Course number and name	END 478 / Applied Optimization Models
Credits, contact hours, categorization of credits	3 credits / 42 hours / Engineering topic
Instructor or course coordinator	Burhaneddin SANDIKÇI
Text book and other supplemental materials	• W.L. Winston, M. Venkataramanan. *Introduction to Mathematical Programming: Operations Research*, Vol. I, 4th ed. (2002). Duxbury. • N. Balakrishnan, B. Render, R.M. Stair, C. Munson. *Managerial Decision Modeling: Business Analytics with Spreadsheets*, 4th ed. (2017). De|G Press. • S.P. Bradley, A.C. Hax, T.L. Magnanti. *Applied Mathematical Programming* (1977). Addison Wesley. • S.G. Powell, K.R. Baker. *Business Analytics: The Art of Modeling with Spreadsheets*, 5th ed. (2016). Wiley Higher Education. • H.M. Wagner. *Principles of Operations Research*, 2nd ed. (1975). Prentice Hall. • H.P. Williams. *Model building in Mathematical Programming*, 5th ed. (2013). Wiley.

Course information	
Content	To cover most important and recent topics in operations research and optimization such as linear, nonlinear, integer and dynamic programming, combinatorial and network optimization and stochastic models, to learn exact and heuristic solution methods and to apply these methods in Excel and optimization software packages, to learn about applications of optimization to real problems in areas such as marketing, sports, transportation science, health care, energy, military, manufacturing and production planning, supply chain management, finance and economics, logistics and distribution and others.
Prerequisites	None
Type	Selected elective

Course learning outcomes
Students who pass the course will: I. Be able to understand the philosophy and principles of modeling II. Be able to identify types of models and solution algorithms III. Learn how to structure decision problems IV. Learn how to identify the data needed for the model in question V. Learn how to move from structuring a problem to actually building a mathematical model to address the problem in question VI. Learn about deterministic and stochastic optimization models, including linear, integer, nonlinear, dynamic, and stochastic programming models VII. Learn about solution methods and apply them in selected software packages VIII. Learn how to analyze the model solution, examine how robust a solution is and how sensitive the results are to model inputs IX. Learn about a variety of applications in areas such as marketing, sports, transportation science, health care, energy, military, manufacturing and production planning, supply chain management, finance and economics, logistics and distribution

Student outcomes	Level of contribution
SO1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	High
SO2. 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.	Little
SO3. An ability to communicate effectively with a range of audiences.	Not applicable
SO4. 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.	Partial
SO5. 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.	High
SO6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	High
SO7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	Partial

Week	Topics	Learning outcome(s)
1	Course overview; Introduction to modeling and the problem-solving process	I, III
2	Linear optimization models	II-IX
3	Sensitivity analysis in linear models: Shadow price, reduced cost	II-IX
4	Network optimization models	II-IX
5	Optimization models with integers	II-IX
6	Optimization models with integers (cont'd)	II-IX
7	Combinatorial optimization models	II-IX
8	Combinatorial optimization models (cont'd)	II-IX
9	Nonlinear optimization models	II-IX
10	Nonlinear optimization models (cont'd)	II-IX
11	Dynamic programming models	II-IX
12	Dynamic programming models (cont'd)	II-IX
13	Stochastic programming models	II-IX
14	Stochastic programming models (cont'd)	II-IX