



# Course Specifications

Institution:	Majmaah University
Academic Department :	Department of Computer Science and Information
Programme :	Computer Science & Information – New Plan
Course :	Operational Research
Course Coordinator :	Dr. Eng. Moustafa Reda AbdALLAH El-Tantawi
Programme Coordinator :	Prof. Yousry Azzam
Course Specification Approved Date :	Zu El-Hejja 1435 H



## A. Course Identification and General Information

1 - Course title :	Operational Research	Course Code:	CIS 327-Z
2. Credit hours :	3 Credit Hours (Lecture: 2 Hrs. + Exercises: 2 Hrs.)		
3 - Program(s) in which the course is offered:	Computer Science and Information Program (B. Sc.)		
4 – Course Language :	English		
5 - Name of faculty member responsible for the course:	Dr. Eng. Moustafa Reda AbdALLAH Eltantawi		
6 - Level/year at which this course is offered :	Elective		
7 - Pre-requisites for this course (if any) :	<ul style="list-style-type: none"> <li>• .Linear Algebra &amp; Differential Equations</li> </ul>		
8 - Co-requisites for this course (if any) :	<ul style="list-style-type: none"> <li>• Non</li> </ul>		
9 - Location if not on main campus :	(College of Science at Az Zulfi (Main Campus		
10 - Mode of Instruction (mark all that apply)			
A - Traditional classroom	<input checked="" type="checkbox"/>	What percentage?	<b>80.00%</b>
B - Blended (traditional and online)	<input checked="" type="checkbox"/>	What percentage?	<b>10.00%</b>
D - e-learning	<input type="checkbox"/>	What percentage?	..... %
E - Correspondence	<input type="checkbox"/>	What percentage?	..... %
F - Other	<input checked="" type="checkbox"/>	What percentage?	<b>10.00%</b>
Comments :	<p>1.Four-fifth of the course is introduced mainly inside well equipped traditional classrooms. So the student will be taught, in a tidy robust way, the main core of the course.</p> <p>2.One-tenth of the course is conducted with a video conference. This mode will allow the student to skip the fear-threshold of scientific interaction.</p> <p>3.One-tenth of the course is presented orally in free discussion, within workgroups, at the traditional classrooms or/and library. This will upgrade the students skills in presentations of his ideas and scientific thoughts, and encourage him for continuous looking of new up-to-date information.</p> <p>4.The 2nd and 3rd modes of instructions makes the students feel "involved" in the discussions, rather than simply being outside spectators.</p>		





## B Objectives

### **What is the main purpose for this course?**

Operations research (OR) seeks the determination of the best (optimum) course of action of a decision problem under the restriction of limited resources. The term operations research quite often is associated almost exclusively with the use of mathematical techniques to model and analyze decision problems. Although mathematics and mathematical models represent a corner stone of OR, there is more to problem solving than the construction and solution of mathematical models. Specifically, decision problems usually include important intangible factors that cannot be translated directly in terms of the mathematical model. Foremost among these factors is the presence of the human element in almost every decision environment. Indeed, decision situations have been reported where the effect of human behavior has so influenced the decision problem that the solution obtained from the mathematical model is deemed impractical.

The purpose of this course is to enable the student to:

1. Understand and apply the paradigm What is, Why we need, How to use tools of, and Where/When to apply: Optimization.
2. Recognize the concept of Absolute Extrema, and the concept of Lagrange Multiplier to determine the conditional Extrema.
3. Determine the type of solution (and find this solution if it exists) for a system of linear equations.
4. Establish linear programming as one of the Operations Research techniques used in planning for utilizing available resources with the best possible manner.
5. Be familiar with the mathematical properties of linear programming models, by graphical and algebraic concepts.
6. Explore practical applications that can be solved by linear programming and the ability to formulate linear programming problems.
7. Apply professionally the Simplex method to solving linear programming problems, then performing sensitivity analysis on optimal solution.
8. Interpret and apply the Duality process.
9. Construct and solve applications of the Transportation Model and its Variants.

### **Briefly describe any plans for developing and improving the course that are being implemented :**

IT

- a. Use of Smart/Interactive Board.
- b. Use of DBS Smart system.
- c. Applications of e-Learning.

Material

1. Using group discussion through the internet with course attending students.
2. Updating the materials of the course to cover the new topics of the field.
3. Increasing the ability of the students to implement -on the computer selected assignments that are presented in the course.



