IME 3110: INTRODUCTION TO OPERATIONS RESEARCH

Course Syllabus; Spring 2011; M/W/F 11:30-12:20pm; Room C0227

2009-2010 Catalog Description: The development of mathematical concepts and models concerned with industrial engineering problems. Topics include queuing theory, linear and dynamic programming. Prerequisite: IME 2610, IME 2620.

Credit/Contact Hrs: This is a 3 credit hour required course in the IEE Program and is scheduled for 3 contact hours/week.

Course Coordinator and Instructor: Dr. Azim Houshyar, Professor, 219-E Parkview Campus
Phone: 276-3363; E-mail: Houshyar@wmich.edu; Course Webpage: http://homepages@wmich.edu/~houshyar

Office Hours: Mondays: 1:00-4:00 pm

Textbook: *Introduction to Operations Research, 9th edition;* Hillier & Lieberman; McGraw-Hill 2009.

References: *Operations Research, 4th edition;* Wayne L. Winston, Duxbury Press, 2004.

Software: *WinQSB v. 2.0: Decision Support Software;* Yih-Long Chang, Wiley, 2003.

Evaluation: Your final grade will be based on the following:

1.	*Quiz*	*15%*
2.	*Assignment/Case Studies/Active Class Participation*	*12%*
3.	*Portfolio*	*3%*
4.	*Term Project*	*10%*
5.	*Tests (2)*	*40% (2x20%)*
6.	*Final*	*20%*

Grading Scale:

93 - 100	A	88 - 92	BA
83 - 87	B	78 - 82	CB
73 - 77	C	68 - 72	DC
60 - 67	D	Below 60	E

Professional Component: This course addresses ABET Criterion 4 (EAC) requirements for professional component as follows:

a) *College-level math, basic science:*	*0 %*
b) Engineering topics (engineering science and design):	*3 credits or 100%*
c) General education:	*0%*

Course Learning Objectives: By the end of semester the student should be able:

1. *To appropriately formulate Linear Programming models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these LP problems.*
2. *To appropriately formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems.*
3. *To appropriately formulate Integer Programming models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these IP problems.*
4. *To appropriately formulate Queuing models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Queuing problems.*
5. *To interpret and apply the results of an operations research model.*
6. *To communicate the results of an operations research project through a written report and an oral presentation.*

Performance Criteria (Learning Outcomes): The student should be able to:

Course Objective 1: Formulate and solve Linear programming Problems:

1.1. Identify a Linear Programming Problem.
1.2 Use graphical method to solve simple LP
1.3 Use Simplex Method to solve general LP
1.4 Perform Sensitivity Analysis on LP
1.5 Model and solve Transportation Problem, Transshipment Problem, and Assignment Problems.

Course Objective 2: Formulate and solve Network Problems:

2.1 Model and solve Maximum Flow Problems, Minimum Spanning Tree Problems, Shortest Path Problems, and a Minimum Cost Network Flow Problems.
2.2 Model and solve Project Networks using CPM/PERT.

Course Objective 3: Formulate and solve Integer Programming (IP) Problems:

3.1 Identify a IP Problem.
3.2 Use graphical method to solve simple IP
3.3 Use Basic Branch & Bound Method for IP Problems.

Course Objective 4: Determine performance measures for basic queuing problems using appropriate closed form equations

Course Objective 5

5.1 Work in teams to complete projects or case studies
5.2 Present brief written reports summarizing the important results and conclusions of an OR study
5.3 Present brief oral presentations.

Relationship to IME Program Educational Objectives/Student Learning Outcomes:

This course provides significant support for the following IME program outcomes:

Course Objectives	Performance Criteria[1]	ABET-EAC Outcomes[2]
To appropriately formulate Linear Programming models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these LP problems.	**E2**. Uses tools to optimize product designs.	**E***: An ability to identify, formulate, and solve engineering problems.
To appropriately formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems.	**A2**. Uses appropriate engineering, science, and mathematical tools for decision making (OR, statics, materials). .	**A***: An ability to apply knowledge of mathematics, science, and engineering.
To appropriately formulate Integer Programming models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these IP problems.	**A2**. Uses appropriate engineering, science, and mathematical tools for decision making (OR, statics, materials). .	**A**: An ability to apply knowledge of mathematics, science, and engineering.
To appropriately formulate Queuing models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Queuing problems.	**A2**. Uses appropriate engineering, science, and mathematical tools for decision making (OR, statics, materials).	**A**: An ability to apply knowledge of mathematics, science, and engineering.
To interpret and apply the results of an operations research model.	**A2**. Uses appropriate engineering, science, and mathematical tools for decision making (OR, statics, materials).	**A**: An ability to apply knowledge of mathematics, science, and engineering.
To communicate the results of an operations research project through a written report and an oral presentation.	**G3**. Presents information in writing that is well-organized, addresses objectives, and meets required standards of grammar and language rules.	**G**: An ability to communicate effectively.

