ABDULLAH GÜL UNIVERSITY
GRADUATE SCHOOL OF ENGINNERING & SCIENCE
INDUSTRIAL ENGINEERING DEPARTMENT
COURSE DESCRIPTION AND APPLICATION INFORMATION

Course Name	Code	Semester	T+P Hour	Credit	ECTS
Modeling and Optimization	IE 511	Fall-Spring	3 + 0	3	10

Prerequisites	No prerequisite

Course Type	Compulsory
Course Language	English
Course Coordinator	Assist. Prof. Muhammed Sütçü
Course Instructor	Assist. Prof. Muhammed Sütçü
Course Assistant	Batuhan Kızılışık
Course Objective	To introduce students to mathematical modeling, formulating several types of linear and nonlinear optimization problems and making inferences from analytical solutions. To acquire general information about common solution methodologies of the problems and computer skills for numerical solutions. To introduce discrete and continuous problems that can be solved consecutively and multi-objective optimization problems.
Course Learning Outcomes	1. Ability to define a solution to a general optimization problem and to develop an opinion on an analytical solution. 2. Ability to interpret a verbalized problem and to translate it into mathematical language by selecting appropriate variables, parameters, objective function and constraints. 3. Having knowledge about the existence and uniqueness of the solution of the functional forms of the problem and the features of the most appropriate solution set. 4. Application of common numerical techniques to find out approximate solutions for nonlinear problems and computer programming skills to apply these techniques. 5. The ability to model dicrete problems with uncertainty in constraints and/or objective functions (in terms of the randomness of a particular decision) in the form of Markov decision processes and to obtain the most appropriate solution. 6. Skills of commenting on solutions with sensitivity analysis including shadow prices. 7. Ability to derive the duality problem of a linear programming problem and establish connections between the dual linear program and the formulations and solutions of primal linear program. 8. Ability to formulate a problem with discrete variables as integer program including binary variables and methods such as big-M methods.
Course Content	Concepts of mathematical modeling Linear programming Nonlinear programming Problem formulation Sensitivity analysis Network optimization Integer linear programming Problem formulation, big-M method, integrality property Markov chains Queuing theory Simulation Decision making under uncertainty

WEEKLY SUBJECTS AND RELATED PRELIMINARY PREPARATION PAGES

Week	Subjects	Preliminary
1	Linear algebra and repetition of general mathematical formulations	
2	Graphical solution methodology for linear programming, linear programming model formulation	
3	Simplex method, big-M method, KKT conditions	
4	Sensitivity analysis and duality	
5	Network optimization	
6	Integer linear programming problem formulation and solution methodologies	
7	Midterm Examination	
8	Nonlinear programming, constrained nonlinear programming	
9	Simulation	
10	Queuing Theory	

11	Markov chains and decision processes	
12	Decision making under uncertainty	
13	Solution methodologies of multi-objective optimization problems	
14	Solution methodologies of multi-criteria optimization problems	
15	Project Presentations	
16	Final examination	

SOURCES	
Lecture Notes	Lecture notes and slides of this course will be shared with the students during the semester via Canvas
Other Sources	Textbook: Winston, W.L., Operations Research: Applications and Algorithms, Fourth Edition, Wadsworth Publishing Company, Belmont, CA, 2003

Sources Sharing	
Documents	They will be shared with the students during the semester via Canvas.
Homeworks	They will be shared with the students during the semester via Canvas.
Exams	There will be 1 midterm exam and 1 final exam, with 2 exams in total.

EVALUATION SYSTEM		
ACTIVITIES	**NUMBER**	**WEIGHT**
Midterm Exam	1	%20
Quizzes	5	%15
Homework	5	%15
Project	1	%20
Final Exam	1	%30
TOTAL		%100
Within Semester Activities Succes Rate		%70
Final Exam Succes Rate		%30
TOTAL		%100

Course Category	
Natural Science and Mathematics	%20
Engineering Science	%80
Social Science	%0

LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS RELATIONSHIP							
No	Program Qualification	Contribution Level				
		1	2	3	4	5
1	PY1.					X
2	PY2.				X	
3	PY3.		X			
4	PY4.			X		
5	PY5.				X	
6	PY6.				X	

* It is in the increasing order from 1 to 5.

ECTS / WORK LOAD TABLE			
Activities	Activity	Duration (Hour)	Total Work Load
Course Duration (including exam week: 16x total course hours)		3	48
Out-of-class Study Time (Pre-study, practice)		4	64

Reading		1	16
Internet browsing, library work		1	10
Project Work		5	50
Report Preparation		15	30
Presentation Preparation		5	5
Presentation		2	4
Homeworks		5	25
Quizzes		1	5
Mid Terms		20	20
Final Exam		30	30
Total Work Load			307
Total Work Load / 30			10.23
Course ECTS CREDİT			10