## C. Course Description

### 1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
1) <b>Introduction and Basic Concepts of Optimization:</b> Absolute Extrema, and Conditional Extrema. Solution of Systems of Linear of Equations.	3	12
2) <b>What is Operational Research:</b> Operational Research Models. Solving the OR Model. Art of Modeling. Solution of Systems of Linear Inequalities in Two Variables. Convexity.	2	8
3) <b>Linear Programming (Graphical Solution):</b> Two Variables LP Model. Applications: Manufacturing/Construction/Scheduling/Education with resource allocation, Nutrition, Psychology, Medicine, Agriculture, Transportation, Investment, Pollution Control, Capital Expansion, Sociology, Advertising, Opinion Survey, Purchasing.	4	16
4) <b>Linear Programming (Analytical Solution):</b> Computational Details of the Simplex Algorithm. Applications. Algebraic Sensitivity Analysis due to Changes in the Right-hand Side. Degeneracy Difficulties. Dual Simplex Algorithm	4	16
5) <b>Transportation Model and its Variants:</b> Definition of the model. Non-traditional Transportation Model. The Transportation Algorithm.	2	8

### 2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	30	30	---	---	---	60
Credit	30	15	---	---	---	45

### 3. Additional private study/learning hours expected for students per week.

5 hours
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The private self-study of my student is crucial for this course. It includes:

- reading carefully the topics in the textbook or reference book,
- browsing the websites that are concerned with the course,
- solving the exercises that are assigned in each chapter,
- discussing the course topics with the instructor in his office hours,
- watching the video lectures of other instructors who presented related topics worldwide.

The total workload of the student in this course is then:  $60 + 5 * 15 = 135$  work hours.





## 4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
<b>1.0</b>	<b>Knowledge</b>		
<b>1.1</b>	Describe exactly and in a formal manner the type of a considered optimization problem.	Developing basic communicative ability through: - Lecturing, - Team work, - Oral Discussion, - Home Assignments.	- Quizzes, - Web search, - Graded homework, - Class Participation, - Midterm and Final Exams,
<b>1.2</b>	Recall and list different methods to attack a problem.		
<b>1.3</b>	Recognize the concepts and mathematical models of Linear programming.		
<b>1.4</b>	Match correctly the appropriate techniques of solutions with the concerned problems.		
<b>2.0</b>	<b>Cognitive Skills</b>		
<b>2.1</b>	Reconstruct, reorganize and analyze an optimization problem.	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Exercises demonstrations</li> <li>• Case studies</li> <li>• Individual</li> <li>• Presentations</li> <li>• Brainstorming</li> </ul>	<ul style="list-style-type: none"> <li>- Class Participation</li> <li>- Essay Question</li> <li>- Presentation</li> <li>- Research</li> </ul>
<b>2.2</b>	Plan and explain how to solve an optimization problem.		
<b>2.3</b>	Reorganize the relationships between a linear programming problem and other objects.		
<b>2.4</b>	Differentiate and compare between the alternative solutions of a linear programming problem to justify the optimal one.		
<b>3.0</b>	<b>Interpersonal Skills &amp; Responsibility</b>		
<b>3.1</b>	Illustrate a plan to attack and solve a LP problem	<ul style="list-style-type: none"> <li>• Small group discussion</li> <li>• Whole group discussion</li> <li>• Brainstorming</li> <li>• Presentation</li> </ul>	<ul style="list-style-type: none"> <li>• Written Exam</li> <li>• Web search and writing reports.</li> <li>• Lab assignments</li> <li>• Class Activities</li> <li>• Quizzes</li> </ul>
<b>3.2</b>	Use the available commercial software systems/packages in application to the suggested solution/plan.		
<b>3.3</b>	Demonstrate the feasibility of an applied solution/plan		
<b>3.4</b>	Analyze the solution's sensitivity due to modifications on a problem.		
<b>4.0</b>	<b>Communication, Information Technology, Numerical</b>		
<b>4.1</b>	Team working skills: cooperative working in groups inside the class, or/and efficient participation in take-home-assignments.	<ul style="list-style-type: none"> <li>• Small group discussion</li> <li>• Whole group discussion</li> <li>• Brainstorming</li> <li>• Presentation</li> </ul>	<ul style="list-style-type: none"> <li>• Written Exam</li> <li>• Web search and writing reports.</li> <li>• Lab assignments</li> <li>• Class Activities</li> <li>• Quizzes</li> </ul>
<b>4.2</b>	Oral Skills: save the students' time and allow them to feel "involved" in the discussion, rather than simply being outside spectators.		
<b>4.3</b>	Communication skills : a video conference help the student to skip the fear-threshold of scientific interaction.		
<b>5.0</b>	<b>Psychomotor</b>		
<b>5.1</b>	Drawing skills	Hard problems in Graph Theory	Optimum clarified Solutions





