyay Parimal(1999):Applied Statistics, New Central Book Agency, Pvt. Ltd. Calcutta.
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,(Brockwell, P.J.,& Davis, R.A.(2016).Introduction to Time Series and Forecasting. Springer

Programme Outcomes and Course Outcomes Mapping:

Course	Programme Outcomes(POs)												
Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	-	3	3	2	-	-	-	-	-	-	-
CO2	3	3	2	3	3	2	3	2	3	-	2	2	-
CO3	3	3	3	3	3	2	3	2	3	2	-	-	-
CO4	2	2	-	3	3	2	3	2	-	-	-	2	-
CO5	3	3	3	3	3	2	3	2	3	-	-	-	-
CO6	3	2	2	3	3	2	3	3	3	-	2	2	2
CO7	2	2	2	2	3	2	2	2	3	2	-	3	3

Justification:

PO1: Comprehensive Knowledge and Understanding

CO1 (3): Strong understanding of correlation is required.

CO2 (3): Feature selection and dimensionality reduction require statistical knowledge.

CO3 (3): Model fitting depends on theoretical knowledge.

CO4 (2): Estimating and interpreting regression parameters needs conceptual clarity.

CO5 (3): Time series analysis requires deep understanding.

CO6 (3): Implementing autoregressive models demands theoretical grounding.

CO7 (2): Statistical modeling relies on strong foundational knowledge.

PO2: Practical, Professional, and Procedural Knowledge

CO1 (2): Correlation computation is a practical skill.

CO2 (3): Applying correlation in ML is a procedural method.

CO3 (3): Model fitting follows structured statistical procedures.

CO4 (2): Regression estimation is a procedural technique.

CO5 (3): Time series analysis uses structured approaches.

CO6 (2): Forecasting techniques require applied knowledge.

CO7 (2): Statistical modeling is a professional skill.

PO3: Entrepreneurial Mindset and Knowledge

CO2 (2): Feature selection aids in ML-based innovations.

CO3 (3): Predictive analytics supports business decision-making.

CO5 (3): Identifying trends aids entrepreneurial strategy.

CO6 (2): Forecasting supports financial and market predictions.

CO7 (2): Data-driven decision-making is key for entrepreneurs.

PO4: Specialized Skills and Competencies

CO1 (3): Computing correlation is a key statistical skill.

CO2 (3): Feature selection techniques are specialized ML skills.

CO3 (3): Model fitting requires advanced expertise.

CO4 (3): Regression modeling requires strong analytical abilities.

CO5 (3): Time series analysis involves complex statistical techniques.

CO6 (3): Forecasting models demand expertise.

CO7 (2): Statistical modeling techniques are specialized competencies.

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

CO1 (3): Correlation interpretation helps in solving statistical problems.

CO2 (3): Applying correlation in ML aids in data-driven problem-solving.

CO3 (3): Model fitting requires analytical decision-making.

CO4 (3): Regression analysis is essential for predictive problem-solving.

CO5 (3): Time series analysis helps in understanding trends.

CO6 (3): Forecasting requires analytical reasoning.

CO7 (3): Statistical modeling supports problem-solving in data science.

PO6: Communication Skills and Collaboration

CO1 (2): Correlation interpretation requires clear explanation.

CO3 (2): Model fitting and results must be communicated effectively.

CO4 (2): Regression coefficients require proper explanation.

CO5 (2): Time series insights must be presented clearly.

CO6 (2): Forecasting outcomes require detailed communication.

CO7 (2): Statistical modeling findings need to be conveyed properly.

PO7: Research-related Skills

CO2 (3): Feature selection techniques are crucial in ML research.

CO3 (3): Model fitting is a research-based methodology.

CO4 (3): Regression estimation and interpretation are widely used in research.

CO5 (3): Time series analysis is applied in various research domains.

CO6 (3): Forecasting techniques contribute to academic research.

CO7 (2): Statistical modeling is extensively used in research work.

PO8: Learning How to Learn Skills

CO2 (2): ML techniques evolve, requiring continuous learning.

CO3 (2): Learning regression models improves adaptability.

CO4 (2): Regression analysis requires continuous learning and improvement.

CO5 (2): Understanding time series enhances learning adaptability.

CO6 (3): Forecasting models require updates with new data patterns.

CO7 (2): Statistical modeling involves continuous skill enhancement.

PO9: Digital and Technological Skills

CO2 (3): Feature selection techniques require ML tools.

