

Spring 2012
Department of Civil and Environmental Engineering
CEE 270 Systems Analysis & Economics for CE

Instructors:

Dr. Song Gao

Office: 214C Marston Hall

Office phone: 545-2688

Email: sgao@engin.umass.edu

Office Hours: Tuesdays 1:00-5:00 (no appointment needed); email for meetings outside office hours

Bernd F. Schliemann, P.E.

Office: 126 Marston Hall

Office phone: 545-6251

Email: bfschliemann@ecs.umass.edu

Office Hours: Mondays 1:00-5:00 (no appointment needed); email for meetings outside office hours

Teaching Assistants:

John Barry, Civil & Environmental Engineering, jabarry@student.umass.edu

Office Hours: Wednesdays 12:30-2:30 (no appointment needed) at 214 Marston Hall; email for meetings outside office hours

Tomer Soran, Civil & Environmental Engineering, tomer.soran@gmail.com

Office Hours: Tuesdays 3:00-4:00 (no appointment needed) at 214 Marston Hall; email for meetings outside office hours

Engineering Science Credits: 2

Engineering Design Credits: 1

Required or Elective course: Required Course

Catalog Description:

Introduction to decision making techniques used in Civil and Environmental Engineering. Develop and solve mathematical models for optimizing engineering systems. Use basic economic concepts to make decisions between alternative engineering designs. Incorporate environmental sustainability and social issues into engineering decisions.

Pre-requisites: CE-ENGIN 121, Math 131.

Credit Hours: 3

Textbook(s) and/or other required material:

1. Blank, L. and Tarquin, A. (2005 or 2012) *Engineering Economy*, 6th or 7th Edition, McGraw-Hill Higher Education, Boston. (B&T)

2. Chapters 1, 2, 3, 4, 8, 9 and 15 of Hillier, F. S. and Lieberman, G. J. (2010) *Introduction to Operations Research 9th Edition*, McGraw-Hill Higher Education, Boston, is available as a custom textbook at the Textbook Annex. (H&L)

Attendance policy: All students are expected to attend all classes and to be at class on time. Poor attendance will negatively affect your grade.

Academic honesty policy: The UMass Academic Honesty Policy applies and can be found at http://www.umass.edu/dean_students/codeofconduct/acadhonesty/. The policy covers plagiarism, cheating, fabrication, and facilitating dishonesty.

Assessment Methods (grading and instructor feedback):

| | |
|---|------------|
| Attendance / class participation | 10% |
| 2 midterm exams (in class) | 50% |
| Final exam (during the final exam period) | 25% |
| Homework | <u>15%</u> |
| | 100% |

Homework:

Weekly homework assignments and the solution keys will be posted on the course Moodle website. Homework will be collected at the beginning of class on the due date (usually Thursdays). Sometimes you will be asked to submit homework through Moodle. The instructions for submission are listed at the beginning of each homework assignment. Please read them carefully. The lowest two scores will be dropped.

Unless the assignment specifies otherwise, you must work individually. Homework will be graded by the teaching assistants. Credit will be deducted for homework that does not clearly show the process used to arrive at a solution.

Exams:

Exams are non-cumulative. Exams must be taken at the regularly scheduled times except under extreme circumstances. Exams will be graded by the instructor.

Course Performance Indicators (CPI's):

| |
|--|
| 1. I am able to solve a 2D linear programming problem graphically. |
| 2. I am able to formulate and solve a linear programming model for a resource allocation problem. |
| 3. I am able to formulate and solve a linear programming model for a transportation problem. |
| 4. I am able to formulate and solve a project scheduling problem using the critical path method (CPM). |
| 5. I am able to formulate and solve a decision analysis problem under uncertainty. |
| 6. I am able to use the present worth method to select an engineering project. |
| 7. I am able to use the benefit/cost method to select an engineering project. |
| 8. I am aware of a civil engineer's professional and ethical responsibility |

Program Outcomes from ABET Criterion 3– (a-k) addressed in the course:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility

Mapping of Course Performance Indicators to Program Outcomes:

| <u>CPI's</u> | <u>ABET (a-k) Mappings</u> |
|---------------------|-----------------------------------|
| 1 | a,e |
| 2 | a,e |
| 3 | a,e |
| 4 | a,e |
| 5 | a,e |
| 6 | a,e |
| 7 | a,e |
| 8 | f |

Course Website (Moodle):

<https://moodle.umass.edu/> (log in using netID and password, then navigate to course)

Email:

Email addresses listed on SPIRE will be used to compile a class list. It is your responsibility to check your email regularly to avoid missing any important announcements.

