ÇANKAYA UNIVERSITY

Faculty of Engineering

Department of Industrial Engineering

COURSE SYLLABUS

Course Code	: **IE 514**		Semester	: **Fall' 2021**	
Course Title	: **Scheduling in Manufacturing Systems**		Groups	: 01	
Pre-requisites	: Consent of the Instructor; Background in Mathematical Programming and Operations Research		Students	: IE	
			Type of Course	: Elective	
Credit	: (3 0 3)		ETCS	: 7.5	

Instructor	: Ferda Can ÇETINKAYA *Professor* B.S., M.S., Ph.D. in I.E.		Lecture Hours	: Tuesday	18:00 – 18:50 19:00 – 19:50 20:00 – 20:50
Office	: Dept. of Ind. Eng., Faculty of Engineering, Block L, 3rd floor, Room L-301, Main Campus		Classroom	: A-301, Balgat Campus	
Office Tel	: +90 – 312 – 233 13 61, +90 – 312 – 233 13 64		Office Hours	: To be announced later.	
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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. Some reference books are as follows:

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.

Note that aside from these books; University Library has quite a good collection of books on the introductory and advanced level in scheduling, which can be searched at http://www.cankaya.edu.tr.

Course Web Site: Course related materials including the lecture notes, term project study and homework assignments, exam evaluation results, and announcements will be uploaded to the webonline site of the course on the link http://webonline.cankaya.edu.tr so that they can be reached at any time.

Lectures: Lectures will be held face-to-face in the classroom. In the lectures, the topics from the several handouts and selected journal articles will be discussed.

Lecture Notes: Lecture notes will be uploaded to the course webonline 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 the **Homework assignments**, each student should study **individually**.
- The assignment reports should be as professional in appearance.
- 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 of the homework assignment.
- Other details regarding the homework assignments will be given later.

Term Project: There will be a term project study, which involves the development of mathematical programming models, algorithms and computer programs and the use of the relevant software packages for the solution of a real-life project scheduling problem. Students are expected to make their own contribution to the solution of the problem. Some details are as follows:

- In the **Term Project Study**, 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 a **single copy** of the ***Info Form of a Term Project Study Team***, which can be downloaded from the course's webonline site, on which the student number, name and surname, cellular phone number and e-mail of the team members are complete. Incomplete forms are not accepted.
- If a student fails to form a team, and submits a form with his/her name only then it will be assumed that he/she accepts to be assigned to a team by the instructor.
- If two students form a team but could not able to find the third member then it will be assumed that they accept that a third member will be assigned to their team or they can be assigned to different teams by the instructor.
- By **October 18, 2021 (Monday); 23:30**, **the electronic file (with the extension doc or docx) 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, and be same for all teams.
- Each team should prepare a **written report** on their project study in accordance with the technical report writing specifications.
- 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 derive the answer and then share that answer with other teams is not an independent work. Likewise, if two teams work alone to derive their answers, compare them and find their mistakes, and then correct them together is not an independent work.
- One of the students in each team should upload the written report to the webonline site of the course *on* or *before* the due date and time of the term project assignment.

- Each team should give an **oral presentation** of the term project study in front of his/her peers and instructor.
- Each student in a team is expected to participate in the oral presentation.
- Other details regarding the term project study will be given later.

Note that late submissions of homework and term project reports will not be accepted.

Exams: There will be **one midterm exam** and the **final exam**.

- Both exams will be scheduled to be in-class exams.
- Midterm exam will have two parts (Part 1 is closed-notes/closed-book type for conceptual questions; Part 2 is open-notes/closed-book type for discussion-type questions, problems, and GAMS related questions.)
- Final exam will have only part, which is open-notes/closed-book type for discussion-type questions, problems, and GAMS related 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.

Makeup Policy: There will be **no makeup for the homework assignments and the term project study**. Exams may be considered for makeup. Make-up exam policies are as follows:

- If a student misses an exam and has a valid, verifiable, and documented excuse for his/her absence, a make-up exam will be given.
- A make-up exam format can be different than a regularly scheduled examination. For example, an oral exam can be used as a part or whole of the make-up exam.

Computer Usage: Homework assignments will require the use of software package GAMS for solving mixed integer programming models of scheduling problems. It is the students' responsibility to learn how to use this software package. On the other hand, students need computers with webcam, speakers and microphone in order to follow the lectures if the education and training activities will be held via distance learning system.

Announcements & Uploads: It is the students' responsibility to regularly check their e-mail accounts and the course webonline site of the course for announcements and updates.

Attendance: Students are expected to attend all lectures, and be in class on time. 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. Some other information regarding the attendance is as follows:

- Attendance will be taken every lecture hour, due to the requirement of the University's rules and regulations, but will not be considered as an assessment item.
- During every lecture hour, students are responsible to remind the instructor for taking the attendance, and sign the attendance sheet.
- Students' attendance records will be kept by the instructor.

Class participation: Class participation does not mean class attendance. Students are expected to intelligently participate in class discussions.

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 assignments, and term project study. 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.

Assessment Item		*Marked Out of*	*Weight (%)*
4 Homework Assignments		100	4 ´ 5
Term Project	Report	100	15
	Oral Presentation	100	5
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 can not 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 10 days following the announcement of the grades.

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 available in the webonline site of the course and the department's web site.
2. You are responsible to know any changes to this course syllabus announced in lectures or through the webonline 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.