CE 5338: System Evaluation

Spring 2016
UTA Civil Engineering Program

Classes:	Tuesdays and Thursdays, 3:30 – 4:50 pm, 149 Business Building
Professor:	Dr. Stephen Mattingly
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Office:	Nedderman Hall 432
Office Hrs:	Tuesdays and Thursdays, 11-12 and 1-3, or by appointment
Teaching Assistant:	Ziaur Rahman (ziaur.rahman@mavs.uta.edu), NH B24
Textbooks:	**Required:** Engineering Project Appraisal, Rogers and Duffy, 2nd edition, 2012
References:	Decisions with Multiple Objectives, Keeney and Raiffa, 1976 Decision Making and Forecasting, Marshall and Oliver, 1995
Software:	Microsoft EXCEL or other spreadsheet
Prerequisite:	Undergraduate probability and statistics

Grades:		
	Home/Class Assignments	16%
	Mid-Term	21%
	Projects	18%
	Presentations	6%
	Discussion	4%
	Final	35%

Course Context: Most civil engineers must make decisions in their career, but they receive little formal training on proper decision-making techniques. This course will address both the frequently applied cost-benefit analysis techniques and the more theoretically appealing multicriteria decision techniques.

Course Goals:

1. Develop decision-making skills and expertise (Advanced Knowledge)
2. Identify decision-making applications (Advanced Knowledge)
3. Improve writing and presentation skills (Effective Communication)
4. Introduce students to transportation research and the critical analysis of journal articles (Critical Thinking/Independent Abilities)

CE 5338 Schedule

Date	Topic	Text	Assignment Due
Jan 19	Intro, Decision-making	Chapter 1	
Jan 21	Basic Tools for Economic Appraisal	Chapter 2	
Jan 26	Present Worth	Chapter 3	
Jan 28	Equivalent Annual Worth	Chapter 4	**Proposal 1 Due**
Feb 2	Rate of Return, B/C Ratio	Chapter 5	
Feb 4	B/C Ratio	Chapter 6	
Feb 9	Cost Benefit Analysis	Chapter 7	
Feb 11	Cost Benefit Analysis	Chapter 7	**1:** Handout Chapters 2-5
Feb 16	Applications & Research	Chapter 8?	
Feb 18	Applications & Research	Chapter 8?	
Feb 23	Risk Analysis	Notes	**2:** Handout Chapter 6-7
Feb 25	Risk Analysis	Notes	
Mar 1	TBD		
Mar 3	Presentations		
Mar 8	Presentations		**First Project Due**
Mar 10	**Midterm**		
Mar 15	SPRING BREAK		
Mar 17	SPRING BREAK		
Mar 22	Multicriteria Analysis	Chapter 11	
Mar 24	Simple Additive Model	Chapter 12	
Mar 29	Simple Additive Model	Chapter 12	**3:** Discussion Paper
Mar 31	Simple Additive Model	Chapter 12	**Proposal 2 Due**
Apr 1	**Last Day to Drop Class**		
Apr 5	Analytic Hierarchy Process	Chapter 13	
Apr 7	Analytic Hierarchy Process	Chapter 13	**4:** Handout Chapter 10
Apr 12	Analytic Hierarchy Process	Chapter 13	
Apr 14	Concordance Techniques	Chapter 14	**5:** Handout Chapter 11
Apr 19	Concordance Techniques	Chapter 14	
Apr 21	Concordance Techniques	Chapter 14	
Apr 26	Contemporary Topics	Notes	
Apr 28	TBD		**6:** Handout Chapter 12
May 3	Presentations		
May 5	Presentations		**Second Project Due**
May 12	Final, 2 – 4:30 pm	Final	**7:** Discussion Paper 2

Course Content

The course covers techniques necessary to perform economic and multi-criteria evaluations of civil engineering projects. These will be used to assess the strengths and weaknesses of different decision-making strategies and analyze contemporary topics and case studies in making civil engineering decisions.

Homework

The homework should be submitted on the day that it is due. I need the homework turned in by this date so that I can return the solutions to you at the next class. If you are unable to attend class, please submit your homework via fax or e-mail. If the homework is not submitted the maximum score will degrade in the following manner with each deduction associated with class meetings (90%, 70%, 40%).

