CIV ENGR 416: Water Resource Systems – Optimization and Simulation

Tuesday and Thursday 11:00 – 12:15. 3 credits

Instructor: Dr. Paul Block
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Office Hours:by appointment

Course Description:
This course presents a variety of systems analysis techniques for water resources planning and management. Deterministic and stochastic optimization and simulation models will be developed and applied. Problems addressed include water supply, water quality, and river basin development.

Course Learning Outcomes:
By the conclusion of the course, students should be able to:
   a) characterize planning, design, and management objectives in water systems
   b) understand optimization and simulation concepts and modeling
   c) formulate, design and solve optimization models of water systems
   d) integrate systems outputs into decision-making
   e) understand the fundamentals of economic theory as applied to water resources
   f) understand current issues in water resource management

Pre-requisites: Hydrology and Statistics (preferred)

Texts:
Water Resource Systems Planning and Management: An Introduction to Methods, Models and Applications, Loucks and van Beek. Free online at:
http://hdl.handle.net/1813/2804

Practical Optimization: A Gentle Introduction, Chinneck. Free online at:
http://www.sce.carleton.ca/faculty/chinneck/po.html

Water Resources Economics: The analysis of scarcity, policies and projects, Griffin. Available through UW library: http://search.library.wisc.edu/catalog/ocm68176078

Notes:
Lecture power-points will be posted to the course website.

Evaluation:		**Expected Grade Breaks:**	
Participation:	5%	A: 100-92	AB: 92-88
Homework:	35%	B: 88-82	BC: 82-78
Reflections:	10%	C: 78-70	
Final Project:	50%	D: 69-60	
		F: 59-0	

Participation:
Parts of the course will include group work, class discussion, and role-playing, thus participation will be critical to advance the learning objectives. All students are expected to regularly participate, in a reasonable manner, during each session. Clearly, attendance is required for full participation.

Homework:
Homework will be assigned throughout the course and typically due 2 weeks later. It will be posted on the course website, and will include creative problem solving, computer modeling, and critical thinking.

Reflections:
Students are expected to come to class having completed the assigned readings, ready for discussion. In addition to this, each student must complete reflections for three (3) readings as assigned, and submit a one-half to one page document reflecting and commenting on the reading. This should *not* be a summary of the reading but rather your impressions and conclusions. Reflections are due on the assigned day of the reading. Readings or links to readings will be posted on the course website.

Final Project:
Students will complete a final project in small groups (2-3), culminating in a presentation. Projects must encompass aspects of the course materials presented. Topic ideas and project expectations will be posted on the course webpage early in the term. Other topics may be selected with the instructor's consent. Various deadlines (topic selection, prospectus, etc.) will need to be met. More details will be given in class.

Course Outline:

Date	Topic	Reading*		Assign. Due
Jan 20	Introduction to Systems & Models	1		
Jan 22	Problem formulation	2	1	
Jan 27	Simulation modeling	3,7		
Jan 29	Optimization - concepts	3		
Feb 3	Linear programming - formulation	4.5	2	HW1
Feb 5	LP - simplex		3	
Feb 10	LP - simplex		4	Reflection1
Feb 12	LP - solving		5	
Feb 17	LP - solving		5	
Feb 19	LP - sensivity analysis		6	HW2
Feb 24	Non-linear programming	4.3	16	
Feb 26	Non-linear programming	4.3	16	Reflection2
Mar 3	Dynamic programming	4.4	15	
Mar 5	*no class - AWRA conf*			
Mar 10	Dynamic programming	4.4	15	HW3
Mar 12	Stochastic optimization	8.4,8.5		
Mar 17	Stochastic optimization	8.4,8.6		Reflection3
Mar 19	Sensitivity and uncertainty analy.	9		
Mar 24	Sensitivity and uncertainty analy.	9		Prospectus
Mar 26	Guest lecture			HW4
Apr 7	Decision analysis	10		
Apr 9	Decision analysis	10		
Apr 14	Economics	HO		
Apr 16	Economics	HO		
Apr 21	Conflict resolution	HO		HW5
Apr 23	Conflict resolution	HO		
Apr 28	Conflict resolution	HO		
Apr 30	Wicked problems	HO		
May 5	Final presentations			Project Rpts
May 7	Final presentations			

* First *Reading* column = Loucks book; second *Reading* column – Chinneck book.
** Readings for *Reflections* will be provided in advance of the due date.

Academic Policies:

Class Attendance:
You are expected to attend all lectures and lab sessions. In the event that you will be absent, please email me *in advance* as a courtesy. You will also be responsible for obtaining notes, etc. from a classmate.

Non-discriminating Environment:
The UW-Madison is committed to creating a dynamic, diverse, and welcoming learning environment for all students and has a non-discrimination policy that reflects this philosophy. Disrespectful behavior or comments addressed toward any group or individual, regardless of race/ethnicity, sexuality, gender, religion, ability, or any other difference is deemed unacceptable in this class, and will be addressed by the professor.

Academic Integrity:
As a UW-Madison student, you have the right to expect that you and other students will be graded fairly. You also have an obligation to conduct your academic work with honesty and integrity according to University standards. Academic honesty requires that the coursework you present to the professor honestly and accurately represent you own academic efforts. Work submitted under a student's name must be solely the work of that student and be carried out as prescribed by the professor. Additional information from the Dean of Students is available online: http://students.wisc.edu/doso/acadintegrity.html

Students with Disabilities:
If you need accommodations for a physical or learning disability, please see me. The McBurney Disability Resource Center (http://www.mcburney.wisc.edu) is available for consultation, diagnosis, and assistance.

The instructor reserves the right to modify this syllabus as circumstances warrant.