INDUSTRIAL ENGINEERING DEPARTMENT

IE 414
Computer Integrated Manufacturing
Spring 2017

Type:	Elective
Credits/ECTS:	3 Credits / 6 ECTS
Class/Laboratory/PS schedule:	Monday 11:00-12:50 (Lecture)
	Wednesday 13:00-14:50 (Lab)
Instructor:	Ümit Bilge
Prerequisite(s):	IE 306 (Systems Simulation), or equivalents.

Course Description:

This course is designed for introducing the third and fourth grade IE students to the state-of the-art issues in advanced manufacturing systems through hands-on experience in BUFAIM-Flexible Automation and Intelligent Manufacturing Laboratory. The course will cover topics such as fundamentals of Computer Integrated Manufacturing (CIM) and automation; concept of Industry 4.0, subtractive and additive manufacturing, industrial robotics, flexible manufacturing systems (FMS) and data integration in CIM applications. The students will work on Lab assignments and a term project using the available hardware and software in BUFAIM in teams of two or three people. Lab assignments will include 3D printing, robot programming and shop floor control applications. The term project will focus on FMS design and management through simulation.

Textbook(s) / other required material:

Class notes, assignment information handouts, assignments, and other material will be available as softcopy at the beginning of the term. The following will be reserved at BUFAIM Lab for reference:

- Groover, M.P., "Automation, Production Systems, and Computer Integrated Manufacturing", Prentice Hall, 2008.
- Gibson, Rosen and Stucker, "Additive Manufacturing Technologies", Springer, 2015.
- Singh, N., "Systems Approach to Computer-Integrated Design and Manufacturing", JohnWiley&Sons, Inc., 1996.

Course objectives (and program outcomes):

This course aims to provide students with the skills and methods for modeling, design, control and simulation of computer integrated automation systems such as Flexible Manufacturing Systems as well as using several automated hardware. By the completion of the course, the students will be able to:

- Discuss history and types of automation, and the concept of Industry 4.0
- Discuss the need for integration and flexibility in manufacturing
- Understand basic technological aspects and use correctly the main technical jargon related to several automation entities including additive manufacturing, robotics, automated guided vehicles (AGV), RFID and communication networks
- Use and program robots within cell control and shop floor control (SFC) contexts

- Use 3D printers and appreciate the new opportunities presented by additive manufacturing
- Develop a simulation model to evaluate and compare various design alternatives and decide on a final design for an FMS and its operational control policies
- Conduct experimentation and report its results

Considering these objectives, this course mainly addresses the following student outcomes of the industrial engineering undergraduate program;

- *Student Outcome (b):* Ability to design and conduct experiments, as well as to analyze and interpret data
- *Student Outcome (c):* An ability to design diverse systems including manufacturing, service, logistics, financial and information, to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- *Student Outcome (e):* An ability to identify, model, formulate and solve industrial engineering problems
- *Student Outcome (k):* An ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering practice.
- *Student Outcome (d):* An ability to function in (multi-disciplinary) teams

Topics covered:
1. Automation and Computer Integrated Manufacturing (week 1)
2. Computer Numerical Control vs Additive Manufacturing (week 2-3)
   LAB WORK: SpectraCAM-Turning and 3D Printing
3. Industrial Robotics (week 4-5)
   LAB WORK: Robot programming for SCORBOT ER IX
4. Real-time Shop Floor Control(week 6)
   LAB WORK: Real-time control of BUFAIM Model Factory
5. Flexible Manufacturing Systems (week 7-8)
   LAB WORK: FMS.NET Simulation Software
6. Network Communication, Enterprise Integration and Internet of Things (week 9)
7. Industry 4.0 (week 9)
8. Project (weeks 9-13)
   LAB WORK: Project design and experimentation meetings

Grading:

Term Project: FMS Design using Simulation (report and presentation)	32%
Assignment 1: 3D Printing Application	12%
Assignment 2: Robotic Cell Control with RFID Application	24%
Assignment 3: Real-Time Shop Floor Control Application	12%
Final	20%

Eligibility for the final exam:
Attendance and participation is required for passing
If more than two sessions are missed (including group-work and project meeting hours) / or any task is not submitted on time/ or a student fails to participate in any one of the group projects/assignments, the student will lose the right to take the final exam

Prepared by, and date of preparation: Ümit Bilge, January 2017