ÇANKAYA UNIVERSITY
Faculty of Engineering
Department of Industrial Engineering

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COURSE SYLLABUS

Course Code	: **IE 232**	Semester	: **Spring 2026**
Course Title	: **Operations Research I - Modeling**	Group(s)	: 01 & 02
Prerequisite(s)	: IE 101 Industrial Engineering Orientation		
Curriculum Year	: 2	Credit	: 4
Type of Course	: Compulsory	ETCS	: 6

Instructor:	Ferda Can ÇETINKAYA Professor B.S., M.S., Ph.D. in Industrial Engineering	Teaching Assistant (TA):	Ahmet Yücel TANRIVERDİ Research Assistant B.S. in I.E., M.S. Student in I.E.
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	GROUP 01			GROUP 02		
	Day	Time	Classroom	Day	Time	Classroom
Lectures:	MONDAY	14:20 – 15:10	L-A14	THURSDAY	10:20 – 11:10	L-A14
		15:20 – 16:10	L-A14		11:20 – 12:10	L-A14
		16:20 – 17:10	L-A14		12:20 – 13:10	L-A14
Recitation & Lab:	FRIDAY	09:20 – 10:10	L-A14	FRIDAY	11:20 – 12:10	L-A14
		10:20 – 11:10	L-A14		12:20 – 13:10	L-A14

Course Description: This is the first of a series of three Operations Research courses in the IE curriculum. The emphasis is on the formulation of deterministic mathematical models rather than solution techniques. The topics covered include an overview of Operations Research and modeling, classification and examples of mathematical models, formulation of linear programming models, integer and mixed-integer linear programming models, network (flow) models, and some special features of mathematical programming models.

Course Objectives: The main aims of this course are:

- to introduce an understanding of the Operations Research approach and mathematical modeling,
- to introduce the formulation of linear programming models under static and dynamic settings,
- to introduce formulation of integer and mixed-integer programming models and to develop skills in representing conditions using integer variables,
- to introduce formulation of network (flow) programming models,
- to introduce the usage of basic mathematical programming and optimization software packages/add-ins.

Learning Outcomes: On successful completion of the course, all students will be able to:

1. Develop skills in building mathematical programming models.
2. Develop skills in using mathematical programming and optimization software packages.
3. Be involved in teamwork.
4. Be aware of ethical issues.

Textbook: Winston W.L. (2003), *Operations Research: Applications and Algorithms*, 4th Ed., Cengage.

Some reference books are as follows:

1. Hillier, F.S., and Lieberman, G.J. (2015), *Introduction to Operations Research*, 10th Ed., McGraw-Hill.
2. Taha, H.A. (2017), *Operations Research: An Introduction*, 10th Ed., Pearson.

Aside from these books, the University Library has a good collection of introductory and advanced-level operations research books, which can be searched at http://www.cankaya.edu.tr.

Course Website: Course-related materials, including lecture notes, homework and lab assignments, exam results, and announcements, will be uploaded to the course website at http://webonline.cankaya.edu.tr for anytime access.

Course Outline:

Week	Topic(s)
1	**Introduction to Operations Research and Model Building:** Classification and Examples of Mathematical Models (Deterministic vs Stochastic, Linear vs. Nonlinear, Single vs. Multi-Objective, Static vs. Dynamic)
2	**Linear Programming Models:** Knapsack, Diet, Workforce Scheduling Problems
3	**Linear Programming Models:** Blending, Financial Planning Problems
4	**Linear Programming in Multi-Period Models:** Inventory Models, Rolling-Horizon Concept, Multiple Products, Backlogging/Lost Sales
5	**Linear Programming in Multi-Period Models:** Production Smoothing, Financial Planning, Workforce Scheduling Problems
6	**Integer Programming Models:** Binary Variables, Logical Conditions
7	**Integer Programming Models:** Fixed costs, Disjunctions
8	**Integer Programming Models:** Knapsack, Assignment Problems, Machine Scheduling Problems
9	**Integer Programming Models:** Set Covering, Set Packing, and Set Partitioning Problems, Cutting-Stock (Trim-Loss) Problems
10	**Some Special Features of Mathematical Programming Models:** Converting Minimization and Maximization Models into Each Other, Unrestricted-in-Sign Variables, Absolute Values, Linearizing a Minimax (or Maximin) Objective, Linearizing the Multiplication of Variables, Constraint with k Possible Values, If-Then Constraints, Enforcing Disjunctions, Piecewise Continuous and Discontinuous Linear Functions
11	**Network Flow Models:** Shortest Path Problem, Minimum Spanning Tree Problem
12	**Network Flow Models:** Transportation and Transshipment Problems
13	**Network Flow Models:** Maximum Flow Problem, Minimum Cost Problem
14	**Network Flow Models:** Traveling Salesperson Problem