CO3 (3): Model fitting uses statistical software.

CO5 (3): Time series analysis is done using programming tools like R and Python.

CO6 (3): Forecasting models require computational techniques.

CO7 (3): Statistical modeling relies on digital tools.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

CO3 (2): Predictive analytics can be used in diverse domains with cultural considerations.

CO7 (2): Data-driven decision-making must consider fairness and inclusivity.

PO11: Value Inculcation and Environmental Awareness

CO2 (2): Feature selection in environmental data analysis helps in sustainability.

CO6 (2): Forecasting can be applied to environmental studies.

PO12: Autonomy, Responsibility, and Accountability

CO2 (2): Feature selection requires ethical considerations.

CO4 (2): Regression model interpretation should be responsible.

CO6 (2): Forecasting models must ensure accountable decision-making.

CO7 (3): Statistical modeling decisions have real-world consequences.

PO13: Community Engagement and Service

CO6 (2): Forecasting can be used in public health and social research.

CO7 (3): Statistical modeling contributes to community-based decision-making.

CBCS Syllabus as per NEP 2020 for T.Y.B.Sc. (Computer Science) (2023 Pattern)

Name of the Programme	: B.Sc. Computer Science
Program Code	: COS
Class	: T.Y.B.Sc. (Computer Science)
Semester	: V
Course Type	: Minor Practical
Course Name	: Practical Based on Predictive Analytics
Course Code	: COS-312-MN(A)
No. of Credits	: 2
No. of Teaching Hours	: 60

Course Objectives:

Students successfully completing this course will be able to:

1) To introduce students to the basics of Python programming for data analysis.
2) To enable students to create effective visual representations of data using Matplotlib and Seaborn.
3) To understand and apply correlation techniques for measuring relationships

between variables.

4) To train students in performing simple and multiple linear regression analysis and interpreting residual plots.
5) To introduce curve fitting techniques for modeling real-world data patterns.
6) To provide knowledge of logistic regression for classification problems.
7) To equip students with time series analysis techniques for trend estimation and forecasting.

Course Outcomes:

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

CO.1 Demonstrate proficiency in Python programming for data analysis.

CO.2 Analyze relationships between variables using correlation techniques.

CO.3 Perform simple and multiple linear regression analysis and interpret diagnostic plots.

CO.4 Fit second-degree and exponential curves to real-world data.

CO.5 Implement logistic regression for binary classification problems.

CO.6 Utilize exponential smoothing techniques for improving time series predictions.

CO.7 Develop and present a case study integrating multiple data analysis techniques.

Topics and Learning Points

Sr. No.	Name of the Practicals	No. of practicals
1	Basic Python	1
2	Introduction to Numpy	1
3	Introduction to Pandas	1
4	Data visualization using matplotlib and seaborn libraries, Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot	2
5	Simple Correlation and multiple correlation	1
6	Simple Linear Regression Analysis and Diagnostics by Residual Plots	1
7	Multiple Linear Regression Analysis and Diagnostics by Residual Plots	1
8	Fitting of second degree curve, exponential curve of type $y = ab^x$, $y = ax^b$	1

9	Logistic Regression	1
10	Time Series- Estimation of trend by using the method of moving averages.	1
11	Time series: Estimation and forecasting of trend by fitting of AR (1) model, exponential smoothing.	1
12	Case Study	3

Programme Outcomes and Course Outcomes Mapping:

Course Outcomes	Programme Outcomes(POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PO12	PO13
CO1	3	3	2	3	3	2	3	2	3	-	-	-	-
CO2	3	3	2	3	3	-	3	2	3	-	-	2	-
CO3	3	3	3	3	3	2	3	2	3	2	-	-	-
CO4	3	2	2	3	3	-	3	2	3	-	-	2	-
CO5	3	3	3	3	3	2	3	-	3	-	-	-	-
CO6	3	2	2	3	3	-	3	3	3	-	2	2	-
CO7	3	3	3	3	3	3	3	3	3	7	2	3	3

Justification:

PO1: Comprehensive Knowledge and Understanding

CO1 (3): Python programming is fundamental for data science.

CO2 (3): Understanding correlation is a key statistical concept.

CO3 (3): Regression analysis is a core topic in analytics.

CO4 (3): Fitting curves requires a strong understanding of mathematical modeling.

CO5 (3): Logistic regression builds on probability and statistics.