Microsoft Excel Access and Tutorial:

The course requires the use of Microsoft Excel Solver to solve homework assignment problems. It is the student's responsibility to get access to Excel, either through personally owned software or university/college computer classrooms. Excel Solver is an add-in of Excel. It is part of the Excel package for the Windows version. It is not part of the Excel package for the Mac version, but can be downloaded freely at <http://www.solver.com/mac/>. Depending on the demand, one or more tutorials will be run by the instructor or the teaching assistants to help students familiarize themselves with the software.

Other References (for engineering economics)

For an online learning center see http://highered.mcgraw-hill.com/sites/0072918632/student_view0/ (6th Edition) or http://highered.mcgraw-hill.com/sites/0073376302/student_view0/index.html (7th Edition); the website offers learning objectives for each chapter, a chapter overview, spreadsheet exercises, and quizzes. Links are on the left side of the screen and you will not need to log into the website.

You can find a set of practice quiz questions for another engineering economy textbook at http://www.oup.com/us/companion.websites/9780195335415/student_resources/?view=usa. Click "Practice Quiz" on the left side of the screen and then choose a chapter.

Schedule and Reading Assignments by Week:

| Date | Outcome | Reading |
|--------------|--|--|
| 1/24 1/26 | Prepare cash flow tables and cash flow diagrams. Calculate the equivalent present worth (P), equivalent future worth (F), and equivalent uniform annual series (A) for engineering projects. | B&T 1.1-2.3 |
| 1/31 2/2 | Calculate arithmetic and geometric gradient series, and capital costs using present worth analysis for engineering projects. | B&T 2.5-2.6, 5.1-5.3, 5.5 |
| 2/7 2/9 | Given projects with different cash flows, recommend one alternative over another, using annual worth, capital recovery, and benefit/cost analysis. Evaluate the effects of varying parameters using breakeven analysis. | B&T 6.1-6.4, 9.1-9.4, 13.1-13.2 |
| 2/14 2/16 | Account for inflation and depreciation in project analysis. Understand how engineers estimate costs for a project. Sensitivity analysis. Engineering ethics. | B&T 14.1-14.2, 16.1- 16.6 |
| 2/21 2/23 | 2/21 Exam 1 Introduction to optimization problems in engineering. Prototype example. | H&L 1-26 (1-26) |
| 2/28 3/1 | Solve 2-D linear programming (LP) problems graphically. LP problem examples. HW4 due. | H&L 27-42 (27-42) H&L 42-60 (42-60) |
| 3/6 3/8 | Formulate and solve (using EXCEL) LP problems. Understand the main features of the simplex method. HW5 due. | H&L 60-68 (60-68) H&L 89-94 (89-94) |
| 3/13 3/15 | Sensitivity analysis. Use EXCEL Solver output to determine model sensitivity. Formulate and solve transportation problems. HW6 due. | H&L 129-137 (129-137) H&L 162-177 (304-319) |
| 3/27 3/29 | Formulate and solve network optimization problems. 3/29 Exam II | H&L 216-247 (358-389) |
| 4/3 4/5 | Formulate and solve network optimization problems (cont.) Formulate and solve integer and binary optimization problems. HW7 due. | H&L 216-247 (358-389) Handout |
| 4/10 4/12 | Formulate and solve integer and binary optimization problems (cont.) Use the critical path method (CPM) to schedule projects. HW8 due. | Handout H&L 257-264 (399-406) |
| 4/19 | (4/17 Monday schedule – no class) Use LP to schedule projects. HW9 due. | H&L 264-268 (406-410) |
| 4/24 4/26 | Introduction to decision analysis. Bayes' theorem. Use decision tree to organize and solve staged probabilistic decision problems. HW10 due. | H&L 282-291 (672-681) H&L 296-300 (686-690) |
| 5/1 | Value of experimentation and perfect information. HW11 due. | H&L 294-295 (684-685) |

Note: The page numbers for H&L refer to the custom textbook, not the original book. The page numbers in the original book are in the parentheses.

Prepared by: Song Gao & Bernd F. Schliemann

Date: 2/28/2012