Lectures: Each week, there will be 3 hours of lectures. Students are expected to read the material from the previous lectures before attending the next class. By becoming prepared, students will find the lectures more engaging and will benefit more from the discussions.

Recitations & Lab Sessions: Each week, there will be one hour of recitation and one hour of a lab session.

- During the recitations, the teaching assistant solves problems related to the material covered in the lectures.
- During the lab sessions, the teaching assistant enables students to learn optimization software packages interactively.

Lecture, Recitation, and Lab Session Notes: Lecture, recitation, and lab session notes will be posted on the course website before each lecture, recitation, and lab session, allowing students to add their own notes to the provided materials.

Assignments: There will be three types of assignments: Reading, Homework, and Lab Work.

Reading Assignments: From time to time, there will be some reading assignments that will support the lectures. For any examination, students are responsible for studying all assigned readings, even if they might not be discussed in class.

Homework Assignment: There will be **one** homework assignment containing discussion questions and problems to be submitted before Midterm Exam 1. Its submission date will be announced later.

Lab Work Assignment: In this course, lab work assignments also play a crucial role in ensuring students' understanding of the optimization software packages that they have learned during the lab work sessions. There will be **a lab work assignment** containing computer exercises. Labwork reports should be uploaded to the course's website **no later than 23:30 on Sunday, May 24, 2026**.

Study Team Formation for homework/labwork assignments:

- For homework and labwork assignments, students are required to **work in teams of three**.
- Students from both sections of the class can collaborate to form a study team.
- It is the student's responsibility to find his/her team members.
- The composition of a team is fixed for the entire semester. If a team member wants to leave their study team for any reason, they are not permitted to join another team or work alone.
- The ***Study Team Info Form***, which is available for download on the course's website, should be completed **by one team member and shared with other members**.
- Each member of the study team must upload the electronic file of the Study Team Info Form (with a .doc or .docx extension) to the course's website **no later than 23:30 on Wednesday, March 4, 2026**, to confirm their membership in the study team.
- **If a student cannot find team members**, he/she should submit the Study Team Info Form with his/her information only. It will then be assumed that this student agrees to be assigned to a team by the instructor.
- **If two students form a team but are unable to find a third member**, they should submit the Study Team Info Form with only their information. By doing this, it will be assumed that they agree to have a third member assigned to their team. Alternatively, the instructor may assign them to different teams.
- **In any of the following cases, it will be assumed that the team has not been established, and the instructor will randomly assign students to different teams.**
  - **The forms submitted by team members differ from one another.**
  - **The forms are incomplete.**
  - **Not all team members have submitted their forms.**

Homework and Lab Work Report Submission:

- Each team is required to submit **one written report** for every homework and lab work assignment.
- The ***Cover Page for the Homework and Lab Work Reports*** available on the course's website should be used for each homework and lab work report.
- **If a team member does not participate in the study of a homework/labwork assignment, the other team members have the right to omit his or her name from the cover page. Consequently, that student's grade for the assignment will be zero.**.
- **Each team is expected to submit an original report that reflects the efforts of its members**. Homework/labwork reports should represent the team's independent work and require original thought. Collaboration between members of different teams is not considered independent work. Additionally, it is not independent work if one team derives an answer and shares it with others. Furthermore, if two teams work separately to find their answers, compare their results, identify mistakes, and correct them together, that also does not qualify as independent work.
- **One student from each team must upload the homework/labwork report to the course's website by the assignment's due date and time.**
- Late submissions of homework/labwork reports will be accepted, but a penalty scheme will be applied.

