

ISE 4150/IHE 6150 – Advanced Probability and Statistics for Engineers

Course Description

Topics in probability and statistics with an emphasis on solving engineering problems. Following this course, students will be able to analyze data, design and analyze statistically valid experiments, and draw statistically valid conclusions. Topics include probability, sampling distributions, probability distributions, confidence intervals, hypothesis testing, regression and correlation, analysis of variance (ANOVA), design of experiments, statistical process control, classification, and computer software for basic statistical analysis.

Offered both face-to-face and online
Undergraduate/Graduate level – 3 credit hours

Graduate students in this course are required to conduct a graduate project that requires them to apply concepts learnt in class in a more in-depth fashion. The graduate project is a written document that constitutes a comprehensive analysis of a topic related to the course content such as descriptive statistics, probability, regression and correlation, regression adequacy testing, multiple regression and feature selection, Analysis of Variance (ANOVA), design of experiments. The purpose of this project is to collect, analyze, and provide insights into data using the tools from this class. The written report will require graduate students to spend more time conducting analysis of peer-reviewed scholarly articles and synthesizing the summary as a 10 page journal paper formatted as APA style document that would present, in-depth application of the concepts learned in class to a real-world problem, and performing what-if analysis of the statistics.

Course Learning Objectives

Students enrolled in this course will learn to:

- Design an experiment and interpret and analyze relevant data using statistical inference methods.
- Understand the definition of random variables and the relationship between distributions, distribution functions and outcomes
- Understand and be able to apply concepts of conditional probability and probability distributions;
- Understand sampling experiments and associated statistics
- Understand confidence intervals and hypothesis tests associated with statistical experiments and be able to interpret them appropriately.

Course Learning Outcomes

Upon successful completion of this course, students can:

- Design an experiment and interpret and analyze relevant data using statistical inference methods.
- Understand the definition of random variables and the relationship between distributions, distribution functions and outcomes

- Understand and be able to apply concepts of conditional probability and probability distributions;
- Understand sampling experiments and associated statistics
- Understand confidence intervals and hypothesis tests associated with statistical experiments and be able to interpret them appropriately.

Tentative Weekly Schedule

Week 1	Introduction
Week 2	Variables
Week 3	Discrete Distribution
Week 4	Continuous Random Variables and Probability Distributions, Joint Probability Distributions
Week 5	Joint Probability Distributions(contd.), Descriptive Statistics
Week 6	Statistical Intervals for a Single Sample
Week 7	Sampling Distributions and Point Estimation of Parameters
Week 8	Tests of Hypotheses for a Single Sample, Midterm exam
Week 9	Statistical Inference for Two Samples
Week 10	Simple Linear Regression and Correlation
Week 11	Multiple Linear Regression
Week 12	Design and Analysis of Single-Factor Experiments: The Analysis of Variance
Week 13	Design and Analysis of Single-Factor Experiments: The Analysis of Variance (contd.)
Week 14	Design of Experiments with Several Factors
Week 15	Project Presentations