



ÇANKAYA UNIVERSITY

Faculty of Engineering

Department of Industrial Engineering

Eskişehir Yolu 29. km., Ankara, Turkey

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COURSE SYLLABUS

Course Code	: IE 514	Semester	: Fall' 2020
Course Title	: Scheduling in Manufacturing Systems	Groups	: 01
Pre-requisites	: Consent of the Instructor	Type of Course	: Elective
Credit	: 3 (ECTS: 7,5)		

Instructor	: Ferda Can ÇETINKAYA, B.S., M.S., Ph.D. in I.E. <i>Professor</i>	Lecture Hours	: Thursday 18:00 – 18:50 19:00 – 19:50 20:00 – 20:50
Office	: Dept. of Ind. Eng., Faculty of Engineering Block L, 3 rd floor, Room L-306, Central Campus	Classroom	: Balgat Campus, SEDAM-1
Office Tel	: +90 – 312 – 233 13 61, +90 – 312 – 233 13 64	Office Hours	: Thursday 17:00 – 17:50 (Balgat Campus A-203C)
E-mail	: cetinkaya@cankaya.edu.tr		

Catalog Data: Classification of scheduling problems and an overview of computational complexity theory. Deterministic scheduling and sequencing problems: single-stage, parallel machine, and multi-stage (open shop, flow shop, job shop, mixed shop) manufacturing environments. Dispatching. Exact solution techniques: linear (integer) programming, branch-and-bound methods, dynamic programming. Approximate solution techniques: Metaheuristics (simulated annealing, tabu search, genetic algorithms), constructive algorithms. Applications to the real-life problems.

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

- An awareness of different shop configurations, manufacturing scheduling problems, and performance measures
- Ability to construct mathematical programming models for various manufacturing scheduling problems
- Ability to identify basic algorithms and procedures written communication skills
- Ability to understand the solution methodologies available in solving manufacturing scheduling problems
- Skills in using the optimization software GAMS and interpreting the solutions obtained

On successful completion of the course, all students will have:

- Improved their independent research skills
- Improved their written communication skills
- Awareness of ethical issues

Textbook: No specific textbook is suggested for the course. Materials from the following books and some selected journal articles will be used.

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.

Course Web Site: Course related materials including the records of the live lectures, lecture notes, term project study and homework assignments and all course related materials will be uploaded to the webonline (moodle) site of the course on the link <http://webonline.cankaya.edu.tr> so that they can be reached any time.

Language: The language of instruction in this course is English as the University commits it. Thus, students and the instructor should avoid the use of other languages in both their oral and written communication during lectures.

Lectures: Our university will continue its education and training activities via distance learning system in the Fall semester of year 2020. In this system, the theoretical hours (lectures) of the courses will be delivered synchronously (i.e., live lectures will be given by the instructors through video conferencing software "Zoom").

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

Lecture Notes: Lecture notes will be uploaded to the course web site within one day before the lectures to give the chance to the students to take extra notes on the lecture notes.

Assignments: There will be three types of assignments: Reading, Homework, and Term Project.

Reading Assignments: From time to time, there will be some reading assignments, which are mainly from journal articles supporting the lectures. For any type of examination, students are also responsible from studying all assigned readings, even if they might not be discussed in class.

Homework Assignments: In this course, homework assignments play crucial role in ensuring students from understanding of the material that they have learned in lectures. Some details are as follows:

- There will be **four** homework assignments (2 assignments before the Midterm exam, and 2 assignments after the Midterm exam) containing some discussion questions, problems, and computer exercises based on lecture notes and reading assignments.
- In doing the **homework assignments**, each student should study individually.
- The homework assignment reports should be as professional in appearance.
- It is expected that each student will submit an original report, which reflects only his/her effort. Homework assignments should be the student's independent work which requires independent thought. If some students work together or one student derives the answer and then share that answer with other students is not an independent work. Likewise, if two or more students work alone to derive their answers, compare them and find their mistakes, and then correct them together is not an independent work.
- Each student should upload his/her **homework assignment report** to the webonline site of the course *on or before* the due date and time of the homework assignment. Note that late submissions of reports will NOT be accepted.

Term Project: There will be a term project study, which involves the detail investigation of a scheduling problem in a manufacturing environment, developing a mathematical programming model and a heuristic algorithm for this environment, and solving the mathematical programming model by GAMS. Some details are as follows:

- In doing the **term project**, students should work in teams with **two or three** members.
- It is the student's responsibility to find his/her team members.
- The composition of the study teams cannot be changed throughout the semester. That is, if a team member wants to leave his/her study team for any reason, then he/she is **neither** allowed to join into another team **nor** work alone.
- Each study team should fill out the **Info Form of a Term Project Study Team**, which can also be downloaded from the webonline site of the course. In the form, the student number, name and surname, cellular phone number and e-mail (other than the e-mail at student.cankaya.edu.tr provided by the University) of the team members should be complete. Incomplete forms are not accepted.
- If a student fails to form a team, then he/she should also submit a form with his/her info only. This student will be assigned to a team by the instructor.
- By **October 15, 2020 (Monday); 16:30**, the **electronic file of the Info Form of a Term Project Study Team** should be uploaded to the webonline site of the course **by each member of the study team** to confirm their membership in the study team.
- The term project topic will be assigned by the instructor.
- The term project reports should be as professional in appearance.
- Each team should upload a **single written report** to the webonline site of the course *on or before* the due date and time of the term project assignment. Note that late submissions of reports will NOT be accepted.
- It is expected that each team will submit an original report, which reflects only the effort of team members. Term project study should be the teams' independent work which requires independent thought. If the members of different teams work together or one team member shares their study with other

teams is not an independent work. Likewise, if two teams work alone, compare their study results and find their mistakes, and then correct them together is not an independent work.

