CE 408 Risk Analysis in Civil Engineering 3 Units

USC | SONNY ASTANI DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

ABET Course Syllabus

Course Information, Textbook and Supplementary Materials

Course Description: The role of risk and 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. Methods for estimating 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 structural, transportation, hydrological, and environmental system design are presented throughout the course.

Required: All Civil and Environmental Engineering undergraduate degree programs

Prerequisites: CE 225 Mechanics of Deformable Bodies; and Math 226

Co-Requisites: None

Required Textbook and Software Requirements:
A.H-S. Ang and W.H. Tang, *Probability Concepts in Engineering,* John Wiley and Sons 2007
Recommended: Matlab Student Version

Reference: None

Topics Covered	Learning Outcomes
Analyzing the probability of occurrence of events in civil engineering problems	Students will understand the following topics, and be able to analyze, characterize and apply them using statistics to solve engineering problems: 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
Analyzing and applying random variables (RVs) governed by various distributions	5. Understand basic concepts characterizing RVs, such as statistics, density functions, etc. 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 variable
Characterizing random variables from sampled data	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

Understanding and applying regression analysis to civil engineering problems	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

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Lecture and Lab Schedule			
Lecture		**Lab**	
Sessions per Week	Duration per Session	Sessions per Week	Duration per Session
2	1.5 hours	n/a	

Relation of Course Objectives to Program Outcomes

The Civil 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.

This course contributes to the program outcomes as outlined in the adjacent table.

Course Contribution to Program Outcomes (a-k)	✓ Key
f. An understanding of professional and ethical responsibility.	
i. Recognition of the need for, and an ability to engage in life-long learning.	✓

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