

SYS ENG 6103 – SYSTEMS LIFE CYCLE COSTING

Summer 2020 - Course Syllabus

Catalog Description. Methods of economic evaluation for engineering projects involving complex systems. Economic impacts on choosing system alternatives, life cycle costing, economic decisions involving risk and uncertainty, and engineering cost estimation for projects in government, defense, and commercial industries. Prerequisite: Graduate standing.

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Please: (1) Start your subject line with: Sys Eng 6103,

(2) Remember to put your name and last name at the end of your email.

Phone: +90312 233 1369 (Office at Çankaya University, Dept. of Industrial Engineering, Ankara, Turkey)

Hours: Email and/or by appointment via email. Emailing me first with your questions will save us time.

If your questions turn out to be hard to explain in an email, we can set an appointment.

Please note the time difference. I am located in Ankara, Turkey, and eight hours ahead of Central Standard Time (CST) at this time of the year (as a reference: 4:00 p.m. in Missouri maps to 12:00 a.m. in Ankara).

Room and Meeting Time. Monday and Wednesday 4:00-6:30 p.m., CST

Course Overview. Most systems engineering activities are performed to support decision making of an organization, and economic analysis is a vital part of a decision process. For economic analysis, the decision process for evaluating a project should encompass all steps from the inception of the project, i.e., a problem is recognized and defined, and cover subsequent steps of generation of solution alternatives, estimation of costs and relevant cash flows, economic evaluation methods, selection and implementation of the best solution alternative, to its completion, i.e., post-implementation analysis and evaluation. This course will cover methods, processes, and tools needed to conduct economic analysis, estimation, and management from a life-cycle perspective of complex systems. The course will begin with introductory engineering economics and life-cycle costing concepts to provide a basic background knowledge for students without previous exposure to engineering economy and cost analysis, and refresh background knowledge for students who have familiarity with these concepts. Subsequently, more advanced topics to support analysis such as comparison of alternatives, breakeven and cost-benefit, sensitivity, and decision making involving risk and uncertainty will be presented. Costing of complex systems and parametric cost estimation will be presented in support of economic estimation. Cost as an independent variable and project management will be discussed to provide an understanding of cost management from a life-cycle costing perspective. Examples of engineering cost estimation/evaluation for projects in government and commercial industries will be used to present applicable concepts and methods of analysis.

Course Objectives. At the end of the course, the students will: understand what life-cycle cost analysis is, how it is achieved and its importance; develop skills to estimate costs, evaluate engineering projects using economic concepts and time value of money; acquire analytical techniques for economic justification of decisions for engineering projects; and understand the role of management in life-cycle costing.

Background Requirements and Software. Familiarity with basic probability, statistics, and mathematical modeling will be helpful. Students are expected to be able to use computers, Microsoft Excel and other Microsoft Office packages. Excel spreadsheets will be used to illustrate concepts and methods in decision making, which will help with understanding the course material and strengthen computer skills. Portable document format (PDF) will be used for lecture notes and other course materials. Your assignment submissions will also have to be in PDF format.

Textbooks.

- Farr, John Vail. 2011. *Systems Life Cycle Costing - Economic Analysis, Estimation, and Management*. CRC Press. ISBN: 978-1-4398-2891-5.
- Leland Blank, Anthony Tarquin. 2017. *Engineering Economy*. 8th Edition. McGraw-Hill. ISBN-10: 0073523437, ISBN-13: 978-0073523439.

Textbook by Dr. Farr is a great material for life-cycle costing, overview of the economic analysis, simulation, cost management and tools for engineering economic analysis, cost estimation of complex systems and management. It also has a nice Excel tutorial (in Appendix) on using spreadsheets for the purposes of this course. However, some methods along with their details, most of the classroom and practice exercises/problems on engineering economic analysis, risk, uncertainty, time-value of money, evaluation and comparison of alternatives will be provided through lecture slides, and outside materials will be mostly based on the second textbook listed above.

Course Requirements and Grading. All homework assignments and exams should be done individually; no collaboration is allowed. Assignment and due dates are given in the tentative list of topics in this syllabus. Late submissions will not be accepted. Students should, in addition, follow the other requirements listed under Submission Rules/Guidelines in this syllabus.

- **30% Homework.** There will be 2 homework assignments, each is 15%. Each homework will have some number of exercises/problems. Homework assignments will require you to use Microsoft Excel and/or some other software which will be mentioned during the class.
- **35% Midterm Exam.** There will be a single, take-home style, midterm exam, involving problems similar to those in homework assignments.
- **35% Final Exam.** There will be a comprehensive, take-home style, final exam, involving problems similar to those in homework assignments.

Submission Rules/Guidelines. Students will need to follow some other rules when submitting their work listed under Course Requirements and Grading in addition to those underlined therein.

