Course Name:
Statistics and Probability in Civil Engineering

Course Number:
20005

Credit:
3

Prerequisite:
Math I

Course Description (Objectives):
The focus of this course will be on developing an understanding of the concepts and applications of statistics and probability in civil engineering. Students completing this course will be able to:

- Communicate using the language of statistics and probability.
- Choose appropriate probabilistic models for a given problem, using information from observed data and knowledge of the physical system being studied.
- Use probability tools to perform civil engineering calculations.

Course Content (outline):

Part I: Probability Theory

- Introduction to Probability
  - Properties of Probability
  - Counting Techniques: Combination and Permutation
  - Conditional Probability
  - Independent Events
  - Bayes' Theorem
- Discrete Distributions
  - Discrete Random Variables
  - Mathematical Expectation
  - Moment Generating Functions
  - Binomial Distribution
  - Geometric Distribution
  - Poisson Distribution
- Continuous Distributions
  - Continuous Data: Histograms and Percentiles
  - Continuous Random Variables
  - Uniform, Exponential, Gamma, Beta, and Chi-Square Distributions
  - Normal and Lognormal Distributions
  - Extreme-value Distributions

- Bivariate Distributions
  - Correlation Coefficient
  - Conditional Distributions
  - Distributions of Two Continuous Random Variables
  - Bivariate Normal Distributions
- Distributions of Functions of Random Variables
  - Functions of One Random Variable
  - Transformations of Two Random Variables
  - Several Independent Random Variables
  - Random Functions Associated with Normal Distribution
  - Central Limit Theorem
  - Monte Carlo Simulation

Part II: Statistics

- Estimation
  - Point Estimation
  - Confidence Intervals for One Mean
  - Confidence Intervals for Two Means
  - Confidence Intervals for Variances
  - Confidence Intervals for Proportions
  - Confidence Intervals for Percentiles
  - Sample Size
  - Simple Linear Regression
- Hypothesis Testing
  - Tests for Proportions
  - Tests for One Mean
  - Tests of Equality of Two Means
  - Tests for Variances
  - Analysis of Variance
- Goodness-of-Fit Tests
  - Chi-Square Tests
  - Kolmogorov-Smirnov Test
- Bayesian Methods
  - Subjective Probability
  - Bayesian Estimation

References:

- آمار و احتمال مهندسی، ن، نعمت‌اللهی، نشر دالفک، 1390.
- Probability, statistics, and decision for civil engineers, J. R. Benjamin and C. A. Cornell, Courier Corporation, 2014.

- Introduction to probability and statistics for engineers and scientists. S. M. Ross, Academic Press, 2014.
- Probability, reliability, and statistical methods in engineering design, A. Haldar and S. Mahadevan, Wiley, 1999.