## 5. Schedule of Assessment Tasks for Students During the Semester:

	Assessment task	Week Due	Proportion of Total Assessment
1	Class Activities:		30.00%
	Homework assignments, Oral discussions	Weekly	
	Written summary reports through web search	3, 7, 9, 13	
	Class participation in solving problems	Weekly	
	Take-home-exams	5, 11	
	Project groups	5, 10	
	Quizzes	2, 4, 8, 14	
2	First Written Exam	6	15 %
3	Second Written Exam	12	15 %
4	Final Exam	16	40 %

### D. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

1. Office hours: Sunday: 10-13, Thursday: 10-13.
2. Office call: Wed 12-14
3. E-mail: m.eltantawi@mu.edu.sa is permanently available.

### E. Learning Resources

#### 1. List Required Textbooks :

- Hamdy A. Taha; Operations Research: An Introduction; 9th Edition, Printice Hall, 2010.

#### 2. List Essential References Materials :

- Ali Emrouznejad, William Ho; Applied Operational Research with SAS; Chapman and Hall/CRC, December 2011.

#### 3. List Recommended Textbooks and Reference Material :

P. Rama Murthy; Operations Research; New Age International Publishers; 2nd Edition; 2007

#### 4. List Electronic Materials :

Course-Lectures as videos (e.g. on Youtube) from Top (high ranked) Universities such as Harvard, MIT, and Stanford ...

[http://fisher.osu.edu/~croxton\\_4/tutorial/](http://fisher.osu.edu/~croxton_4/tutorial/)

[http://people.hofstra.edu/Stefan\\_Waner/realworld/LPGrapher/lpg.html/](http://people.hofstra.edu/Stefan_Waner/realworld/LPGrapher/lpg.html/)

[/http://people.hofstra.edu/Stefan\\_Waner/realworld/simplex.html](http://people.hofstra.edu/Stefan_Waner/realworld/simplex.html)

#### 5. Other learning material :

1. Excel software.
2. TORA software.
3. STORM software.
4. Net search for highly well achieved systems: Educational, Transportation, Cultural, Social, Economic.





## F. Facilities Required

### 1. Accommodation

Lecture rooms are well equipped with:

- air conditioned with at least 20 adequate seats.
- Interactive/smart Board.
- Up-to-date projector.

An Auditorium is well equipped with:

- Air conditioned with at least 100 adequate seats.
- Interactive/smart Board.
- .date projector-to-Up

### 2. Computing resources

- Personal computer with necessary up-to-date software.
- DBS Smart Systems.
- Interactive Board.
- .Laptop

### 3. Other resources

1. Colored Printer (needed)
2. Central laser-Printer, and Scanner.
3. Wall Boards (are essentially needed.)
4. Internet inside the classroom (missed.)
5. Library: Up to date scientific books, in the library.
6. Wi-Fi and internet connections are available inside the teaching staff rooms, and the seminar room.

## G Course Evaluation and Improvement Processes

### 1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching:

- Questionnaires (course evaluation) achieved by the students and it is electronically organized by the University.
- Students-faculty management meetings.

### 2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor :

A department committee is established to be responsible for the development of the strategies of Teaching through:

- Discussions within the staff member teaching the course.
- Departmental internal review of the course.

### 3 Processes for Improvement of Teaching :

Availability of all the tools that facilitate the education process considering both the students and staff, through:

- Providing the computer labs with up-to-date computers and software.
- Conducting and attending workshops given by experts on the teaching and learning methodologies.
- Periodical departmental revision of methods of teaching.
- Monitoring of teaching activates by senior faculty members.

Training Courses.





#### 4. Processes for Verifying Standards of Student Achievement

Efficiency of course will be reflected on the results of the class, so reviewing the final exam questions and a sample of corrected papers is essential. This could be achieved by members of the teaching staff (or/and external reviewers) in addition to other duties such as discussing ideas and ways of teaching and learning. The course should be developed periodically to ensure that it contains the latest developments in the field of study. Development could be put as an objective in the report of the course to be achieved each semester.

#### 5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement :

- 1-Course Evaluation
- 2-Exam Evaluation
- 3-Improvement plan
- 4-Program Outlearning with course outlearning
- 5-Outlearning from the pre-requisite course.

### Course Specification Approved

Department Official Meeting No ( ..... ) Date ... / .... / ..... H

#### Course's Coordinator

**Name :** Dr. Eng. Moustafa  
-Reda AbdALLAH El  
Tantawi

**Signature :** .....

**Date :** Zu El-Hejja 1435 H

#### Department Head

**Name :** .....

**Signature :** .....

**Date :** ... / ... / ..... H

