Course number and name	END 331 / Operation Research I
Credits, contact hours, categorization of credits	3 credits / 42 hours / Engineering topic
Instructor or course coordinator	Özgür KABAK, Y. İlker TOPCU, Kutay TİNÇ
Text book and other supplemental materials	• Winston W.L. (2004) *Operations Research: Applications and Algorithms,* Brooks/Cole – Thomson Learning • *Taha H.A. (2003) Operations Research: An Introduction,* Pearson Education Inc. • *Taha H.A. (2000) Yoneylem Arastirması, Literatur Yayincilik (cev. Alp Baray ve Sakir Esnaf)* • *Winston W.L., Albright S.C. (2001) Practical Management Science, Duxbury Press, Wadsworth Inc.* • *Render B., Stair R.M. Jr., Hanna M.E. (2003) Quantitative Analysis for Management,* Pearson Education Inc. • *Taylor B.W. III (2002) Introduction to Management Science,* Pearson Education Inc • Rardin R.L. (1998), Optimization in Operations Research, Prentice Hall Inc.

Course information	
Content	This course aims to teach quantitative decision making, modeling philosophy and model building, the modeling concepts in production and management, linear programming and Simplex algorithm, Big M and Two Phase Simplex Methods, Revised Simplex method, Duality and economic analysis, transportation models and their solution methods, introduction to network models, and the use of Lindo, Excel Solver, OpenSolver for Excel, and GAMS software for solving linear models.
Prerequisites	MAT 121 / MAT 261 Linear Algebra/MAT 210 Engineering Mathematics/ END 210 Linear Algebra for Industrial Engineering
Type	Required

Course learning outcomes
Students who pass the course will: I. Formulate mathematical programs, II. Solve a linear programming problem and comprehend the analysis of results, III. Understand the sensitivity of a solution to the changes in parameters of a linear model, IV. Use some computer software to model, solve and analyze a linear model, V. Identify whether a solution is optimal or not, VI. Solve and analyze transportation and assignment problems with some dedicated methods, VII. Recognize and succeed in modeling network flows.

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.	Partial
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.	Little
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.	Partial
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	Introduction to OR, Introduction to LP, Modeling with LP	I
2	Modeling (LP formulation)	I
3	Graphical Method, Simplex Algorithm	II, V
4	Big M Method, Two Phase Simplex	II, V
5	Introduction of LINDO, Excel Solver and OpenSolver for Excel software packages	II, IV
6	Introduction to GAMS software	II, IV
7	Sensitivity Analysis (Utilizing graphical solution, utilizing software output, the 100% rule)	III
8	Duality, Complementary Slackness and Dual Simplex	III, V
9	Revised Simplex	II, V
10	Sensitivity Analysis (Utilizing revised simplex)	III
11	Formulating the Transportation Problem and identifying a Basic Feasible Solution	I, II
12	Solution for Transportation Problems using Transportation Simplex and Sensitivity analysis	II, III, V, VI
13	Assignment and Transshipment Problems	I, VI
14	Introduction to network flows	I, VII