Probability and Statistical Inference

Course Code: IECO2C002T
Course Title: Probability and Statistical Inference
Semester: III
Credits: 4

Rationale

The syllabus covers fundamental concepts such as probability axioms, combinatorics, and probability distributions, essential for modelling random phenomena. Additionally, it delves into sampling techniques, estimation methods, and hypothesis testing, providing practical skills for analysing data and drawing valid conclusions. Mastery of these topics is invaluable for professionals in fields like economics, finance, science, engineering, and social sciences, enhancing their ability to interpret and utilize data effectively.

Course Outline

Contents	No. of Lectures
Unit-I: Elementary Probability Theory Overview of Probability: Basic concepts, sample spaces, events, and probability axioms; Combinatorics: Permutations and combinations; Addition and Multiplication Theorem of Probability; Conditional Probability and Independence, Law of total probability; Bayes' Theorem and its applications.	10
Unit-II: Random Variables and Probability Distributions Random Variables: Definition, types, and probability distributions; expected values and functions of random variables; properties of commonly used discrete and continuous distributions (uniform, binomial, exponential, Poisson, hypergeometric and Normal random variables); Sampling distribution of sample mean and sample variance.	10
Unit-III: Sampling Distributions and Jointly Distributed Random Variables Population and Sample: Definitions and distinctions; Sampling Distribution of the Mean: Central Limit Theorem and its implications; Sampling Distribution of the Proportion and application in estimation; Density and distribution functions for jointly distributed random variables; computing expected values of jointly distributed random variables; covariance and correlation coefficients	10
Unit-IV: Point and Interval Estimation Point Estimation: Methods and properties; Estimation of population parameters using methods of moments and maximum likelihood procedures; properties of estimators; Interval Estimation: Confidence intervals for population parameters: means and proportions	10

Unit V: Hypothesis Testing	10
Basics of Hypothesis Testing: Null and alternative hypotheses; Type I and Type II Errors: Understanding and minimizing; One-Sample and Two-Sample Tests: T-tests and Z-tests, F-tests, Chi-square tests, Analysis of variance (ANOVA), Non-parametric methods and their applications	

Course Outcomes

Upon successful completion of the course, the candidates will be able to

1. Students will gain a solid grasp of fundamental probability principles to analyse and predict outcomes in uncertain situations.
2. Students will acquire a thorough understanding of commonly used discrete and continuous probability distributions.
3. Students will learn the concepts of population and sample, including sampling distribution of the mean and proportion. They will understand the Central Limit Theorem and its implications.
4. Students will learn various point and interval estimation techniques, including methods of moments and maximum likelihood procedures. They will develop the ability to estimate population parameters with confidence intervals, enhancing their skills in drawing conclusions from data.
5. Students will be able to conduct various one-sample and two-sample tests, including parametric and non-parametric methods, facilitating sound decision-making based on statistical evidence.

Text Books

1. Devore, J. (2012). *Probability and statistics for engineers*, 8th ed. Cengage Learning.
2. J.E.Freund.*Mathematical Statistics withApplications*,7th edition, PearsonPrenticeHall,2004.

Suggested Readings:

1. Larsen, R., Marx, M. (2011). An introduction to mathematical statistics and its applications. Prentice Hall.
2. Miller, I., Miller, M. (2017). J. Freund's Mathematical Statistics with Applications, 8th ed. Pearson India.
3. Irwin Miller and M. Miller. *Probability and Statistics*, Prentice Hall,2003.
4. F. Kenney and E. S .Keeping. *Mathematical Statistics*: Part1&PartII,ChapmanandHall,NewYork,195
5. Hogg, R. Gand A. T. Craig. *Introduction to Mathematical Statistics*, Pearson Education (Indian Edition),2004.
6. V. K. Rohatgi and A. K. M. E Saleh. *An Introduction to Probability and Statistics*,2nd Edition,Wiley,2000.