IE 402 - Integrated Manufacturing Systems
FALL 2020

Instructor: L. Taner TUNÇ (ttunc@sabanciuniv.edu, Office: Online)
Mon: 10.40 – 11.30 Zoom Link https://sabanciuniv.zoom.us/j/7933111536
Wed: 10.40 – 12.30 Zoom Link: https://sabanciuniv.zoom.us/j/7933111536

Labs and Teaching Assistants
Lab 01: Tue 14.40 – 16.30 – Zoom Link, TA: TBA
Lab 02: Fri 08.40 – 10.30 – Zoom Link, TA: TBA
Lab 03: Mon 08.40 – 10.30 – Zoom Link, TA: TBA
Lab 04: Mon 11.40 – 13.30 – Zoom Link, TA: TBA

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 machining operations (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)

Note:
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!

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 20 % (2 midterms)
5. Lab Final (Conditional & Tentative) 0% → PASS/FAIL

Manufacturing Project
Students are expected to complete a part manufacturing project in order to implement the theoretical knowledge gained during the lectures. The students will draw their own 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 each sub-step of the project. Every student is expected to attend the project implementation, which will be announced later on. 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 in the 2 Midterm Exams should be minimum of 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.**