COURSE SYLLABUS

The University of Texas at Arlington

College of Engineering

Department of Civil Engineering

CE/CM 5350 – Risk Management

(3 Credit Hours)

Fall 2018

Instructor: Dr. Sharareh Kermanshachi

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Office Hours: Wednesday, 1:00 PM- 3:00 PM- Friday 1:00 PM- 3:00 PM, Additional Office Hours by Appointment.

Section Information: CE/CM 5350- Risk Management-Section 001 and 002

Time and Place of Class Meetings: Friday, 4:00 PM - 6:50 PM, WH 311

Description of Course Content: This course is designed to provide an overview for engineers and managers in the application of a risk management approach to scheduling and cost estimating of projects. Topics include: risk identification, response, monitoring and control through the use of good data input, systematic approach and quantitative evaluation analysis.

Course Objective: The course objective is to prepare students to demonstrate sound engineering and managerial judgment in the application of an integrated qualitative and quantitative cost and schedule risk analysis to improve decision-making and optimize the use of available resources.

Student Learning Outcomes: Upon completion of the course, the student will be able to:

1. explain the role of **risk and decision analysis** in engineering and construction;
2. summarize multiple **risk identification methods** and explain their application;
3. explain **biases and heuristics** that decision makers use;
4. apply **risk assessment techniques** to rank risks;
5. apply **Monte Carlo simulation techniques** to cost and schedule analysis;
6. interpret **sensitivity analyses** and apply their results;
7. explain **risk mitigation** techniques and determine their appropriate application;
8. develop a **risk management plan** for a construction project;
9. explain **risk allocation** in project delivery methods and contract provisions;
10. develop **multi-criteria decisions models** for application on a variety of problems;
11. apply **decision tree techniques** to engineering decisions;
12. strengthen **problem-solving skills**, working both individually and in groups;
13. strengthen **written and oral communication skills**; and
14. identify **professional responsibilities** of construction engineers to assure quality of the constructed facilities and infrastructure.

Suggested Course Materials:

1) Amarjit Singh, 2017. *Quantitative Risk management and Decision Making in Construction, American Society of Civil Engineers (ASCE), Unites States* (ISBN: 9780784414637)
2) Handouts, notes, reading assignments, problem solutions and other information are located on the class Blackboard site which will be provided by the instructor.

Descriptions of major assignments and examinations: There will be two exams (one midterm, and one final), one individual project, two team projects and several homework assignments.

Attendance: At the University of Texas at Arlington, taking attendance is not required. Rather, each faculty member is free to develop his or her own methods of evaluating his or her students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I have established the following attendance policy: students are expected to attend all classes. For total professional development, class participation and oral discussions will be encouraged. Everyone is asked to arrive and be seated promptly for duration of class to minimize the disruption to others.

Grading: Grades will be determined according to the following scale (the grading scale may be lowered at the discretion of the instructor, but will not be raised):

Grade	% Required
A	90 -100
B	80-89
C	70-79
D	60-69
F	Less than 60

The breakdown of the final grade for **final grade calculation** is as following:

- Assignments 15%
- Project #1 10%
- Midterm Exam 25%
- Project #2 15%
- Final Exam 35%

Team Projects

There will be two projects this semester. One of the projects is a team project and will be conducted in groups of four students. We will focus these projects on real world decision/risk analyses. For online students, the team project will be defined with smaller scopes and will be conducted individually.

Assignment questions will be uploaded on the Blackboard. Assignments are due at the beginning of the class. *No late Assignment will be accepted*.

*Online students should reply to the instructor's emails as soon as possible to answer her questions and facilitate a constant communication. They can also send their questions to the instructor via email.

Make-up Exams: All students must take the exams. Only extenuating circumstances will be accepted as excuse for missing the exam. Health related excuses require medical reports and the signature of a physician that provided treatment.

Grade Grievances: Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current University Catalog. See below: http://catalog.uta.edu/academicregulations/grades/#undergraduatetext

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA),* and *Section 504 of the Rehabilitation Act.* All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of **a letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting: **The Office for Students with Disabilities, (OSD)** www.uta.edu/disability www.uta.edu/disability. or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit* uta.edu/eos.

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit* www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at https://www.uta.edu/conduct/.

Student Support Services Available: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

The IDEAS Center (2nd Floor of Central Library) offers free tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email IDEAS@uta.edu or call (817) 272-6593.

Civil Engineering Librarian:
Martin Wallace, Engineering Librarian Mailing address:
Central Library, Office Number: 518. Phone: 817-272-3924, Email: martin.wallace@uta.edu

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

Laptop use in the classroom: In order to minimize distraction, the use of laptop and/or any other digital device (except standard scientific calculators) in the classroom is NOT allowed.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

CE/CM Risk Management- Course Outline

What is Risk Management and Why is it Important?

