



ÇANKAYA UNIVERSITY
Faculty of Engineering
Department of Industrial Engineering
Eskişehir Yolu 29. km., Ankara, Turkey
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COURSE SYLLABUS

Course Code : **IE 474**

Course Title : **Scheduling and Sequencing**

Pre-requisites : IE 366 Manufacturing and Service Systems Planning II

Credit : (3 0 3)

Semester : **Fall' 2026**

Groups : 01

Type of Course: Elective

ETCS : 5

Instructor: Ferda Can ÇETINKAYA
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Office Hours: To be announced later.

Teaching Assistant (TA): To be announced later.

	Day	Time	Classroom
Lecture Hours:	TUESDAY	09:20 – 10:10	L-A14
		10:20 – 11:10	L-A14
		11:20 – 12:10	L-A14

Course Description: This course introduces the principles, techniques, and algorithms for solving machine (resource) scheduling problems of the manufacturing and service systems. The topics covered in this course are an overview of terminology, characteristics, and classification of scheduling and sequencing problems, an overview of computational complexity theory, single machine, parallel machines, flow shop, job shop, and open shop scheduling problems with various scheduling criteria, dispatching rules, branch-and-bound, dynamic programming, local search, and metaheuristic approaches.

Course Objectives: The main aims of this course are:

- to introduce the basic concepts to understand and describe a variety of scheduling problems faced in manufacturing and service systems,
- to introduce the techniques for modeling scheduling problems using appropriate mathematical models of linear and integer programming types, and
- to introduce a comprehensive treatment of the various types of algorithms to solve the scheduling problems.

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

1. Able to identify basic concepts and issues for scheduling and sequencing problems in manufacturing and service systems.
2. Capable of using quantitative methods to model, analyze, and optimize scheduling and sequencing problems.
3. Capable of formulating mathematical programming models for solving a variety of scheduling and sequencing problems, and have improved their skills in mathematical modeling.
4. Have skills in using basic mathematical programming and optimization software (such as LINGO, GAMS, CPLEX, etc.) and coding an algorithm in a general-purpose language.
5. Have skills in report writing.
6. Search and use databases for scheduling papers.
7. Able to involve in teamwork.
8. Able to be aware of ethical issues.

Textbook: There is no specific textbook for the course. Students are recommended to obtain a copy of one of the following reference books:

1. K.R. Baker, D. Trietsch, Principles of Scheduling and Sequencing, Wiley, 2009.
2. J. Blazewicz *et al.*, *Scheduling Computer and Manufacturing Processes*, Springer-Verlag, 1996.
3. P. Brucker *et al.*, *Scheduling Algorithms*, Springer-Verlag, 2007.

4. J.M. Framinan *et al.*, *Manufacturing Scheduling Systems*, Springer-Verlag, 2014.
5. T.E. Morton, *Heuristic scheduling systems: with applications to production systems*, Wiley, 1993.
6. R. G. Parker, *Deterministic Scheduling Theory*, Chapman & Hall, 1995.
7. M. Pinedo, *Scheduling: Theory, Algorithms, and Systems*, Prentice Hall, 2008.
8. M. Pinedo, and X. Chao, *Operations Scheduling with Applications in Manufacturing and Services*, McGraw-Hill, 1999.
9. D. Sule, *Industrial Scheduling*, PWS Publishing, 1997.

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

Course Website: Course-related materials, including lecture notes, homework 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: Definition of the scheduling problem, notation, three-field representation for scheduling problems, classification of scheduling problems
2	Introduction: Equivalency of performance measures, regular and irregular performance measures, complexity theory, classification of solution algorithms, measuring performance of approximation algorithms
3	Single machine scheduling problems: Dominant sets, mathematical programming formulations, total flow time minimization, weighted flow time minimization, total lateness minimization
4	Single machine scheduling problems: Maximum lateness and maximum tardiness minimization, number of tardy jobs minimization, total weighted completion time minimization with precedence constraints, dynamic programming approach
5	Single machine scheduling problems: Neighborhood search techniques, dominance properties in total tardiness minimization, branch and bound algorithm for total tardiness minimization
6	Parallel machines scheduling problems: Mathematical programming formulations, list scheduling, makespan minimization, makespan minimization with preemption, mean flow time minimization
7	Parallel machines scheduling problems: Mean flow time minimization with machine availability, uniform and unrelated parallel machines
8	Metaheuristics: Simulated annealing, tabu-search, and genetic algorithms
9	Flow shop scheduling problems: Permutation schedules, mathematical programming formulations, two-machine makespan minimization, three-machine makespan minimization, branch and bound algorithm for makespan minimization
10	Flow shop scheduling problems: Heuristics for multiple machines makespan minimization, two-machine total flow time minimization by branch and bound algorithm
11	Flow shop scheduling problems: Flow shops with dominating machines, proportionate flow shops, ordered flow shops
12	Job shop scheduling problems: Two-machine makespan minimization
13	Job shop scheduling problems: Network representation of the job shop problem, disjunctive programming formulation, priority dispatching rules, heuristic algorithms for makespan minimization
14	Open-shop scheduling problems: Two-machine makespan minimization; multi-machine makespan minimization.