CO6 (3): Exponential smoothing is crucial for time series forecasting.

CO7 (3): A case study requires integrating multiple knowledge areas.

PO2: Practical, Professional, and Procedural Knowledge

CO1 (3): Python is widely used in professional data analysis.

CO2 (3): Correlation is commonly applied in analytics projects.

CO3 (3): Regression techniques are used across industries.

CO4 (2): Curve fitting is useful in research and industry applications.

CO5 (3): Logistic regression is widely used in classification problems.

CO6 (2): Exponential smoothing is an essential forecasting tool.

CO7 (3): Case studies require practical knowledge of multiple techniques.

PO3: Entrepreneurial Mindset and Knowledge

CO1 (2): Python skills are valuable for tech startups.

CO2 (2): Correlation is useful for business analytics.

CO3 (3): Regression models support data-driven decision-making.

CO4 (2): Curve fitting is used in product development and forecasting.

CO5 (3): Logistic regression is crucial for business intelligence.

CO6 (2): Time series forecasting helps in financial planning.

CO7 (3): A case study integrates analytical techniques for real-world applications.

PO4: Specialized Skills and Competencies

CO1 (3): Python programming is a specialized technical skill.

CO2 (3): Advanced statistical analysis requires expertise.

CO3 (3): Regression analysis is a specialized skill in data science.

CO4 (3): Curve fitting techniques demand mathematical and computational skills.

CO5 (3): Logistic regression is fundamental in machine learning.

CO6 (3): Time series smoothing requires domain expertise.

CO7 (3): Case study development involves multiple specialized skills.

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

CO1 (3): Python is an essential tool for solving data-related problems.

CO2 (3): Correlation techniques help in problem-solving and pattern detection.

CO3 (3): Regression analysis is widely used for predictive analytics.

CO4 (3): Curve fitting is essential for engineering and business solutions.

CO5 (3): Logistic regression is used in real-world classification problems.

CO6 (3): Time series techniques are applied in demand forecasting.

CO7 (3): A case study requires strong problem-solving abilities.

PO6: Communication Skills and Collaboration

CO1 (2): Python programmers must effectively communicate their code and findings.

CO3 (2): Regression results must be interpreted and communicated clearly.

CO5 (2): Logistic regression findings are used in decision-making.

CO7 (3): Case study presentation develops communication skills.

PO7: Research-related Skills

CO1 (3): Python is widely used in data science research.

CO2 (3): Correlation is crucial for statistical research.

CO3 (3): Regression analysis is extensively used in research papers.

CO4 (3): Curve fitting is common in experimental research.

CO5 (3): Logistic regression is fundamental in social science research.

CO6 (3): Time series forecasting is a key research area.

CO7 (3): A case study involves research, data collection, and analysis.

PO8: Learning How to Learn Skills

CO1 (2): Learning Python requires continuous practice.

CO2 (2): Understanding correlation requires hands-on learning.

CO3 (2): Regression analysis requires practice and continuous learning.

CO4 (2): Curve fitting techniques are learned through experimentation.

CO6 (3): Forecasting models evolve, requiring constant updates.

CO7 (3): A case study requires adaptability and self-learning.

PO9: Digital and Technological Skills

CO1 (3): Python programming is a core digital skill.

CO2 (3): Correlation techniques require statistical software.

CO3 (3): Regression modeling is implemented using computational tools.

CO4 (3): Curve fitting is performed using digital tools.

CO5 (3): Logistic regression is implemented in software like R and Python.

CO6 (3): Time series smoothing techniques use technological tools.

CO7 (3): A case study involves various digital and analytical tools.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

CO3 (2): Regression models can address diverse societal problems.

CO7 (2): Case studies can analyze data from different cultural contexts.

PO11: Value Inculcation and Environmental Awareness

CO6 (2): Time series analysis can be applied to environmental data.

CO7 (2): Case studies can focus on sustainability and ethical issues.

PO12: Autonomy, Responsibility, and Accountability

CO2 (2): Correlation analysis should be conducted responsibly.

CO4 (2): Curve fitting results should be interpreted accurately

CO6 (2): Forecasting models require accountability in decision-making.

CO7 (3): A case study demands responsibility and independent work.

PO13: Community Engagement and Service

CO7 (3): Case studies can address community-related issues.

