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
Discrete Optimization	IE 515	Fall-Spring	3 + 0	3	10

Prerequisites	IE 511 Modeling and Optimization (or equivalent)

Course Type	Elective
Course Language	English
Course Coordinator	Assist. Prof. Selçuk Gören
Course Instructor	Assist. Prof. Selçuk Gören
Course Assistant	
Course Objective	The objective of this course is to introduce the theory, algorithm and applications of combinatorial and integer optimization to students.
Course Learning Outcomes	Student who accomplishes this course successfully, 1. Formulate appropriate problems in practice as combinatorial optimization problems, 2. Formulate appropriate problems in practice as mixed integer optimization problems, 3. Compare different models with each other, 4. Apply exact solution methods to solve these models, 5. Develop decompostion methods for large size problems, 6. Apply these methods to solve the problems.
Course Content	Combinatorial optimization problems and their integer formulations, Compare different formulations according to their capacity to provide lower and upper bounds, Cutting planes, branch-and-bound and branch-and-cut basic solution methods, Computational complexity of problems and algorithmic complexity, Decomposition techniques for large size problems

WEEKLY SUBJECTS AND RELATED PRELIMINARY PREPARATION PAGES

Week	Subjects	Preliminary
1	Formulations and comparisons	
2	Methods of strengthening formulations	
3	Computational complexity for algorithms	
4	Computational complexity for problem classes, P and NP classes	
5	Simplex algorithm	
6	Easily solvable problems, total unimodality	
7	Midterm, project progress report and presentation	
8	Dynamic programming	
9	Branch and bound algorithms	
10	Heuristics	
11	Polyhedron theory, valid inequalities and strengthening of them	
12	Cutting plane algorithms, branch and cut	
13	Lagrange relaxation, duality	
14	Benders decomposition, column generation, branch and price algorithms	
15	Project presentations	
16	Final exam	

SOURCES

Lecture Notes	Slides will be shared with the students during the semester via Canvas.
Other Sources	Required Textbook: Wolsey, Laurence A. *Integer Programming*. Wiley-Interscience, 1998. Kaynak Kitap: Nemhauser, George, and Wolsey, Laurence A. *Integer and Combinatorial Optimization*, Wiley-Interscience, 1988. Recommended Textbook: Bertsimas, Dimitris, and Robert Weismantel. *Optimization over Integers*. Dynamic Ideas, 2005 Makaleler

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	%40
Engineering Science	%60
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		0,2	1
Mid Terms		20	20
Final Exam		30	30
Total Work Load			303
Total Work Load / 30			10.1
Course ECTS CREDİT			10