Project

For each general topic, a two person group student will select one of the following options:

1. Choose two papers and critically analyze and compare and contrast them.
2. Apply one of the techniques from class for a decision-making problem of your choosing or creation.
3. Choose a single paper and apply a decision-making technique from the class to the problem described in the paper. Compare and contrast the different results and make a critical assessment of the preferred strategy.

Each group must submit a proposal paragraph, which identifies the general approach that the group will use. A paper should be identified or the case study decision problem should be described. The project will be graded on difficulty, presentation, and content.

Presentations

Each group should make a presentation of their project for 20 minutes with another 10 minutes for questions and discussion. You should be able to answer any questions from the audience. Presentations will be graded on quality, difficulty, discussion and timeliness.

Expectations

Any of the topics covered during the in class presentations or supplementary application and research lectures may be addressed during the final or mid-term. You should also be able to participate in any discussions associated with the presentations.

Missed Exams

All missed exams will be handled at the instructor's discretion.

Mid-term and Final (open and closed book)

The mid-term will last one and a half hours and the final will both last two and a half hours and the final will cover the entire course. All of the problem solving will be open book while other portions of the test will be closed book.

Reading List

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, which is located through the doors on both my left and right. After leaving through these doors, the closest exit is to the right down the corridor; however, if this exit is blocked, turn left and proceed to the end of the corridor and another 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.

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/ses/fao).

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.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Academic Integrity: All students enrolled in this course 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.

Instructors may employ the Honor Code as they see fit in their courses, including (but not limited to) 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.

Title IX: The University of Texas at Arlington is committed to upholding U.S. Federal Law "Title IX" such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit www.uta.edu/titleIX.

Americans with Disabilities Act: The University of Texas at 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).* 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 that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Student Support Services: 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.

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 students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I allow students to attend class at their own discretion; however, there will be a few unannounced quizzes held during class throughout the semester.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory shall be directed to complete a 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.

Objectives:

1. Be able to describe different decision-making techniques.
2. Be able to select and justify the use of a particular decision-making technique based on a description of the problem.
3. Be able to compare and contrast rational, behavioral and irrational decision-making theories.
4. Be able to compare and contrast the implications associated with the following decision-making conditions: certainty, risk and uncertainty.
5. Be able to apply the basic tools for economic appraisal, including but not limited to nominal and effective interest rates, present and future worth, sinking fund, capital recovery, etc. (see chapter 2)
6. Be able to design and solve a life-cycle cost problem.
7. Be able to select an alternative using present worth evaluation.
8. Be able to compare projects using equivalent annual worth.
9. Be able to rank multiple alternatives using rate of return analysis.
10. Be able to the strengths and limitations of various evaluation techniques including but not limited to present worth evaluation, equivalent annual worth, rate of return, cost-benefit analysis
11. Be able to compare projects using benefit-cost ratios.
12. Be able to design and a cost-benefit analysis problem.
13. Be able to describe techniques available to place values on all costs and benefits/disbenefits.
14. Be able to explain the importance of sensitivity analysis and apply it.
15. Be able to formulate and design a Multi-attribute Utility theory model.
16. Be able to apply any of the non-compensatory models described in chapter nine.
17. Be able to compare and contrast compensatory and non-compensatory models.
18. Be able to construct a decision tree and use it to select an optimal strategy.
19. Be able to determine the veracity of descriptions pertaining to the multicriteria models: Simple Additive Weighting, Analytic Hierarchy Process and concordance techniques.
20. Be able to apply sensitivity analysis to the Simple Additive Weighting Method.
21. Be able to assign weights to the decision criteria for the Simple Additive Weighting Method.
22. Be able to compare and contrast the multicriteria models: Simple Additive Weighting, Analytic Hierarchy Process and concordance techniques.
23. Be able to describe the importance of criteria scoring systems for the Simple Additive Weighting Method.
24. Be able to formulate and apply the Simple Additive Weighting Method.
25. Be able to describe and explain Saaty's nine-point comparison scale.
26. Be able to formulate and apply the Analytic Hierarchy Process.
27. Be able to explain the definition and importance of a consistency index.
28. Be able to formulate and apply PROMETHEE and ELECTRE
29. Be able to explain preference and indifference.
30. Be able to critically assess journal articles.
31. Any additional objectives derived from student projects and contemporary issues.