Probability & Statistics

Code	Credit Hours
STAT 835	3-0

Course Description

The course offers a basic understanding of Statistics and Probability. This course covers statistical analysis of civil engineering problems. It reviews descriptive statistics and probability and a detailed study of important distributions such as binomial, exponential, Poisson, normal distributions, etc., and their applications in civil engineering. The course covers inferential statistics, including hypothesis testing, reliability analysis, and paired t-tests for comparison across groups. In the end, the course covers simple linear regression, multiple linear regression, non-linear regression, and an introduction to machine learning.

Text Book:

1. Probability and Statistics for Engineering and Sciences by Jay L. Devore (9th Edition) (Available in SCEE Library)
2. Class notes, presentations, and any additional material provided.

Reference Books:

(1) Dixon, W. J. and Massey, F. J. Introduction to Statistical Analysis, 4th ed. New York: McGraw-Hill, 1983.

(2) Everitt, B. Chance Rules: An Informal Guide to Probability, Risk, and Statistics. Copernicus, 1999.

(3) Feller, W. An Introduction to Probability Theory and Its Applications, Vol. 1, 3rd ed. New York: Wiley, 1968.

(4) Fisher, N. I.; Lewis, T.; and Emblazon, B. J. J. Statistical Analysis of Spherical Data. Cambridge, England: Cambridge University Press, 1987.

(5) Fisher, R. A. and Prance, G. T. The Design of Experiments, 9th ed. rev. New York: Hafner, 1974.

(6) Keeping, E. S. Introduction to Statistical Inference. New York: Dover, 1995.

(7) Mises, R. von Probability, Statistics, and Truth, 2nd rev. English ed. New York: Dover, 1981.

(8) O'Hagan, A. Kendall's Advanced Theory of Statistics, Vol. 2B: Bayesian Inference, 6th ed. New York: Oxford University Press, 1998.

(9) Ostle, B. Statistics in Research: Basic Concepts and Techniques for Research Workers, 4th ed. Ames, IA: Iowa State University Press, 1988.

Prerequisites

Nil

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10-15%
Assignments	5-10%
Mid Terms	25%
ESE	40-50%
Term Project	10%

Teaching Plan

Week No	Topics	Learning Outcomes
1-2	Descriptive Statistics	Populations, Samples, Processes Pictorial and Tabular Methods in Descriptive Statistics (Stem-and-leaf, box plot, dot plots, histogram) Mean, Median, Quartiles, Percentiles, Trimmed mean Measures of Variability (variance, standard deviation)
3-4	Probability Basics	Sample Spaces, Events Axioms, Interpretations and Properties of Probability
5	Conditional Probability	Conditional Probability, Independence and Bayes' Theorem
6-8	General and Specific Probability Distributions	Discrete and Continuous Random Variables General Discrete Probability Distribution Binomial, Negative Binomial, Poison specific Probability Distributions General Continuous Probability Distributions Normal and Standard Normal Distributions, Student's t-distribution, and Exponential Probability Distribution
9	**MID SEMESTER EXAM**	
10-11	Hypothesis Testing	Hypotheses and Test Procedures Test about a population Mean Inferences based on two samples (two-sample t test)
12-13	Simple Linear Regression	Simple linear Regression Model Estimating Model Parameters and their inferences Correlation
14-16	Multiple and Non-linear Regression	Diagnostics and Remedial Measures Nonlinear and Multiple Regression Software Learning (Excel, SAS 9.1.3, SPSS (PASW 18.0))
17	Introduction to Machine Learning	Supervised and Unsupervised Machine Learning K-Means Clustering Decision Tree Regression
18	**END SEMESTER EXAM**	