[1]**Performance Criteria:** IME performance criteria may be found at http://www .wmich.edu/ime
[2]**ABET/TAC Outcomes:** Outcomes may be found at http://www.abet.org/
***Tracked to course notebook.

Attendance Policy:

Attendance is mandatory. The student will receive a score of zero for any assessment item not submitted because of absence. (This includes the assignments, projects, tests, and the final exam.) Extreme circumstances will be considered on an individual basis, however, when possible arrangements must be made prior to the due date, and supporting documentation is necessary. Moreover, you are expected to actively participate in the discussion. Please note that you will be graded on your participation, so don't keep quiet!

Academic Honesty Policy:

The Faculty Senate's Professional Concerns Committee recommends all instructors include the following paragraph in each syllabus they prepare.

"You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate and Graduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at http://catalog.wmich.edu under Academic Policies, Student Rights and Responsibilities.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test."

You are also directed to: http://osc.wmich.edu and www.wmich.edu/registrar to access the Code of Honor and general academic policies on such issues as diversity, religious observance, student disabilities, etc.

Homework/Case studies/Project:

Homework and assignments and case studies are to be turned in at the beginning of lecture on the day they are due. All submissions must be type-written, and on one-side of the paper. Assignments will be announced in the class. Only one copy of the written report is necessary per team. ***Late submissions will not be accepted!*** You are welcome to answer any questions using software, unless I have specified otherwise. If you use software to solve a problem you must submit sufficient documentation to illustrate your approach to the problem, along with the appropriate output to justify your results. ***You will receive a score of zero for each assignment that you fail to turn in at the specified time.*** At times, I may choose to grade only a few of the submitted homework (i.e., you submit your solution to 10 problems, and only grade three of those 10 problems). In such case, your grade will be based on the ones that I actually grade.

Tests:

The tests will be administered during the lecture period on the days indicated in the schedule. You are responsible for the material up to the day of the test. During each test you are allowed to have a calculator, but no cell phones or laptops are allowed. You will have 50 minutes to complete each test.

Final Exam:

The day and time is listed in the schedule. During the exam you are allowed to use a calculator, but no cell phones or laptops are allowed. You will have 2 hours to complete the final.

Portfolio:

Each individual is expected to create a portfolio that contains all the graded assignments, quiz, tests, case studies and project, and submit it along with a disk containing all the created files. Therefore make sure that you keep all your grade work in a folder to be turned in prior to the final exam date. The submitted material will not be returned to you, so if you prefer, you may keep a copy of your graded work for your own future reference.

Project:

The purpose of the semester project is to give the student an opportunity to apply the OR concepts learned in class. The project will be conducted in teams of 2 or 3 (this number may vary depending on the number of students in the class). I will let you choose your own teams; however, if this becomes a problem, I reserve the right to assign any class member to any team.

Each team will choose the problem they wish to study. The ideal problem is a real world problem that at least one of the students on the team is working on. For example, consider problems you encounter or have encountered at work, at home, on an internship, or in another course. Be careful in your choice of topic and make sure that it is something that you can finish by the middle of March. The only stipulation to the project topic is that you must be able to model the problem, or a major part of the problem as one or more of the following: Linear Programming, Assignment Problem, Transportation Problem, Network Problem, Dynamic Programming Problem, Queuing Problem, or a Nonlinear Programming Problem.

There are various elements of the project that must be submitted throughout the semester. ***Early in the semester you must submit a team name, with team members, and a project proposal***. The proposal should include a brief description of the problem, a set of objectives, and an outline of the steps to be followed. The project should culminate in a written report and a 10-minute presentation. The format for the written report should follow a format similar in structure to the sample report that I will post. Finally, team presentations must include participation from all team members. Due dates for all elements will be announced. Remember that this is a semester project, so start early!

Please note that it is your responsibility to present your findings to your industrial sponsor prior to the end of semester. Any dissatisfaction from your sponsor, will adversely affects your grade. In addition, the members of a team may receive different grade which will be based on their contribution to the work.