	Total Penalty
$0 < \text{Delay} \leq 10$ minutes	25 points
$10 < \text{Delay} \leq 20$ minutes	50 points
$20 < \text{Delay} \leq 30$ minutes	75 points
$30 < \text{Delay}$	100 points (The report will not be evaluated.)

- There will be **no opportunities to make up homework/labwork assignments**.
- Additional details about the homework assignments will be provided later.

Computer Usage: Lab work assignments require the use of optimization software packages (LINDO, GAMS, and Excel Solver) to solve linear, integer, and mixed-integer programming models. For this purpose, you need to

- download GAMS (http://www.gams.com/download), and LINDO (hhtp://www.lindo.com/donloads/lnd61.zip), and
- enable the Excel Solver add-in in Microsoft Excel.

Announcements & Uploads: Students should consistently check their university email accounts and the course website for announcements and uploads.

Attendance: Some information regarding the attendance is as follows:

- **Students are required to attend all lectures in the same course section (group). Similarly, they must attend all recitation and lab sessions in the same course section.**
- **Lecture and recitation/lab sections may differ if there are course conflicts in students' course schedules. Students will be assumed to attend in their registered sections unless they inform the instructor of their course conflicts.**
- **Attendance will be taken during each hour.**
- **The MINIMUM ATTENDANCE REQUIREMENT IN BOTH LECTURES AND RECITATION/LAB SESSIONS IS 60%**, according to the University's Senate decision.

- **Students who do not meet the minimum attendance requirement will not be allowed to take the final exam, as stated by the University's rules and regulations. In this case, if a student takes the exam, their exam will be considered invalid.**
- **Medical report periods are counted as absences in the calculation of the attendance percentage, as stated by the University's rules and regulations.**
- Every hour, it is the students' responsibility to remind the instructor/TA to take attendance.
- Students' attendance records for each week will be updated and announced on the course's website at the end of the week.
- The instructor will maintain records of student attendance.
- If students miss a lecture, recitation, and lab session, it is their responsibility to learn about course-related activities and the material covered during this hour.

Class participation: Class participation goes beyond attending lectures, recitations, and lab sessions. Students are expected to engage thoughtfully in class discussions. Regular attendance and active participation are essential for effective learning and success in this course. Students who consistently attend lectures, recitations, and lab sessions and study regularly are likely to benefit significantly and will receive marks accordingly.

Academic Misconduct: All students at Çankaya University are expected to always uphold academic integrity, whether faculty members are present or not. Collaboration of any kind is not allowed during exams. Any suspected cases of academic dishonesty will be addressed in accordance with the University's rules and regulations.

Honesty Policy: All students admitted to Çankaya University must acknowledge their understanding and commitment to the Honor Code established by the Department of Industrial Engineering for examinations and assignments. This statement serves as a reminder of your responsibilities as a Çankaya University student, emphasizing the importance of honesty in all submitted work and during exams in this course.

Exams and Quiz: There will be **three exams** (two midterms and one final) and **a quiz**.

- All exams will:
  - Be held in class (no take-home exam will be given).
  - Be closed-notes/closed-book.
  - Have two parts:
    - Part 1 has fill-in-the-blanks, short-answer, and discussion questions.
    - Part 2 has problem-type questions.
- Quiz will:
  - Be held in class (no take-home exam will be given) before the final exam period.
  - Be closed-notes/closed-book.
  - Have two parts:
    - Part 1 has fill-in-the-blanks, short-answer, and discussion questions on the optimization software packages (LINDO, GAMS, Excel Solver) used for solving linear, integer, or mixed-integer programming models.
    - Part 2 has coding questions related to the optimization software packages (LINDO, GAMS, Excel Solver).
- Midterm Exam 2 will only cover the material studied after Midterm Exam 1.
- The Final Exam will cover all material studied throughout the semester and will take place during the designated final exam week.
- In all exams and the quiz,
  - Students should ensure they take all necessary precautions before coming to the exam places and may bring their own water, snacks, and other items.
  - Students are required to bring their **University ID cards**.
  - Students should arrive early for the scheduled exam, as seating will be assigned according to a list.
  - Students are **<u>not</u>** allowed to:
    - Ask any questions.
    - Write anything on the back of each sheet of the exam booklet (If this rule is violated, the corresponding answer will not be graded, and no points will be awarded for this question.)
    - Detach the papers from the exam booklet (If this rule is violated, a penalty of 50 points will be imposed.)
    - Keep cellular phones on the desks.
    - Use smartphones.
    - Share personal belongings with other students, such as calculators, erasers, pencils, etc.
    - Use their cellular phone as a calculator.
    - Leave the exam room for any reason, including but not limited to visiting the restroom, smoking, or any other activities.

