



**EASTERN MEDITERRANEAN UNIVERSITY**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING**  
**IENG313 OPERATIONS RESEARCH I**  
**COURSE OUTLINE**



<b>COURSE CODE</b>	IENG/MANE313	<b>COURSE LEVEL</b>	Third Year
<b>COURSE TITLE</b>	Operations Research I	<b>COURSE TYPE</b>	Area Core
<b>CREDIT VALUE</b>	(4, 1, 0) 4	<b>ECTS Credit Value</b>	6
<b>PRE-REQUISITE(S)</b>	IENG212, MATH241	<b>CO-REQUISITE(S)</b>	-
<b>PREPARED BY</b>	Asst.Prof.Dr. Oğuzhan KIRILMAZ	<b>SEMESTER / ACADEMIC YEAR</b>	FALL 2024-2025

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<b>COURSE SCHEDULE</b>	Tuesday 08:30-10:20; Thursday 08:30-10:20; Wednesday 12:30-14:20 (Lab and Tutorials); Office Hour: Mondays 09:30-11:30			
<b>COURSE WEB LINK</b>	<a href="https://staff.emu.edu.tr/oguzhankirilmaz/">https://staff.emu.edu.tr/oguzhankirilmaz/</a>			

### **COURSE DESCRIPTION**

This course is designed to introduce the fundamentals of operations research. The emphasis is on solution of deterministic optimization models. The topics covered are application of scientific methodology to business problems, systems concept, team concept in problem analysis, and mathematical modeling. Basic deterministic methods used in the course are linear programming, simplex method, duality, dual simplex method, post-optimality analysis, integer programming, formulation, branch and bound technique, cutting plane algorithm, simple network models, minimal spanning tree algorithm, Dijkstra's algorithm and maximal flow algorithm, nonlinear programming, unconstrained nonlinear optimization and Lagrange multiplier method.

### **COURSE OBJECTIVES**

The main objectives of this course are:

1. Application of the Graphical Solution Method (Contributing Student Outcomes 1, 6)
2. Application of the Simplex Algorithm, Big-M and Two Phase methods (Contributing Student Outcomes 1, 2, 4, 6)
3. Duality (relationships between primal-dual problems and their solutions) (Contributing Student Outcomes 1, 4, 6)
4. Application of the Dual Simplex Algorithm (Contributing Student Outcomes 1, 2, 4, 6)
5. Performing Sensitivity and Post Optimality Analysis (Contributing Student Outcomes 1, 2, 6)
6. Solving Transportation and Transshipment Problems (North-West Cell Method, Least Cost Cell Method, Vogel Approximation Method and Transportation Simplex Algorithm) (Contributing Student Outcomes 1, 2, 6)
7. Solving the Assignment Problem (Hungarian Algorithm) (Contributing Student Outcomes 1, 2, 6)
8. Application of the Branch and Bound Algorithm (Contributing Student Outcomes 1, 2, 4, 6)
9. Using a solver program (LINGO) in optimization (Contributing Student Outcome 4)

## COURSE LEARNING OUTCOMES

On successful completion of this course, students are expected to develop **knowledge** and **understanding** of:

1. Modelling real life problems,
2. Mathematical aspects of basic feasible solutions,
3. Elements of Simplex Method and its variations,
4. Methods of finding solution to problems involving linear models with continuous and integer variables,
5. Sensitivity of optimum solution of a model to possible changes in values of uncontrollable parameters,
6. Solving Linear Programming and Integer Programming problems using LINGO,
7. Modelling and solving network problems.
8. Solving unconstrained and constrained non-linear Programming Problems

On successful completion of this course, students are expected to develop **their skills** in:

1. Building models of real life systems,
2. Finding solutions to linear and integer linear models,
3. Performing post-optimality analyses to facilitate the smooth application of theoretical results to the actual problem.
4. Finding solutions to unconstrained and constrained non-linear objective functions

On successful completion of this course, students are expected to develop their appreciation of and respect for **values and attitudes** regarding the issues of:

1. Role of linear models in industrial engineering,
2. Importance of modeling and optimization in diverse fields of sciences and engineering,
3. Impact of optimization software in solving models for real-life situations,
4. Systems approach to problem solving.

## CONTRIBUTION OF THE COURSE TO CRITERION 5

Mathematics and Basic Sciences	: 0
Engineering Topics	: 4
General Education	: 0

## RELATIONSHIP OF THE COURSE TO STUDENT OUTCOMES

Student Outcomes	Level of Contribution		
	No	Moderate	High
(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(3) an ability to communicate effectively with a range of audiences	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## GRADING CRITERIA

**Exams:** All examinations will be based on lectures, tutorials, labs, assigned readings, project study or other work. To pass these exams students should study the material well in advance in order to understand the concepts, procedures and techniques. Exam results will be announced on the portal program as soon as the exam papers have been evaluated. Descriptions of these examinations are as follows:

- Quiz:* There will be 3 face-to-face, in class quizzes. There will NOT be any make up for the quizzes.
- Midterm Exam:* There will be one face-to-face, in class midterm exam at the mid of the semester. Exam date will be determined later by the university.
- Final Exam:* There will be a face-to-face, in class final exam at the end of the semester. Exam date will be determined later by the university.
- Make-up Exam:* There will be ONLY ONE make-up exam at the end of the semester, after the final exam. Dates will be announced later. Make-up examination will only be offered to students who missed the **final or midterm exams** and provided adequate documents for the reason for their absence **within three working days at the latest after the examination date**. A student's illness will **only** be accepted as a valid excuse if it is supported by a written report of a physician from the Health Center of the EMU including the exam date in the report. Students who missed both of the midterm and final exams will have a chance to take the make-up exam only for the final exam. Students will be responsible from all the topics covered in the semester in the make-up exam.