Lectures: The instructor will discuss only selected important concepts and points. To be familiar with the material presented in lectures and to participate in class discussions, students are expected to read the material covered in previous lectures before the new class meeting. If the students come prepared, then they will find the lectures more interesting and will benefit from the discussion. In doing homework assignments, students should work in teams.

Lecture Notes: All lecture notes will be posted on the course website at the beginning of the semester, allowing students to add their own notes to the provided materials.

Assignments: There will be two types of assignments: Reading & Self-study and Homework Assignments.

Reading & Self-study

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

Homework Assignments: There will be **two** homework assignments (1 assignment to be submitted before the Midterm Exam and one assignment to be submitted before the Final Exam) containing discussion questions, problems, GAMS exercises, and the research study. Homework submission dates will be announced when the homework is assigned.

Study Team Formation for Homework Assignments:

- For homework assignments, students are required to **work in teams of three**.
- 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, October 14, 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 their 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 Submission:

- Each team is required to submit **one written report** for every homework assignment.
- The **Cover Page for the Homework Reports** available on the course's website should be used for each homework submission.
- If a team member does not participate in the study of a homework assignment, the other team members have the right to omit their 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 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 does not qualify as independent work either.
- One student from each team must upload the file(s) having the homework report and GAMS file(s), if any, to the course's website by the assignment's due date and time.**
- Late submissions will be accepted, but a penalty scheme will be applied.

	<u>Total Penalty</u>
0 < Delay £ 10 minutes	25 points
10 < Delay £ 20 minutes	50 points
20 < Delay £ 30 minutes	75 points
30 < Delay	100 points (The homework will not be graded.)
- There will be **no opportunities to make up homework assignments**.
- Additional details about the homework assignments will be provided later.

Computer Usage: Homework assignments may require the use of the optimization software GAMS to solve mathematical programming models. Students are expected to have learned how to use this software package in courses taken in previous semesters. If you are not familiar with it, it is primarily your responsibility to learn how to use it.

Generative AI Usage: Students are permitted to use generative AI in their homework assignments, as long as they adhere to Çankaya University's Generative Artificial Intelligence (AI) Policy available on the University's website at https://www.cankaya.edu.tr/duyuru/uploadfiles/106_10221/files/2025-07-22-13-10-09_00411.pdf. It is essential to clearly identify and reference any use of generative AI in homework assignments. Failure to comply with the Generative AI Policy may result in a reduction in homework grades.

Announcements &

Uploads: Students should regularly check their university email accounts and the course website for announcements and updates.

Attendance: Some information regarding the attendance is as follows:

- **Attendance will be taken during each hour.**
- **The minimum attendance requirement 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 final 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 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, 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. 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 and study regularly are likely to benefit significantly and will receive marks accordingly.

Academic Misconduct: All students at Çankaya University are expected to uphold academic integrity, whether faculty members are present or not. No collaboration is 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: There will be **two exams** (a **midterm** and a **final**).

- All exams will:
 - Be held in class (no take-home exam will be given).
 - Be closed-notes/closed-book type.
 - Have two parts:
 - Part 1 has fill-in-the-blanks and short-answer questions.
 - Part 2 has problem-type questions.
- Final Exam will only cover the material studied after the Midterm Exam.
- For all exams,
 - Students should ensure they take all necessary precautions, including but not limited to visiting the restroom, smoking, etc., before coming to the exam halls.
 - Students are required to bring their **University ID cards**. **If this rule is violated, they are not allowed to take the exam.**
 - A list showing which exam hall each student is assigned to will be posted on the door of the exam hall 15 minutes before the exam. Each student must take the exam in his/her assigned hall. **If a student takes the exam in an exam hall other than the assigned one, their exam will be considered invalid, as stated by the University's rules and regulations.**
- During the exams,
 - Mobile phones, smartwatches, programmable calculators, tablets, laptops, pencil cases, lecture notes, books, and clothing should **not** be kept on desks, inside desks, or on seats.
 - Mobile phones, smartwatches, programmable calculators, tablets, laptops, pencil cases, lecture notes, and books should be placed in bags, backpacks, or clothing.
 - Bags, backpacks, and clothing should be kept on the coat racks and hangers on the walls of the exam halls.
 - Only personal belongings such as University ID cards, non-programmable calculators, pens, pencils, erasers, beverage bottles, biscuits, crackers, and similar foods are permitted to be kept on desks.
 - Students are **not** 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.**)
 - Share personal belongings with other students.
 - Leave the exam room for any reason, including but not limited to visiting the restroom, smoking, etc.

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 believe they received an improper grade 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 assignments must be made to the TA.

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

<i>Assessment Item</i>	<i>Marked Out of</i>	<i>Weight (%)</i>
Homework Assignments	100	25
Midterm Exam	100	35
Final Exam	100	35
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.

<i>UNDERGRADUATE AND GRADUATE STUDENTS</i>		
<i>Letter grade</i>	<i>Coefficient</i>	<i>Score Intervals</i>
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 the case below** will lead to **grade NA:**

- Case: **Students being absent from both midterm and final exams on their scheduled dates, with or without taking their make-up exams.**

Please note that:

- **The case above does not apply to the students who are not 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.