

Professor Roger Ghanem

Risk analysis in Civil Engineering

COURSE OBJECTIVES AND OUTCOMES

Goal. The course provides the students with basic knowledge of probability and statistics, emphasizing the fundamental steps (e.g., setup, analysis, solution, discussion) of engineering problems. The role of risk probability in Civil Engineering is described and basic probability concepts are presented. Probability distribution functions commonly used to model and analyze Civil Engineering problems are discussed. Parameters and determining distribution models from observational data are introduced. Monte Carlo simulation methods are practiced. Detailed examples of the application of probabilistic methods to hydrological, and environmental system design are presented throughout the course.

Objective. To study and analyze the probability of occurrence of events in civil engineering problems

Outcome. The student will be able to:

		1	2	3	4	5
1	Express events in set notation and apply operations from set theory					
2	Understand when events are mutually exclusive, collectively exhaustive, and statistically independent					
3	Use conditional probability concepts to compute occurrence probability of correlated events					
4	Use the Theorem of Total Probability and Bayes Theorem to compute occurrence probability					

Objective. To study, analyze and apply random variables (RVs) governed by various distributions

Outcome. The student will be able to:

5	Understand basic concepts characterizing RVs, such as statistics, density functions and so forth					
6	Determine probabilities with Normal and Lognormal random variables					
7	Determine probabilities and the relationship between Binomial- and Geometric-distributed RVs					
8	Determine probabilities and the relationship between Poisson- and Exponentially-distributed RVs					
9	Solve problems involving multiple random variables					
10	Characterize random variables that are functions of other random variables					

Objective. To characterize random variables from sampled data

Outcome. The student will be able to:

11	Understand and determine statistics of sampled data					
12	Estimate the parameters of a distribution from sampled data					
13	Determine confidence intervals from sampled data					
14	Test the validity of proposed distribution for a set of sampled data					

Objective. To study, understand and apply regression analysis to civil engineering problems

Outcome. The student will be able to:

15	Understand and compute linear regression from sampled data					
16	Estimate probabilities based on a regression analysis					
17	Determine regression with multiple independent variables and with linear and nonlinear models					

Objective: The Civil (Environmental) Engineering program is designed to teach beyond the technical content of the curriculum and prepare the students to utilize what they learn in a professional setting. Engineering projects and research activities enlist skills and demonstrate ability to understand the subject matter and communicate in a proficient manner. This course contributes to the overall program goals in the following ways.

How well did you learn?					
Not at all → Very Well					
1	2	3	4	5	
<p>PLEASE CIRCLE YOUR RATINGS</p> <p>↓ BELOW ↓</p>					

Professor Roger Ghanem

Risk analysis in Civil Engineering

How well did you learn?				
Not at all → Very Well				
1	2	3	4	5

COURSE OBJECTIVES AND OUTCOMES						
Outcome. How well did this course increase your understanding and prepare you with						
a	An ability to apply knowledge of mathematics, science, and engineering	1	2	3	4	5
d	An ability to function on multi-disciplinary teams	1	2	3	4	5
e	An ability to identify, formulate, and solve simple engineering problems	1	2	3	4	5
g	An ability to communicate effectively	1	2	3	4	5
h	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	1	2	3	4	5
i	A recognition of the need for, and an ability to engage in life-long learning	1	2	3	4	5
k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	1	2	3	4	5