Course Syllabus

CE/SSE 4760 – Optimization Methods and Applications

College of Engineering

Spring 2013

Instructor Information

Instructor:	David Watkins, PhD
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Office Hours:	T 11-12, W/Th 1-2, or by appt.

Course Identification

Course Number:	CE/SSE4760
Course Name:	Optimization Methods and Applications
Course Location:	EERC 227
Class Times:	MWF 10:05pm – 10:55pm
Prerequisites:	(MA 2320 or MA 2321 or MA 2330) and (MA 2720 or MA 3710)

Course Description

This course introduces students to optimization and decision analysis techniques and tools. Students apply fundamentals of linear programming, integer programming, dynamic programming, nonlinear programming, and multi-objective programming to real-world problems with a focus on decision making in service systems and civil engineering. Adaptive decision making techniques including decision trees, Bayesian analysis, and stochastic optimization methods are also introduced. Problems and case studies will require the use of spreadsheets and math programming software.

Course Learning Objectives

By the end of this course, you should have:

- Improved problem-solving skills.
- A fundamental understanding of basic optimization algorithms.
- The ability to recognize when optimization may be useful.
- The ability to "do" optimization in an engineering setting: Formulate problems, generate solutions, interpret results, and evaluate tradeoffs.
- The ability to use computer models to solve problems.

Course Resources

Course Website(s)

- Canvas < http://www.courses.mtu.edu >
- Textbook < http://www.sce.carleton.ca/faculty/chinneck/po.html >

Required Course Text

- *Practical Optimization: A Gentle Introduction*, by John W. Chinneck, 2010. Available on-line at http://www.sce.carleton.ca/faculty/chinneck/po.html

Grading Scheme

Letter Grade	***Percentage***	***Grade points/credit***	***Rating***
A	> 92%	4.0	Excellent
AB	87– 92%	3.5	Very good
B	82 – 87%	3.0	Good
BC	77– 82%	2.5	Above average
C	72 – 77%	2.0	Average
CD	67 – 72%	1.5	Below average
D	60 - 67%	1.0	Inferior
F	< 60%	0.0	Failure
I	Incomplete; given only when a student is unable to complete a segment of the course because of circumstances beyond the student's control. A grade of incomplete may be given only when approved in writing by the Dean.		
X	Conditional, with no grade points per credit; given only when the student is at fault in failing to complete a minor segment of a course, but in the judgment of the instructor does not need to repeat the course. It must be made up within the next semester in residence or the grade becomes a failure (F). An "X" grade is computed into the grade point average as an "F" grade.		

	%
Homework	35
Project/Case Study	15
Mid-term exam	25
Final exam	25

Late Assignments

Late assignments will be accepted up to one week after the due date. If you know an assignment will be completed late, please notify the instructor as soon as possible to make arrangements for the late submittal. If no prior arrangement is made, a deduction of 20% per day will be applied.

Course Policies

Regular class attendance is expected. Please inform the instructor in the event of illness or other reason for missing class, and obtain notes from a classmate if possible.

Collaboration/Plagiarism Rules

Consultation and "good faith" collaboration are encouraged on course homework assignments and case studies. Each student is to make an honest effort to contribute fairly in any collaboration.

Cell phones, Blackberries, iPods, PDAs, or any other electronic devices are not to be used in the classroom. Calculators may be used, but calculators on other devices are strictly prohibited. Information exchanges on these devices during class are also prohibited and violate the Academic Integrity Code of Michigan Tech.

University Policies

Academic regulations and procedures are governed by University policy. Academic dishonesty cases will be handled in accordance the University's policies.

If you have a disability that could affect your performance in this class or that requires an accommodation under the Americans with Disabilities Act, please see the instructor as soon as possible so that appropriate arrangements can be made. The Affirmative Action Office has asked that you be made aware of the following:

Michigan Tech complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990. If you have a disability and need a reasonable accommodation for equal access to education or services at Michigan Tech, please call the Dean of Students Office, at 487-2212. For other concerns about discrimination, you may contact your advisor, department head or the Affirmative Action Office, at 487-3310

Academic Integrity:
http://www.studentaffairs.mtu.edu/dean/judicial/policies/academic_integrity.html

Affirmative Action: http://www.admin.mtu.edu/aao/

Disability Services:
http://www.admin.mtu.edu/urel/studenthandbook/student_services.html#disability

Equal Opportunity Statement: http://www.admin.mtu.edu/admin/boc/policy/ch3/ch3p7.htm

Course Schedule

Week	Date	Topic	Reading / Assignment
1	M, 1/14	Introduction	Ch. 1
	W, 1/16	Objectives, Constraints & Calculus	
	F, 1/18	Lagrange Multipliers	***Hw. 1***
2	M, 1/21	*No Class - Martin Luther King Day*	
	W, 1/23	Introduction to Linear Programming (LP)	Ch. 2
	F, 1/25	Formulating Linear Programs	Sections 1-2 of *Brown & Dell*
3	M, 1/28	LP Simplex Method	Ch. 3, ***Hw. 2***
	W, 1/30	LP Simplex Method	Ch. 4
	F, 2/1	Solving General LPs	Ch. 5
4	M, 2/4	LP Sensitivity Analysis	Ch. 6
	W, 2/6	LP Duality	Ch. 7
	F, 2/8	*No Class – Winter Carnival*	
5	M, 2/11	LP Applications	Ch. 7, ***Hw. 3***
	W, 2/13	LP Software	
	F, 2/15	LP Models	
6	M, 2/18	Introduction to Networks	Ch. 8
	W, 2/20	Network Flow Programming	Ch. 10
	F, 2/22	PERT for Project Planning & Scheduling	Ch. 11
7	M, 2/25	Integer Programming (IP)	Ch. 12, ***Hw. 4***
	W, 2/27	Mixed Integer Programming (MIP)	Ch. 13
	F, 3/1	IP/MIP Applications	
8	M, 3/4	Review, Q&A	
	W, 3/6	**Midterm Exam** (TBA)	
	F, 3/8	*No class*	
9	M, 3/18	Heuristic Methods	Ch. 14
	W, 3/20	Heuristics Applications	
	F, 3/22	Dynamic Programming (DP)	Ch. 15, ***Hw. 5***
10	M, 3/25	DP Applications	Ch. 15
	W, 3/27	Nonlinear Programming (NLP)	
	F, 3/29	NLP Algorithms	
11	M, 4/1	NLP Software	***Hw. 6***
	W, 4/3	NLP Applications	
	F, 4/5	Multi-Objective Decision Models	
12	M, 4/8	Probability & Statistics Review	
	W, 4/10	Bayesian Analysis	
	F, 4/12	Decision Trees	

Course Schedule (continued)

Week	Date	Topic	Reading / Assignment
13	M, 4/15	Decision Analysis Applications	***Hw. 7***
	W, 4/17	Stochastic Programming	
	F, 4/19	Stochastic Programming	
14	M, 4/22	Project Presentations	
	W, 4/24	Project Presentations	
	F, 4/26	Wrap Up & Review	
15		FINAL EXAM (TBA)	

Important Dates

1/23	Last day to drop full semester courses with a refund Last day to add full semester courses or change a section
2/1	Last day to drop full semester courses without a grade appearing on the academic record - No Refund
3/29	Last day to drop full semester courses with a grade of 'W'