

Course content

This course focuses on the foundational principles of probability theory and mathematical statistics, which are essential for solving complex engineering problems. It provides a detailed exploration of random events, probability distributions, statistical methods, and estimation techniques. Students will learn how to apply these methods to analyze data, perform statistical inference, and understand the behavior of random variables in various engineering contexts.

Key topics covered include:

1. **Events and Probability:** Random events, properties of probability, probability calculations, conditional probability, and independence.
2. **One-Dimensional Random Variables:** Definition and distribution of random variables, discrete random variables, special discrete distributions, continuous random variables, and special continuous distributions.
3. **Multidimensional Random Variables:** Joint distributions, marginal distributions, independence of random variables, and distributions of functions of random variables.
4. **Statistical Characteristics of Random Variables:** Mathematical expectation, variance, covariance, correlation coefficients, moments, and other statistical characteristics, including the central limit theorem.
5. **Foundations of Mathematical Statistics:** Population and sample, statistical quantities, sampling distributions.
6. **Parameter Estimation:** Moment estimation, maximum likelihood estimation, criteria for point estimation, confidence intervals, and confidence intervals for single and double normal population parameters.
7. **Hypothesis Testing:** Basic principles and steps of hypothesis testing, hypothesis testing for unknown parameters in single and double normal populations.

Course objectives

Knowledge

1. Master the basic concepts and methods in probability and statistics, and understand their application in solving complex engineering problems.
2. Learn the definitions, properties, and calculations of probability, random variables, and distributions.
3. Understand statistical inference techniques, including parameter estimation and hypothesis testing, to analyze and interpret data.
4. Apply probability theory and statistical methods to model and solve problems in engineering and computer science.

Skills

1. Develop skills in solving probability and statistical problems, including calculating and interpreting expectations, variances, and correlations.
2. Use statistical techniques such as maximum likelihood estimation and confidence intervals to make informed decisions based on data.
3. Conduct hypothesis testing to draw conclusions about populations from sample data.

4. Apply probabilistic models to real-world engineering and computer science problems, including those involving random variables and distributions.

Competencies

1. Demonstrate the ability to apply probabilistic and statistical tools to solve engineering problems in the field of computer science.
2. Independently perform data analysis and statistical inference, making sound decisions based on quantitative analysis.
3. Collaborate with peers to tackle complex problems involving random variables, distributions, and statistical methods.
4. Communicate the results of statistical analyses effectively, both in written reports and oral presentations.