Anekant Education Society's

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

Course & Credit Structure for T.Y.B.Com. (2023 Pattern as per NEP-2020)

Sem	Course Type	Course Code	Course Title	Theory / Practical	Credits
V	Major Elective (MJE)	STA-304-MJE(D)	Quantitative Techniques – I	Theory	04
	Minor (MN)	STA-311-MN(D)	Probability and Distribution Theory	Theory	04
VI	Major Elective (MJE)	STA-354-MJE(D)	Quantitative Techniques – II	Theory	04
	Minor (MN)	STA-361-MN(D)	Distribution Theory and Testing of Hypothesis	Theory	04

CBCS Syllabus as per NEP 1.0 for T.Y.B.Com. (2023 Pattern)

Name of the Programme : B.Com

Programme Code : UCOM

Class : T.Y.B.Com

Semester : V

Course Type : Major Elective (MJE) (Theory)

Course Code : STA-304-MJE(D)

Course Title : Quantitative Techniques – I

No. of Credits : 04

No. of Teaching Hours : 60

Course Objectives:

1. To study the fundamental concepts of game theory, including players, strategies, payoffs, and equilibrium..
2. To study the basic principles and concepts of decision theory, including decision-making under uncertainty and risk.
3. To introduce different types of quality control techniques, such as statistical process control (SPC) and acceptance sampling.
4. To study the concept of replacement problem in operations management.
5. To apply various criteria, such as cost minimization and reliability maximization, in solving replacement problems.

Course Outcomes:

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

CO1. solve simple games using various techniques.

CO2. to model and analyse conflicting situations using game theory.

CO3. formulate decision making problems.

CO4. identify decision alternatives, the states of nature and payoff associated with every possible combination of decision alternatives and states of nature.

CO5. identify the one best decision alternative for decision situation of uncertainty and risk.

CO6. understand the philosophy and basic concepts of quality control.

CO7. understand the mathematical tools that are needed to solve optimization problems.

CO8. to develop their ability to apply those concepts to the design and management of quality control processes in industries.

TOPICS/CONTENTS:

UNIT 1 Game Theory: (15L)

Meaning, two-person zero-sum game, pure and mix strategies, Pay off tables, saddle points, minimax and maximin principles, Dominance principles. Examples and problems.

UNIT 2: Statistical Decision Theory: (15L)

Introduction, acts, states of nature, pay off, regret, Decision Making Under Risk, Expected Opportunity Loss (EOL) Criterion and Expected Monetary Value (EMV) Criterion. Decision Making Under Uncertainty, Maximin Criterion, Maximax, Minimax Regret Criterion, Laplace Criterion, Hurvitz Criterion, Examples and problems.

UNIT 3: Replacement Problem (10L)

Introduction, replacement of Item that deteriorates with time when value of money remains same during the period.

UNIT 4: Statistical Process Control: (20L)

Introduction, Chance and assignable Causes of variation, Uses of SQC, Control limits, specification limits, Tolerance limits Process and product control, Control charts for mean, range, P-Chart, C-Chart, Process, Capability study, Interpretation of capability index Cp and Cpk.

List of Practical's Based on this Topics:

Practical No.	Title
1	Game theory
2	Statistical Decision Theory
3	Statistical Process Control

References:

1. Taha, H. A. (2007). Operations research: An introduction (8th ed.). Pearson Education.
2. Swarup, K., Gupta, P. K., & Mohan, M. (2001). Operations research. Sultan Chand & Sons.
3. Sharma, J. K. (2011). Business mathematics. Vikas Publishing House.
4. Montgomery, D. C. (2012). Introduction to statistical quality control (7th ed.). Wiley.

5. Gupta, S. C., & Kapoor, V. K. (2000). Fundamentals of mathematical statistics. Sultan Chand & Sons.
6. Gupta, S. C. (2007). Fundamentals of statistics. Himalaya Publishing House.

