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
Nonlinear Optimization	IE 516	Fall - Spring	3 + 0	3	10

Prerequisites	IE 511 Modelling and Optimization or equivalent

Course Type	Elective
Course Language	English
Course Coordinator	Assistant Professor Selçuk Gören
Course Instructor	Assistant Professor Selçuk Gören
Course Assistant	-
Course Objective	This course introduces students to the basic theory of nonlinear programming. In the course, theoretical methods for determining the characteristics of optimal solutions, as well as computational methods for finding optimal solutions with computers, and convergence features of these methods are given with equal prefix. As a software, it is necessary to use solvents such as BARON, CONOPT, MINOS in a package such as GAMS, and to encode basic methods in basic programming languages.
Course Learning Outcomes	A student who successfully completes this course, 1. Problems encountered in practice can be formulated as nonlinear optimization problem, 2. Look for non-linear models are convex, 3. Apply basic complete solution methods to solve these models, 4. Develop decomposition methods for large-scale problems, 5. These methods can be applied to solve problems
Course Content	• Nonlinear optimization problems and their formulations, • Unconstrained optimization and limited optimization • Gradient methods, projection methods • The characteristics of the optimal solutions, sufficient and necessary conditions for • optimality, • Duality, • Semidefinite programming

WEEKLY SUBJECTS AND RELATED PRELIMINARY PREPARATION PAGES

Week	Subjects	Preliminary
1	Unconstrained optimization and optimality conditions	
2	Gradient based solution methods (Newton vs)	
3	constrained optimization	
4	Optimality conditions in constrained optimization	
5	Projection in equality constrained problems	
6	Projection methods, punishment methods	
7	Midterm Exam, Project development report and presentation	
8	Barrier, Conditional Gradian methods	
9	Inner point methods for linear programming	
10	Convex analysis	
11	Duality	
12	Duality	
13	Gradient suboptimization	
14	Semidefinite programming	
15	Repetition, advanced topics	
16	Project presentations, Final exam	

SOURCES

Lecture Notes	Lecture notes and slides of the course will be shared with students during the semester via CANVAS system.
Other Sources	**Textbook:**

	Bertsekas, Dimitri P. *Nonlinear Programming*. Athena Scientific Press, 2016. **Supplementary Textbooks:** Bazaraa, Mokhtar S., Hanif D. Sherali, ve C. M. Shetty. *Nonlinear Programming: Theory and Algorithms.* New York: John Wiley & Sons, 2006

MATERIAL SHARING	
Documents	will be shared with students during the semester via CANVAS system.
Homework	will be shared with students during the semester via CANVAS system.
Exams	1 (one) midterm exam and 1 (one) final exam. 2 exams in total

EVALUATION SYSTEM		
ACTIVITIES	**QUANTITY**	**WEIGHT**
Midterm Exam	1	%20
Quiz	5	%15
Homework	5	%15
Project	1	%20
Final Exam	1	%30
TOTAL		%100
Midterm Activities Percentage		%70
Final Exam Percentage		%30
TOTAL		%100

Course Category	
Natural Sciences and Mathematics	%40
Engineering Sciences	%60
Social Sciences	%0

LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS RELATIONSHIP							
No	Program Qualification	Contribution Level					
		1	2	3	4	5	
1	PQ1.					X	
2	PQ2.				X		
3	PQ3.		X				
4	PQ4.			X			
5	PQ5.				X		
6	PQ6.			X			

*Increasing 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		5	50
Report Preperation		15	30
Presentation Preperation		5	5
Presentation		2	4
Homework		5	25
Quiz		0,2	1
Midterm		20	20

Final Exam		30	30
Total Work Load			303
Total Work Load / 30			10.1
Course ECTS CREDİT			10