

CE 6003 Probabilistic Analysis and Reliability in Civil Engineering

Course Syllabus

Lecture: Wednesday, 6:30 pm – 9:00 pm

Instructor: Prof. Mahyar Amirgholy
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Office: M-162C Hours: Wednesday 6:30 pm – 8:45 pm

Prerequisite: Data Collection and Analysis in Engineering (ENGR 3305)

Textbook

The primary course text will be the following books:

Montgomery, D.C. and Runger, G.C., 2014. *Applied Statistics and Probability for Engineers*. John Wiley & Sons.

Carlton, M.A. and Devore, J.L., 2017. *Probability with applications in engineering, science, and technology*. Springer.

Singh, V.P., Jain, S.K. and Tyagi, A., 2007. *Risk and Reliability Analysis: A Handbook for Civil and Environmental Engineers*. American Society of Civil Engineers.

Available Online: <https://library.kennesaw.edu>

Additional readings and references will be posted as necessary to D2L Brightspace.

Description and Objectives

[3 credits] The course objectives are for students to understand statistical modeling and probabilistic analysis in civil engineering. Upon completing the course, students should be familiar with multivariate linear regression, analysis of variance, stochastic processes, extreme value distributions, reliability analysis, first-order reliability methods, and Monte-Carlo simulation. Students should be able to compute and interpret descriptive statistics, apply Bayes' theorem, analyze sampling distributions, conduct hypothesis tests, perform analysis of variance, apply linear regression techniques, develop stochastic models, perform reliability analysis, and use statistical software programs. The student will leave the class with computational and software skills that can be applied in different fields of civil engineering.

Course Topics

- Probability and Statistics
- Random Events, Random Variables, and Sampling Distributions
- Hypothesis Test
- Analysis of Variance
- Linear Regression
- Stochastic Process
- Extreme Value Distribution
- Reliability Analysis and Modeling

Course Learning Outcomes

1. Describe and interpret random events and variables, and probability distributions.
2. Apply Bayes' theorem to solve stochastic engineering problems.
3. Conduct hypothesis test as part of an engineering decision-making process.
4. Apply linear regression techniques to engineering problems.
5. Develop statistical models in engineering and evaluate the accuracy of results.
6. Model stochastic systems and perform reliability analysis.

Course Requirements and Grades

Course grades will be based on three components:

1. **Homework** [30%] In order to practice concepts from the class, some shorter exercises will be assigned as homework. Homework assignments must be submitted to the D2L website in a single PDF with a file name as "FirstInitial_LastName_HW#.pdf". Homework solutions will be posted on the D2L website. Please don't hesitate to contact me to schedule a one-on-one meeting so we can discuss any questions you may have.
2. **Midterm Exam** [30%] The midterm exam evaluates your knowledge in the middle of the semester. The problems will be similar in size and scope to the assigned homework. The midterm exam must be submitted to the D2L website in a single PDF with a file name as "FirstInitial_LastName_MTE.pdf".
3. **Term Project** [40%]. The topic of your project must be related to statistical modeling and probabilistic analysis. You will be expected to prepare a report in the format of a journal or conference paper on your project analysis. The project report must be submitted to the D2L website in a single PDF with a file name as "FirstInitial_LastName_TPR.pdf". To learn more about the term project, please refer to the project description located in the Project module on D2L website.

Microsoft Word Template: https://github.com/chiehrosswang/TRB_MSWORD

Course Communication

Course communications will be sent to the class using the D2L website. This site is where videos, notes, readings, assignments, and other announcements will be posted. It is important that if you are registered for the course, you are also on the roster for the D2L site.

Communication Rules

To maintain a respectful and productive learning environment, it is important to adhere to certain communication rules in our online class. These rules are referred to as Netiquette. To ensure successful online communication, you should be sensitive and reflective towards what others are saying, avoid typing in all capital letters as it can come across as shouting, refrain from using offensive language and outbursts of extreme emotion or opinion, and think carefully before posting as you won't be able to take it back. Use clear subject lines, refrain from using abbreviations or acronyms unless everyone in the class knows them, and keep the conversation collegial and professional. It can be challenging to convey humor online, so it's best to avoid it. Assume good intent and respond accordingly, even if you are unsure or annoyed by a message. If you need time to process, wait 24 hours before responding.