ERE465/665: Environmental Systems Engineering

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OFFICE HOURS:	Days before homework is due and by appointment	
LECTURES:	Mon/Wed: 9:05 am – 10:25 am	Baker 437

RECOMMENDED TEXTS: *Civil and Environmental Systems Engineering,* Revelle, Whitlatch, and Wright. Any edition is fine with me.

Water Resources Systems Planning and Management: *An introduction to methods, models and applications* by D.P. Loucks and E. Van Beek, available for **free** in pdf form from http://unesdoc.unesco.org/images/0014/001434/143430e.pdf

Throughout the semester readings will be distributed electronically

PREREQUISITES: At least 1 calculus course
At least 1 probability and statistics course (can be concurrent)
Working knowledge of Excel
[Knowing computer programming may be helpful, it is not essential for this course.]

COURSE SOFTWARE: In this course we will primarily use two software packages: Excel and R. In Excel, we will use the SOLVER, an optimization package built into EXCEL. R is a language and environment for statistical computing and graphics. We will use multiple computing packages within the R environment.

GRADING:

Exam 1:	Tentative Date => October 7	25%
Exam 2:	Tentative Date => During Finals Time Slot	25%
Homework Assignments		30%
Course Projects and Presentations		20%

Note: Exam and project formats will be discussed later in the semester

Course Objectives:

This course will introduce students to mathematical models and methods to aid in management and decision making. These techniques can be applied to many different engineering and non-engineering situations, and class applications will involve a variety of environmental resources (water, forest, etc.), as well as issues with model calibration. The course will focus primarily on three subject areas:

- Engineering economic methods to compare competing alternatives with varying benefits and costs over time,
- Optimization techniques for developing improved planning and management strategies, as well as model calibration, and
- Decision theory and techniques given risk and uncertainty in the decision making process.

Program Learning Objectives:

By the end of the semester students should be able to:

a) Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (ABET Outcome 1)
b) Analyze and interpret data and use engineering judgment to draw conclusions (ABET Outcome 6)

College Learning Outcomes: This course will contribute to students achieving the following College-wide learning outcomes:

a) Quantitative Reasoning: Students will be able to effectively describe, interpret, apply, and evaluate quantitative information.
b) Technological and Information Literacy: Students will be able to: use critical thinking skills to determine the information needed to solve a problem, access information using appropriate technologies, and effectively and appropriately use information to accomplish a specific purpose.
c) Critical Thinking: Students will be able to: identify, analyze, evaluate, and develop well-reasoned arguments.

Academic Dishonesty:

Academic dishonesty is a breach of trust between a student, one's fellow students, or the instructor(s). By registering for courses at ESF you acknowledge your awareness of the ESF Code of Student Conduct (https://www.esf.edu/students/handbook/documents/19-20%20Student%20Handbook.pdf), in particular academic dishonesty includes but is not limited to plagiarism and cheating, and other forms of academic misconduct. The Academic Integrity Handbook contains further information and guidance (https://www.esf.edu/provost/documents/AcademicIntegrity.pdf). Infractions of the academic integrity code may lead to academic penalties as per the ESF Grading Policy (https://www.esf.edu/provost/documents/GradingPolicy.11.12.2013.pdf)

While we don't discourage students discussing problems from the homework, we do discourage students from working entirely with others, and handing in assignments that are replicas of other student's submissions. Such submissions will be considered a breach of academic integrity and will be addressed according to university guidelines. The homework assignments are designed to help you understand and synthesize the course material.

I would encourage you to:

1. ALWAYS attempt every problem on the assignment on your own before coming to office hours or discussing problems with other students. Office hours are not a place to sit and do your entire assignment. You should come with questions.
2. If possible, come to office hours for help. While your fellow students are awesome, the TA and I generally know the material and can explain it better than your fellow students can.
3. If you work with others, you should:
    a. Avoid going problem-by-problem through the assignment with others.
    b. Always provide your own write-up and discussion.
    c. Never copy another student's work line-for-line.
    d. Indicate at the top of your assignment who you have worked with on the assignment.

Ultimately, academic integrity is a core value of our educational institution.

Sources of Support and Class Absence:
If you experience academic or personal difficulties that affect your studies or life, there are people and resources that will help you. There is a website that serves to answer many student questions: http://www.esf.edu/students/success. In addition, the ESF Office of Student Life, 110 Bray Hall (470-6660) will provide academic support, career guidance, personal counseling, or direct you to the proper source of help. If you encounter a situation beyond your control in which you will be missing 3 or more days of classes, you should contact the Office of Student Life and they will get in touch with all your instructors for you. Supportive documentation may be required.

Accommodations for Students with Learning and Physical Disabilities:
SUNY-ESF works with the Office of Disability Services (ODS) at Syracuse University, who is responsible for coordinating disability-related accommodations. Students can contact ODS at 804 University Avenue- Room 309, 315-443-4498 to schedule an appointment and discuss their needs and the process for requesting accommodations. Students may also contact the ESF Office of Student Affairs, 110 Bray Hall, 315-470-6660 for assistance with the process. To learn more about ODS, visit http://disabilityservices.syr.edu. Authorized accommodation forms must be in the instructor's possession one week prior to any anticipated accommodation. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible.

Inclusive Excellence Statement:
As an institution, we embrace inclusive excellence and the strengths of a diverse and inclusive community. During classroom discussions, we may be challenged by different ideas. Understanding individual differences and broader social differences will deepen our understanding of each other and the world around us. In this course, all people are strongly encouraged to respectfully share their unique perspectives and experiences. This statement is intended to help cultivate a respectful environment, and it should not be used in a way that limits expression or restricts academic freedom at ESF.

Religious Observance:
ESF protects the rights of students to observe religious holy days according to their tradition. Students will be provided an opportunity to make up any exam or work requirements that may be missed due to a religious observance provided they give the instructor reasonable advance notification.

Tentative Course Outline:

Comparative Economics (15% of Course): Economic methods to compare competing alternatives with varying benefits and costs over time. Topics include:

- Cash Flows, Interest, and Equivalence
- Nominal and Effective Interest Rates
- Net Present Worth and Annual Worth Analyses
- Benefit-Cost Ratio Analyses

Optimization (75% of Course): Systems analysis and numerical methods techniques, including unconstrained and constrained linear and constrained linear and nonlinear optimization. Topics include:

- General Unconstrained and Constrained Optimization
- Lagrange Multipliers
- Linear Programming
- Advanced Search Techniques (Simulated Annealing, Genetic Algorithms, etc.)
- Modern Heuristic Search Techniques
- Multi-Objective Optimization

Decision Theory (10% of Course): Techniques for examining decisions given system risk, uncertainty and probabilistic outcomes, considering tradeoffs between decision criteria and the use of forecasts to aid in decision making. Topics include:

- Decision Theory, Risk and Uncertainty
- Decision Criteria in Absence of Probabilities (Expected Return, Minimax Regret, etc.)
- Sequential Decision Making and Decision Trees
- Value of Information