- Submissions should be in PDF file format except for Microsoft Excel files. Both types of files should be submitted through Canvas.
- Filenames should start with the course code, your own name and a reference to the assignment, such as "SysEng6103_Doe_Jane_HW1..."
- Use 1 Excel sheet per 1 Exercise, and label sheet tabs with: Exercise#
- **Highlight answers in the Excel sheet**
- Use a spreadsheet with "live" formulae to implement the equations. Construct the formulas from their mathematical descriptions, do not use the prepackaged functions in Excel unless permitted in the assignment.

Grading Policy. The final (letter) grades will be assigned as follows. (Note that the following letter grades will be converted into a pass/fail grade by the system if the grade option change was requested.)

- A** 90% and above, i.e., for [90, 100],
- B** 80% and above up to 90%, i.e., for [80, 90),
- C** 70% and above up to 80%, i.e., for [70, 80),
- F** Below 70%, i.e., for [0, 70).

Regrading Policy. Requests for regrading of any assignment will only be accepted within one week after the grades are announced on Canvas. This means that it is your responsibility to request the graded assignment from the instructor via email within this one-week period and request for a regrading. To request a regrading, please write the instructor a concise explanation/argument of why you believe that there is a mistake regarding the previous grading and while doing so, you need to refer to the posted solutions of the assignments if applicable.

Makeup Policy. There will be no makeup for the homework. Exams may be considered for makeup with valid, verifiable, documented excuses. Students need to contact the instructor for requesting a makeup exam.

Course Topics. A tentative outline is given below and the instructor reserves the right to make changes as she sees necessary.

Session	Topics	Farr	B&T/other	Assignment/Exam
Jun 8	0. Course Introduction 1. Overview of Economic Analysis & Life-Cycle Costing	1, 4	Slides 1, 6	
Jun 10	1. Overview of Economic Analysis & Life-Cycle Costing 2. Time Value of Money & Economic Equivalence	1, 4 2	1, 6 1, 2, 3, 4, 14	
Jun 15	2. Time Value of Money & Economic Equivalence	2	1, 2, 3, 4, 14 Slides	
Jun 17	2. Time Value of Money & Economic Equivalence	2	1, 2, 3, 4, 14 Slides	HW 1 assigned
Jun 22	3. Breakeven and Payback Analysis	3	13	
Jun 24	4. Comparing Decision Alternatives	2	5, 6, 12	HW 1 due MT Exam assigned
Jun 29	4. Comparing Decision Alternatives	2	7, 8, 12	
Jul 1	5. Benefit/Cost Analysis and Public Sector Economics	2	9	MT Exam due
Jul 6	6. Depreciation Methods and Replacement Study	3	11, 16, 17.6	
Jul 8	7. Costing of Complex Systems, Work Breakdown Structure	6, 9	15	
Jul 13	8. Estimating Economic and Costs Elements: Cost Engineering Techniques	8	15	
Jul 15	8. Estimating Economic and Costs Elements: Statistical Techniques	8	Slides	HW 2 assigned
Jul 20	8. Estimating Economic and Costs Elements: Statistical Techniques	8	Slides	
Jul 22	9. Decision Making Involving Risk and Uncertainty	3	18, 19, Slides	HW 2 due Final Exam assigned
Jul 27	9. Decision Making Involving Risk and Uncertainty	3, 5	18, 19, Slides	
Jul 29	10. Project Management's Role in Life-Cycle Costing	12		Final Exam due

Attendance. The class attendance is not required, that is, no credit is associated with attendance. The lecture videos will be available for streaming only for distance section students. The lecture videos will not be available for streaming for on-campus students.

Class Communication. Class-related materials such as lecture slides, homework assignments and solutions, exam solutions, etc., as well as announcements will be posted on Canvas. Please make sure that you check the course page on Canvas and your emails frequently.

Academic Dishonesty. Please read through <http://registrar.mst.edu/academicregs>. If you conduct any dishonest act (for example: cheating on an exam, copying someone else's homework/exam, copying material from published and electronic sources without paraphrasing and/or citing appropriately), you will get a credit of 0 on that particular assignment (homework, exam) and further action may take place depending on the severity of the act. All academic dishonesty cases will be handled through Missouri University of Science and Technology.

Students with disabilities. If you have a documented disability and anticipate needing accommodations in this course, you are strongly encouraged to contact me early in the semester. You will need to request that the Disability Services staff send a letter to me verifying your disability and specifying the accommodation you will need before I can arrange your accommodation.

Other Links. Emergency Exists <http://designconstruction.mst.edu/floorplan/>, Honor code: <https://stuco.mst.edu/documents/honor-code/>, Student success center: <http://studentsuccess.mst.edu/>.

NOTE THAT EVERYTHING ON THIS SYLLABUS IS SUBJECT TO CHANGE. STUDENTS WILL BE NOTED ABOUT ANY CHANGE.