Fall 2015

Water Resources Systems Analysis - University of Texas San Antonio

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CE 5703 – Water Resources Systems Analysis - Fall 2015

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MW 7:30 - 08:45pm – Classroom: BSE 2.208

Office hours: MW 10:30am - 12:00pm, or by appointment.

Overview: Systems Analysis methods use algorithmic and mathematical approaches for problem-solving. These are powerful methods that can be applied to solve complex design and management problems for water resources systems and other engineering areas. This class will focus on optimization methods, such as linear programming, integer programming, nonlinear programming, genetic algorithms, and dynamic programming, and their application to water resources systems. Advanced Systems Analysis methods, including sensitivity analysis, alternatives generation, and multi-objective optimization will be introduced to address the complexities associated with public sector decision-making.

Course Objectives: To achieve the course objectives, the student will complete assignments, projects and readings, and engage in discussions to complete the following:

- Define and describe optimization methods (linear programming, integer programming, nonlinear programming, genetic algorithms, and dynamic programming) and advanced systems analysis tools (sensitivity analysis, alternative solutions generation, multi-objective optimization).
- Examine the challenges of using Systems Analysis for water resources systems
- Investigate and analyze how others have formulated optimization models for water resources systems problems and applied Systems Analysis to solve them.
- Formulate optimization models from word problems.
- Solve test problems using Systems Analysis methods.
- Apply optimization and advanced methods to solve water resources systems problems.

Prerequisites:

No formal pre-requisites, although knowledge on computer programing and water resources modeling is desirable.

Textbook(s) and/or Required Material:

- No formal textbook is required. Articles and other material readings will be provided throughout the semester.

Alternative Texts:

- Water Resources Systems Analysis through Case Studies: Data and Models for Decision Making. Edited by David W. Watkins, Jr. sponsored by Task Committee on Environmental and Water Resources Systems Education, Environmental and Water Resources Institute, American Society of Civil Engineers. ISBN 978-0-7844-1287-9 (paper) – ISBN 978-0-7781-6 (ebook).

- Loucks, Daniel P. and Eelco van Beek, Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications, UNESCO, Paris, 2006. Free download online.
- Charles Revelle and Arthur McGarity, Design and Operation of Civil and Environmental Engineering Systems, ISBN: 978-0-471-12816-8
- Larry W. Mays and Yeou-Koung Tung, Hydrosystems Engineering and Management, ISBN 1-887201-32-7

Topics Covered:

1. Introduction to water resources systems analysis
2. Basics on computer programming (Matlab, Java)
3. Linear Programming
4. Integer Programming
5. Nonlinear Methods
6. Dynamic Programming
7. Evolutionary Algorithms

Relationship to Civil Engineering Program Outcomes (PO):

This course contributes to the following program outcomes:

a. Ability to apply knowledge of mathematics, science, and engineering. (E)

c. Ability to design a system, component, or process to meet desired needs. (E)

e. Ability to identify, analyze, and solve engineering problems. (E)

k. Ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)

Contribution of Course to Professional Education:

This course prepares students to practice the design of hydraulic structures.

Evaluation Methods:

Homework Assignments (25% of final grade):

For each main topic, students will be assigned a computational homework. This will involve implementing systems analysis methods using a computing language, conceptual exercises, and writing exercises.

Reading and Writing Assignments (25% of final grade):

Each week, a required reading will be assigned and posted on Blackboard. Students are required to post on blackboard a . As the semester progresses, students may select articles for this assignment.

Class Project (50% of final grade):

A major part of the course will be a class project. Students will study a water resources planning or management problem to which they will apply systems analysis methodologies. Students may propose their class project or may work with Dr. Giacomoni to formulate the project. The problem statement will be formulated mathematically and solved using optimization methods.

Key Milestones:

- Presentation and Written Proposal: Problem Statement / Scope (Feb 26th 2014)
- Presentation and Written Report: Preliminary Results (April 2nd 2014)
- Presentation and Written Report: Final Results and Recommendations (May 7th 2014)

Letter grades: **A ≥ 90%, B 80 to 89.99%, C 70 to 79.99%, D 60 to 69.99%, F ≤59.99%**

Course Content:

Math/Basic Science: 1 Credit

Engineering Design: 2 Credits

Please, refer to the link http://provost.utsa.edu/syllabus.asp for information concerning disability services, the academic dishonesty policy, and other important issues.

The Calendar and syllabus may be modified to fit the needs of the class and progress. Anyone having special needs will be accommodated, please talk to Dr. Giacomoni, at the beginning of the semester at marcio.giacomoni@utsa.edu, ext.6922, or BSE 1.346