Programme Outcomes and Course Outcomes Mapping:

Justification:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	3	2	3	2	1	1	2	1	1	2	1	1	1
CO2	3	3	3	2	3	2	1	1	2	1	1	2	1	1	1
CO3	3	3	3	2	3	1	2	1	2	1	1	2	1	1	1
CO4	3	3	3	3	3	2	2	1	2	1	1	2	1	1	1
CO5	3	3	3	2	3	2	2	1	2	1	1	2	1	1	1
CO6	3	2	2	1	2	2	1	1	2	2	2	1	1	2	1
CO7	3	3	3	1	3	2	2	1	2	2	2	2	1	2	1
CO8	3	3	3	1	3	3	2	1	2	3	2	2	1	2	1

Justifications by Program Outcome (PO)

PO1: A Fundamental Knowledge and Coherent Understanding

CO1, CO2, CO3, CO4, CO5, CO6, CO7, CO8: Each CO builds a strong understanding of fundamental concepts such as game theory, decision-making problems, quality control, and optimization, all of which are essential for comprehensive knowledge and coherent understanding. (Weight: 3)

PO2: Procedural Knowledge for Skill Enhancement

CO1-CO8: All COs involve hands-on problem-solving using procedural skills like decision-making techniques and mathematical tools, contributing directly to procedural knowledge. (Weight: 3 for most; 2 for simpler COs like CO1 and CO6)

PO3: Critical Thinking and Problem-Solving Skills

CO1-CO8: The course outcomes require students to apply analytical reasoning to solve games, make decisions under uncertainty, and optimize processes, enhancing critical thinking and problem-solving abilities. (Weight: 3)

PO4: Communication Skills

CO3, CO4, CO5: These COs involve interpreting decision-making problems and communicating results, developing the necessary communication skills. (Weight: 2-3)

CO6-CO8: Lesser focus on communication but still partially related. (Weight: 1)

PO5: Analytical Reasoning Skills

CO1-CO8: Analytical reasoning is at the core of the outcomes, especially in decision analysis, game theory, and optimization techniques. (Weight: 3)

PO6: Innovation, Employability, and Entrepreneurial Skills

CO1, CO2, CO5, CO6, CO7, CO8: These COs directly contribute to practical applications in quality control, optimization, and game theory, promoting skills for innovation and employability. (Weight: 2-3)

PO7: Multidisciplinary Competence

CO3, CO4, CO7, CO8: These COs touch on skills applicable across fields, such as decision-making, quality control, and process design, contributing to multidisciplinary competence. (Weight: 2)

PO8: Value Inculcation through Community Engagement

CO1-CO8: Though not directly tied to community engagement, some COs can indirectly apply through real-world problem-solving and optimization processes that benefit communities. (Weight: 1)

PO9: Traditional Knowledge into Modern Application

CO1-CO8: The application of game theory, decision theory, and quality control techniques can involve the modern application of traditional concepts. (Weight: 2)

PO10: Design and Development of System

CO6-CO8: These COs specifically focus on the design of quality control processes and system optimization, making them strongly related. (Weight: 2-3)

CO1-CO5: Decision-making and game-solving also contribute but to a lesser extent. (Weight: 1)

PO11: Ethical and Social Responsibility

CO6-CO8: Understanding quality control and decision-making processes can tie into ethical responsibilities, particularly when designing systems for public or industrial use. (Weight: 2)

PO12: Research-Related Skills

CO1-CO8: Research-related skills, including the use of mathematical tools and models in decision-making and quality control, are developed throughout these COs. (Weight: 2)

PO13: Teamwork

CO1-CO8: While most COs focus on individual skills, problem-solving in teams for certain projects may still occur. (Weight: 1)

PO14: Area Specific Expertise

CO6-CO8: Quality control and optimization are highly specific to industries, contributing to area-specific expertise. (Weight: 2)

CO1-CO5: Lesser relevance but still contribute by providing broad foundational knowledge. (Weight: 1)

PO15: Environmental Awareness

CO6-CO8: Concepts of quality control and system design can be applied to sustainable practices, promoting environmental awareness. (Weight: 1)

CBCS Syllabus as per NEP 1.0 for T.Y.B.Com. (2023 Pattern)

Name of the Programme : B.Com
Programme Code : UCOM
Class : T.Y.B.Com
Semester : V
Course Type : Minor (Theory)
Course Code : STA-311-MN(D)
Course Title : Probability and Distribution Theory
No. of Credits : 04
No. of Teaching Hours : 60

Course Objectives:

1. To distinguish between random and non-random experiments.
2. To introduce the concept of random variables and their role in probability distributions.
3. To introduce basic probability concepts, such as sample space, events, and probability measures
4. To compute probabilities of events.
5. To introduce some standard discrete probability distribution and their applications.
6. To apply discrete probability distributions to model real-world situations
7. To concept of bivariate discrete random variables and compute probabilities of discrete bivariate random variable.