Project Due Dates:

1)	***First Report***	***Project Selection***	***Due Date: Monday January 31***
2)	***Second Report***	***Intermediate Report 1***	***Due Date: Monday February 21***
3)	***Third Report***	***Intermediate Report 2***	***Due Date: Monday March 28***
4)	***Fourth Report***	***Final Report***	***Due Date: Monday April 18***

Use the following format for all your submissions:

Title: Times New Roman 16, Bold; Leave two line-space above title for submission code

Executive Summary heading: Times New Roman 14, Bold, Italic

Executive Summary text: Times New Roman 11, Italic

Heading 1 (e.g., introduction): Times New Roman 14, Bold

Heading 2: Times New Roman 12, Bold, Italic

Heading 3: Times New Roman 11, Bold

All other text: Times New Roman 11

Use white, 8 ½ - by 11" paper. Leave one-inch margins all around the text of your paper -- left side, right side, and top and bottom. Paragraphs should be indented half an inch. The submission must be single-spaced. Your submission does not need a title page. At the top of the first page, at the left-hand margin, type your Team number, names, your instructor's name, the course number, and the date -- all on separate, single-spaced lines. Then double-space and center the title above your text. Double-space again before beginning your text. The title should be neither underlined nor written in all capital letters. Capitalize only the first, last, and principal words of the title. Titles might end with a question mark or an exclamation mark if that is appropriate, but not in a period.

Generally, the simpler the better. Why spend money on gimmicky, unwieldy, slippery binders, when I prefer nice, flat stacks of papers they can stuff into my briefcase. A simple staple in the upper left-hand corner of your paper should suffice.

Electronic Submissions:

All your electronic submission should be sent at least 30 minutes before the start of the class to: houshyar@wmich.edu

When naming your electronic file, use the following format: **TeamX-HWX-IMExxxx-Spring11.doc**

Topics and Schedule: This schedule is a guide only; sometimes we will spend a little longer on one topic and a little less on another. The test and final exam times will occur on the dates listed, however, content of the tests may be altered based on the material covered prior to test time.

Dates		Topics	Chapter/Section
January	10	Introduction to Operations Research	1.1 - 1.4
	12	OR Modeling Approach	2.1 - 2.4
	14	OR Modeling Approach	2.5 - 2.7
	17	***MARTIN LUTHER KING, JR. DAY***	
	19	Introduction to Linear Programming	3.1 - 3.2
	21	LP Assumptions & Examples	3.3 - 3.4
	24	LP Examples	3.4 - 3.5
	26	Solving LP's with Software	3.6 - 3.8
	28	More LP Models	
	31	***Due Date for Project Selection***	
	31	Introduction to the Simplex Method	4.1
February	2	The Essence of Duality Theory	6.1
	4	Economic Interpretation of Duality	6.2
	7	Primal-Dual Relationships	6.3 - 6.4
	9	Sensitivity Analysis	6.5 - 6.8
	11	Transportation Problem	8.1-8.2
	14	Transportation Problem	8.1-8.2
	16	Assignment Problem	8.3 - 8.4
February	***18***	***TEST 1***	
	21	***Due Date for Project Interim Report #1***	
	21	Networks & Shortest Path	9.1 - 9.3
	23	Minimum Spanning Tree	9.4
February	***25***	***Spirit Day Recess***	
Feb 28-March 4		***SEMESTER RECESS***	
	7	Maximum Flow	9.5
	9	Minimum Cost Network Flow	9.6
	11	Project Planning CPM/PERT	9.8
	14	Integer Programming	11.1 -11.2
	16	Integer Programming	11.3 - 11.4
	18	Integer Programming	11.5 - 11.6
	21	Queueing Theory	17.1 - 17.3
	23	Queueing Theory	17.4 - 17.5
	25	Queueing Theory.	17.6 - 17.7
	28	***Due Date for Project Interim Report #2***	
	28	Queueing Theory	17.8 - 17.9
	30	Review for 2nd Test	
April	***1***	***TEST 2***	
	4	Introduction to the Simplex Method	4.1
	6	Setting up the Simplex Method	4.2
	8	Setting up the Simplex Method	4.2
	11	Algebra of the Simplex Method	4.3
	13	Simplex Method in Tabular Form	4.4
	15	Tie Breaking in Simplex Method	4.5
	18	***Due Date for Project Final Report***	
	18	Adapting to Other LP models	4.6
	20	Adapting to Other LP models	4.6
	22	Review for final exam	
April	***27***	***FINAL EXAM (Wednesday); 10:15 am-12:15 pm***	