Make-up Exam Policy: Make-up exam policies are as follows:

- A make-up exam will be offered to students who miss an exam and provide a valid, verifiable, and documented excuse (e.g., a medical report approved by the Çankaya University Health Center). If those students want to take the make-up exam, they should inform the instructor by email within three days following the exam.
- There will be no additional make-up exam for the make-up exam in accordance with the University's rules and regulations. Students who do not attend a make-up exam are considered to have used their rights.
- The format of a make-up exam may differ from that of a regularly scheduled exam.

Objections: Any form of document concerning work, which is to be used by the instructor as the basis of grading, will be shown to the student upon request. Students who feel they received improper grades have the right to a formal appeal.

- An objection to the grade of the exams must be made to the instructor.
- An objection to a grade for the homework/labwork assignments and the quiz must be made to the TA.

Assessment Items: The percentages below indicate the relative importance of various assessment tools considered in this course.

Assessment Item	***Marked Out of***	***Weight (%)***
1 Homework	100	5
1 Labwork	100	5
1 Quiz	100	5
2 Midterm Exams	100	2 ´ 30
Final Exam	100	25
TOTAL		100

Grade Improvement: The semester letter grades will be based solely on the required work listed above and cannot be improved by submitting additional work.

Grading Policy: **Letter grades** will be assigned using the standard scales of the catalog grading system described in Çankaya University regulations and listed below.

UNDERGRADUATE AND GRADUATE STUDENTS		
Letter grade	***Coefficient***	***Score Intervals***
AA	4.00	90-100
BA	3.50	85-89
BB	3.00	80-84
CB	2.50	70-79
CC	2.00	60-69
DC	1.50	50-59
DD	1.00	45-49
FD	0.50	35-44
FF	0.00	0-34

The instructor may bypass the catalog grading system if needed, allowing for different score intervals.

The Registrar's Office will announce the letter grades for the semester.

Letter Grade NA: The **occurrence of one of the cases below** will lead to **grade NA**:

- Case 1: Being **absent from all midterm and final exams on their scheduled exams, with or without taking their make-up exams**.
- Case 2: Being **absent from both midterm exams on their scheduled exams, with or without taking their make-up exams**.
- Case 3: Being **absent from a midterm exam and the final exam on their scheduled dates, with or without taking their make-up exams**.

Please note that:

- **Case 3 above does not apply to the students who will not be able to take the final exam due to not satisfying the minimum attendance requirement.**
- Students with a grade of NA are not eligible to use their Additional Exam Rights (Ek Sınav Hakları) as stated by the University's rules and regulations.

Course Evaluations: Çankaya University is committed to continuous improvement and encourages student involvement in course evaluations. Your feedback will be treated confidentially, ensuring that your identity remains unknown unless you choose to disclose it.

You are welcome to provide feedback at any point during the semester, not just at the end-of-semester evaluation. To give your comments, please write or type them on a small piece of paper without including your name. Once you have written your feedback, simply slide the paper under the instructor's office door.

Important Notes:

1. Please retain this course syllabus for future reference, as it contains important information. It will also be accessible on the course and department's website.
2. You are required to stay informed about any syllabus changes announced during lectures or on the course's website this semester.
3. If you have questions about the coursework, please refer to this syllabus first to find the answer yourself. If the answer is in the syllabus, do not ask your instructor the same question.