- Risk and Uncertainty
- Risks Vs. Opportunities
- Precision, Accuracy and Transparency
- Risk Management Steps
- Risk-Based and Risk-Informed Decision Making
- Why Risk Management is Important?
- Risk and Decision Analysis

Deterministic Estimates

- Project Failure Causes
- Engineer Estimate and Contingency
- Basis of Cost Estimate
- Phase-based Accuracy of Cost Estimates
- Base Cost Variability
- Epistemic Risks
- Contingency Range Calculation in Project Development Process
- Key Cost Estimate Techniques
    - Conceptual/Parametric Estimating
    - Historical Bid-Based Estimating
    - Cost-Based Estimating
    - Risk-Based Estimating
- Project Maturity and Accuracy Estimation
- Cost Management Techniques
    - Indexing
    - Letting Strategies for Cost Control
    - Analysis of Contractor Bids
    - Performance Measures for Cost Estimating

Risk Identification Process

- Risk Identification
- Internal Vs. External Risks
- Complexity Vs Uncertainty Vs Difficulty
- Risk Analysis Types
- Contingency Calculation Methods
- Contingency Percentage Range Calculation
- Risk Categorization
- Risks among Project Stakeholders
- Risk Statement Structure
- Industry-based Risk Determination
- Risk Identification Tools and Techniques
    - Analogy
    - Brainstorming
    - Assumption Analysis
    - SWOT Analysis

    - Delphi Technique
    - Expert Interviews
    - Crawford Slip
    - Checklists
    - Red Flag Items
    - Cause and Effect Analysis (Fishbone Diagram)
- Integration of Risk Identification Techniques with Risk Analysis Methods
- Risk Breakdown Structure (RBS)

Risk Assessment Process

- Qualitative Probabilities
- Likelihood and Impact
- PxI Matrix
- Bowtie Method
- Risk-Based Incentive/Penalty Allocation Using Various Contracting Methods *(Problem Solving)*
- Risk Analysis Methods
- Decision Making with Probabilities
- Corrective Risk Time and Risk Cost
- Expected Value *(Problem Solving)*
- Decision Tree *(Problem Solving)*

Decision Theory

- Decision Making Without Probabilities
- Uncertainty and Payoff Tables *(Problem Solving)*
    - Maximax- Optimistic Approach
    - Maximin- Pessimistic Approach
    - Minimax (Regret Tables)- Opportunist Approach
    - Expected Value with Equal Probabilities- Realistic Approach

Bayesian Theory

- Bayes' Theorem
- Posterior Probability
- Prior Probability
- Conditional Probability *(Problem Solving)*
- Application of Bayes' Theorem in Construction Industry *(Problem Solving)*

Scheduling under Uncertainty

- Variability of Activity Duration (Distribution)
- Central Limit Theorem
- Program Evaluation and Review Techniques *(Problem Solving)*
- Interpretation of Monte Carlo Simulation Output

Economical Decision Making *(Review Materials)*

- Net Present Value (NPV) *(Problem Solving)*
- Profitability Index *(Problem Solving)*
- Benefit Cost Ratio *(Problem Solving)*
- Breakeven (Payback Period) *(Problem Solving)*
- Internal Rate of Return *(Problem Solving)*

Decision Making under Utility Function

- Decision Making and Utility
- Three Types of Decision Makers
    - Risk Averse
    - Risk Seeker/Taker
    - Risk Neutral
- Expected Utility Calculation *(Problem Solving)*
- Utility Curve Calculation *(Problem Solving)*

Heuristics in Decision Making

- What is Heuristic?
- Anchoring and Adjustment Heuristic
- Availability Heuristic
- Representativeness Heuristic

Risk Mitigation and Planning

- Formal Risk Management Plan
- Risk Response Strategies
    - Avoid
    - Transfer
    - Reduce
    - Accept (Passive Vs Active)
    - Share
- Risk Tracking and Controlling

Construction Insurance

- What is Insurance?
- Insurance Vs. Bonds
- Construction Insurance Types
    - Commercial General Liability
    - Business Automobile Liability
    - Workers' Compensation and Employer's Liability
    - Professional Liability
    - Builder's Risk (Property)

Risk Register and PCAM Tool

- Project Complexity Assessment and Management (PCAM) Tool
- Risk Register Software
    - Risk Identification
    - Deterministic Approach
    - Probabilistic Approach
    - Risk Response Strategies
    - Risk Allocation