IE 402 - Integrated Manufacturing Systems
FALL 2022

Instructor: L. Taner TUNÇ (ttunc@sabanciuniv.edu, Office: Online)
Mon: 09.40 – 10.30 – FENSL062
Tue: 12.40 – 14.30 – FENS L055

Labs and Teaching Assistants
Wed 10.40 – 12.30
TA: **Bora Gönül**

Credits: 3

Objectives
Introduction to basic elements of integrated manufacturing systems. The students will gain theoretical and practical background on important aspects of integrated manufacturing systems, particularly on Computer-Aided Manufacturing (CAM), Computer Numerical Control (CNC) modelling of turning and milling processes, measurement, and process automation.

Course Description
Overview of Computer Integrated Manufacturing (CIM); overview of process engineering, computer aided manufacturing (CAM), process planning, fundamentals of CNC; CNC programming and applications, error sources in manufacturing, fundamentals of measurement and inspection systems; elements of automated manufacturing systems: sensors, actuators and computer interfacing, robots, monitoring and modelling of manufacturing processes and equipment and the concept of Industry 4.0.

References
- Chang, T-C., Wysk, R.A. and Wang, H-P., 'Computer-Aided Manufacturing' Prentice Hall (third edition), 2006
- J. Tlusty, 'Manufacturing Processes and Equipment', Prentice Hall, 2000.
- S. Kalpakjian and S.R. Schmid, 'Manufacturing Engineering and Technology', Prentice Hall.
- Y. Altintas, Manufacturing Automation, Cambridge, 2000.
- Groover, M.P., 'Automation, Production Systems and Computer-Integrated Manufacturing', Prentice Hall, 2001.

Tentative Schedule

Week	Class	Topic
1	1	Introduction to IE402
	2	Overview of Computer Integrated Manufacturing
2	3, 4	CNC Machines in the Manufacturing Context
3	5, 6	Elements of CNC Machine Tools
4	7,8	Computer Aided Manufacturing (CAM)
5	9	Process Planning
	10	APT Coding – Geometrical definitions
6	11	APT Coding - Motion commands
	12	APT Examples and Applications
7	13,14	**MIDTERM - 1 (TBD)**
8	14	G-Codes in Turning and Milling
	15	Advanced G-Codes in Turning Operations
9	16	Advanced G-Codes in Milling Operations
	17	Modelling of Machining – Orthogonal Cutting
10	18	Modelling of Machining – Oblique Cutting
	19	Mechanics of Turning Operations
11	20, 21	**MIDTERM - 2 (TBD)**
12	22	Introduction to Modelling of Milling

	23	Mechanics of Milling
13	24, 25	Sensors in manufacturing
	26,	Data acquisition and signal processing
14	27	Industry 4.0
	28	Last Lecture

Labs

1. Introduction to Labs
2. CAD (review + advanced modelling)
3. CAM (introduction and turning)
4. CAM (2 ½ axis milling)
5. CAM (3 axis milling)
6. CAM (advanced applications)
7. Part measurement and inspection
8. LabView (basics)
9. LabView (data acquisition and processing)
10. Process monitoring (force measurement)

Exams

There will be 2 x Written Midterm and 1 Final Exam.

In case of any online exam, your webcam and microphone should be ON during the exam. In the case of non-compliance with this and other declared exam procedures, your exam will be void. Make sure to check that your webcam and microphone function properly before the exam.

If you want to take a make up for any of the above exams, you need to give a written notice at least 1 day prior to the exam, via email to the instructor.

The instructor has the right to invite any student to additional oral exams as a double-check after the midterm and/or final exams. The instructor or one of the Tas within the instruction team may go through the exam paper with some of the students on a random selection basis.

Attendance

-You must attend the hybrid and/or synchronous Zoom lectures, recitations, etc. and real-time online exams with your SU email account.
-Attendance to the lab sessions is **mandatory**. You will lose points for each lab session you miss according to the following:

For the 1st lab session: 10 % of the overall Lab work points
For the 2nd lab session: 30 % of the overall Lab work points
For the 3rd lab session: 70 % of the overall Lab work points
For the 4th lab session: **You fail the course!!!**
No exceptions!

F 30, LAB 20, ATT 10, MT 15, QUIZ 10

Tentative Grading (To be decided by you)

1. Final 30 %
2. Lab work 20 %
   (50% Project, 30% HW, 15% Pre/Post lab quiz, 15% TA's evaluation)
3. Lecture Attendance 10 %
4. Midterms 15 % (2 midterms)
5. Lab Final* (Conditional & Tentative) 0% → PASS/FAIL

*The instructor holds the right to conduct Lab Final exam for the whole class.

Manufacturing Project

Students are expected to complete a part manufacturing project to implement the theoretical knowledge gained during the lectures. The students will draw their own 3D part geometry (subject to constraints), prepare the tool path, verify it with their teaching assistants and manufacture it using a CNC machine tool at the Manufacturing Research Lab. **Students are expected to perform simulation study for representative processes of the project.**

It will be 9 weeks long project and guidelines will be provided for the project. Every student is expected to attend the project implementation as announced. If the students do not follow the guidelines or do not attend either monitoring or manufacturing hours, their project will not count towards their grade.

1) **Your average of Midterm Exams should be minimum 30% otherwise you will not be able to take the FINAL Exam.**
2) **You must complete the manufacturing project or you will directly fail the course (F)**
3) **Plagiarism will not be tolerated in any submission relevant to the course. Any attempt to plagiarism will result in an "F" grade.**