**Note:** The students may need a calculator so they should bring their calculators to all lecture/tutorial/lab/exam hours.

### **Assignments:**

There will be 3 assignments about the subjects of the course and 2 assignments about using LINGO. There may be some reading, studying and application assignments, which will support the lectures. For any type of examination, students are also responsible from studying all assigned materials, even if they might not be discussed in class.

### **Attendance:**

Attendance will be taken every Lecture/Tutorial/Lab session.

## RELATIONSHIP WITH OTHER COURSES

It is a synthesis course of all the previously taken departmental courses and also co-requisite course for the course IENG314.

## LEARNING / TEACHING METHOD

The instructor will lecture in class by writing on the board and using computer presentations. Several examples will be covered and discussed in detail by the lecturer in the classroom. To get a hands-on experience, lectures will be supplemented by tutorials and lab sessions. The function of teaching is to enable students to learn. Therefore, students are required to study from the declared books and other operations research books. Students are expected to use the library and internet in their searches and studies.

## METHOD OF ASSESSMENT

Although the student's overall grade will be based on the general assessment of the instructor, the following percentages may give an idea about the relative importance of various assessment tools.

Quizzes	15 % (5 % each)
Assignments	5 % (1 % each)
Attendance ( Lecture and LAB)	5 %
LAB Exam	5 %
Midterm	30 %
Final	40 %
<b>TOTAL</b>	<b>100 %</b>

## NG GRADE

**The instructor may give NG grade to a student;**

- **who does not enter midterm exam OR final exam without any valid excuse,**
- **Note that EMU regulations allow instructors to give a grade of NG (Nil Grade) to a student whose absenteeism is more than 30% of the Lecture/Tutorial/Lab hours and/or who do not complete sufficient work that are included in the assessment of the course.**

Note that the instructor reserves the right to modify these percentages in case he finds it necessary. Letter grade equivalents of numerical performances will be announced by the Registrar's Office after the last day for the submission of letter grades.

## TEXTBOOK/S

Students should have the following textbooks:

- Taha, Hamdy A., "Operations Research", 10th international edition, Prentice Hall 2017.
- An Introduction to Management Science: Quantitative Approaches to Decision Making, Revised Thirteenth Edition David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Jeffrey D. Camm, & Kipp Martin.
- WINSTON, Wayne L., "Operations Research: Applications and Algorithms" 3rd edition, Duxbury Press 1993. ISBN: 0-534-20971-8.

## FURTHER READING LIST

- BAZARAA, M., "Linear Programming and Network Flows" 4<sup>th</sup> edition, Wiley, 2010. ISBN:978-0470-46272-0.
- Hillier, F.S. and G.J. Lieberman, "Introduction to Operations Research", 7th international edition, McGraw Hill 2001;
- Beltrami, Edward J., "Models for Public Systems Analysis ", Academic Press 1977
- "LINGO", LINDO Systems Inc.
- BENDER, Edward, "An Introduction to Mathematical Modelling", Dover Ed.,Dover Publications,2000

## EXTENDED READING LIST

Note that aside from these books, EMU Library has quite a good collection of books on the intermediate and advanced levels in the related fields of industrial engineering discipline.

PLEASE KEEP THIS COURSE OUTLINE FOR FUTURE REFERENCE AS IT CONTAINS IMPORTANT INFORMATION!!!

## TOPICS COVERED and COURSE SCHEDULE

WEEK	TOPICS
1	Introduction to OR
2	Graphical Solution Method
3	Basics of the Simplex Algorithm
4	Simplex Algorithm
5	Two Phase and Big M Methods
6	Duality
7-8	<b>MIDTERM EXAM WEEK</b>
9	Dual Simplex Algorithm
10	Dual Simplex Algorithm
11	Sensitivity and Post Optimality Analysis
12	Sensitivity and Post Optimality Analysis
13	The Transportation Problem
14	The Transportation Problem
15	The Assignment Problem
16	Integer programming, Branch and Bound Algorithm

## ACADEMIC HONESTY, PLAGIARISM & CHEATING

This is intentionally failing to give credit to sources used in writing regardless of whether they are published or unpublished. Plagiarism (which also includes any kind of cheating in exams) is a disciplinary offence and will be dealt with accordingly. According to university by laws cheating and plagiarism are serious offences punishable with disciplinary action ranging from simple failure from the exam or project/report, to more serious action (suspension from the university for up to one semester). Disciplinary action is written in student records and may appear in student transcripts. Any act not suitable for a university student will not be tolerated and may lead to formal disciplinary action. Example of this are: getting someone else to take the examinations for you, misrepresentation of your own answer sheet as another's work, cheating, knowingly assisting other students to cheat, abusing the tolerance or breaking the discipline of the class.