Course Outcomes:

The students will be able to

CO1. distinguish between random and non-random experiments.
CO2. explore concept of random variables and their role in probability distributions.
CO3. use basic probability concepts, such as sample space, events, and probability measures.
CO4. compute probabilities of events.
CO5. demonstrate applications of standard discrete probability distributions.
CO6. apply discrete probability distributions to model real-world situations.
CO7. explore concept of bivariate discrete random variables and their role in probability distribution.

TOPICS/CONTENTS:

UNIT 1: Introduction to Probability (15L)

1.1 Definitions of Permutation, Combination, Sample Space

1.2 Event, different types of events, Probability of an event

1.3 Conditional Probability, Independence of two events

1.4 Partition of sample space, Bayes Theorem (statement only)

1.5 Examples and problems.

UNIT 2: Uni-variate Discrete Probability Distribution (15L)

2.1 Definitions of random variable, discrete random variable.

2.2 Probability distribution of discrete random variable

2.3 Probability mass function (p.m.f.), Cumulative distribution function, mean, variance and standard deviation. Properties of distribution function.

2.4 Examples and problems.

UNIT 3: Some Standard Discrete Probability Distributions (15L)

3.1 Discrete uniform distribution

3.2 Bernoulli: p.m.f., mean and variance. (statement only)

3.3 Binomial: p.m.f., mean, variance and additive property. (Statement only), real life situation.

3.4 Poisson: p.m.f., mean, variance and additive property. (Statement only), real life situation.

3.5 Examples and problems.

UNIT 4: Bi-variate Discrete Probability Distribution (15L)

4.1 Bivariate discrete random variable

4.2 Joint probability distribution of bivariate discrete random variable

4.3 Marginal and conditional distribution and independence of two variables.

4.4 Examples and problems.

List of Practical's Based on This Topics:

Sr. No.	Title
1.	Applications of Binomial Distribution
2.	Applications of Poisson Distribution
3.	Application of Bivariate DiscreteProbability Distribution-I
4.	Application of Bivariate DiscreteProbability Distribution -II

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. Gupta and Kapoor : Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.

Programme Outcomes and Course Outcomes Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	3	1	3	2	2	1	1	2	2	2	2	3	1
CO2	3	2	3	1	3	2	2	1	2	2	2	2	1	3	1
CO3	3	2	3	1	3	2	2	1	2	2	2	2	2	3	1
CO4	3	2	3	1	3	2	2	1	2	2	2	2	2	3	1
CO5	3	2	3	1	3	3	2	1	2	3	2	2	2	3	1
CO6	3	2	3	1	3	3	2	1	2	3	2	2	2	3	1
CO7	3	2	3	1	3	3	2	1	2	3	2	2	2	3	1

Justification for Mapping:

PO1 (Fundamental Knowledge and Coherent Understanding): Strongly related (3) to all COs as the course builds fundamental knowledge in probability.

PO2 (Procedural Knowledge for Skill Enhancement): Moderately related (2) because students develop skills in probability computations and applications.

PO3 (Critical Thinking and Problem-Solving Skills): Strongly related (3) since the course involves probability-based problem-solving.

PO4 (Communication Skills): Partially related (1) as students may need to explain probability concepts but it is not the main focus.

PO5 (Analytical Reasoning Skills): Strongly related (3) as probability involves logical and analytical reasoning.

PO6 (Innovation, Employability, and Entrepreneurial Skills): Moderately related (2-3) since probability is applied in risk assessment and decision-making.

PO7 (Multidisciplinary Competence): Moderately related (2) as probability is used in various disciplines such as engineering, finance, and science.

PO8 (Value Inculcation through Community Engagement): Partially related (1) as probability concepts can be applied in social studies but are not directly engaged.

PO9 (Traditional Knowledge into Modern Application): Partially to Moderately related (1-2) as

probability integrates classical and modern statistical techniques.

PO10 (Design and Development of Systems): Moderately to Strongly related (2-3) since probability is used in system modeling and risk analysis.

PO11 (Ethical and Social Responsibility): Moderately related (2) as probability helps in fair decision-making and policy design.

PO12 (Research-Related Skills): Moderately related (2) since probability is fundamental to research methodologies.

PO13 (Teamwork): Moderately related (2) as probability problems can be solved collaboratively.

PO14 (Area-Specific Expertise): Strongly related (3) as probability is crucial in many specialized fields like machine learning, data science, and finance.

PO15 (Environmental Awareness): Partially related (1) since probability can be used in environmental risk analysis but is not the core focus.