- Other details regarding the term project study will be given later.

Computer Usage: Some homework assignments may require the use of MS-OFFICE (Word, Excel, and Visio) and the computer software package (GAMS) for solving linear or integer programming models of scheduling problems. It is the students' responsibility to learn how to use these software packages.

Exams: There will be one midterm exam and the final exam. All exams will be held in a classroom at Balgat Campus (i.e., no take-home exam will be given.) and will have two parts (Part 1 is closed-notes/closed-book type with multiple-choice and short-answer questions; Part 2 is open-notes/closed-book type with problems and discussion-type questions.)

Final exam will be non-cumulative (i.e., it covers only the material studied after the midterm exam) and will be scheduled for a day and time in the designated final exams week.

During the exams, students may need a hand-calculator and will not be allowed to ask anything regarding the exam questions.

Make-up Exams: Make-up exam policies are as follows:

- If a student misses an exam and has a genuine and valid excuse for his/her absence, a make-up exam will be given.
- Student's illness or death of his/her family member will be accepted as a valid excuse.
- If the student's absence is the student's illness, then the medical report should be submitted to the University's Health Center. Note that medical reports given by private medical doctors or medical centers may not be approved by the University's Health Center. On the other hand, if the student's absence is the death of his/her family member, then official note given by the Government Office should be submitted to the Department Chairman's Office.
- A make-up exam format may have a different format and may contain different types of questions than a regularly scheduled examination. For example, an oral exam may also be used as a part or whole of the make-up exam.

Announcements &

Uploads: It is the students' responsibility to regularly check their e-mail accounts and the webonline (moodle) site of the course for announcements and uploads.

Zoom Meetings for

Lectures: During a Zoom meeting for a lecture, each student should keep his/her video open and unmute his/her microphone when he/she wants to ask a question. After each question is asked, the microphone should be closed.

Punctuality: Students are expected to be in class on time. Those joining to a Zoom meeting 5-minute late will not be admitted to the Zoom meeting since the meeting will be locked and no one else can join the meeting. There will be normally ten-minute break between two consecutive hours in the same day; thus, students who are late will have to wait outside the Zoom meeting until the break is given.

Attendance: Students are expected to attend all lectures. Regular class attendance is not a sufficient condition for effective learning and success in this course. However, those students who attend lectures and study regularly are likely to benefit greatly and receive marks accordingly. At least 50% attendance is required. In case of an overall grade below CC, having an attendance to lectures less than 50% will lead to grade NA.

Class participation: Class participation does not mean class attendance. Students are expected to intelligently participate in class discussions. Silence will be considered as not being prepared for the course or everything has been understood.

Academic Misconduct: Academic integrity is expected of all students of Çankaya University at all times, whether in the presence or absence of members of the faculty. No collaboration of any kind is permitted during any of the examinations, homework and term project studies. All suspected cases will be treated according to the University's rules and regulations.

Grading Policy: Although the student's overall grade will be based on the general assessment of the instructor, the following percentages may give an idea about the relative importance of various assessment tools.

<i>Assessment Item</i>	<i>Marked Out of</i>	<i>Weight (%)</i>
Homework Assignments	100	20
Term Project	100	20
Midterm Exam	100	30
Final Exam	100	30
TOTAL		100

Note that the instructor reserves the right to modify these percentages in case he deems it necessary. In general, overall grades will be assigned using the standard scales for the letter grades. Depending on the difficulty of the exams and the performance of the class, they may be curved accordingly. Semester letter grades will be announced by the Registrar's Office.

Grade Improvement: The grade for the course will only be based on the required work listed above and cannot be improved with additional work.

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 strongly that they have received grades that are improper, have the right of formal appeal. The objection to any grade must be made to the instructor within 7 days following the announcement of the grades.

Office Hour: If you have difficulty in understanding any material after you have tried your best, you should consult your course instructor during his office hour. However, if you wish to meet the instructor outside of his office hour, you can communicate via e-mail or through phone calls to make an appointment, at least one day in advance.

Course Evaluations: Çankaya University is committed to continuous improvement and seeks students' input to that process through their participation in course evaluation process. Your response will be processed so that, unless you wish otherwise, the course instructor will not be aware of your identity. Please help us to help our future students by providing feedback on your experiences in this course. In addition to the end of semester evaluation, you may also provide your feedback at any time during the semester by writing (or typing) your comments on a small piece of paper without indicating your identity and sliding this paper under the door of the instructor's office.

Important Notes:

1. Please keep this course syllabus for future reference as it contains important information. It will also be available in the course and department web sites.
2. You are responsible to know any changes to this course syllabus announced in the course web site and lectures during the semester.
3. If you have any question on the coursework, please always refer to this syllabus to obtain the answer yourself first. If the answer is in the syllabus, then please do not insist on asking the same question to your instructor.