IE 414  
Computer Integrated Manufacturing  
Spring 2015

Type: Elective  
Credits/ECTS: 3 Credits / 6 ECTS  
Class/Laboratory/PS schedule: Wednesday 11:00-12:50 (BUFAIM Lab)  
                                      Friday 11:00-12:50 (M3100)  
Instructor: Ümit Bilge  
Office Hours: M 11:00 – 12:00, Tue 11:00-12:00  
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 the area of computer integrated manufacturing (CIM) through hands-on experience in BUFAIM- Flexible Automation and Intelligent Manufacturing Laboratory. The course will cover topics such as fundamentals of CIM and automation; CAD/CAM, numerical control manufacturing, 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 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:  

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  
- 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 NC, robotics, automated guided vehicles (AGV), RFID and communication networks
- Use and program robots and AGVs within cell control and shop floor control (SFC) contexts
- 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:**

I. **Introduction**
   1.1 Manufacturing systems
   1.2 Automation
   1.3 Computer Integrated Manufacturing

II. **Numerical Control Production Systems**
   2.1 Numerical Control: NC and CNC
   2.2 Computer Assisted Part Programming
   2.3 DNC
   **LAB WORK:** SpectraCAM-Turning

III. **Industrial Robotics**
   3.1 Robot Applications
   3.2 Robotics Technology
   3.3 Robot Programming
   **LAB WORK:** ACL programming for SCORBOT ER IX

IV. **Real-time Shop Floor Control**
   **LAB WORK:** Real-time control of BUFAIM Model Factory

V. **Flexible Manufacturing Systems**
   5.1 Definition and Basic Issues
   5.2 Automated Guided Vehicle Systems
   5.3 Simulation software developed in BUFAIM: FMS.NET
   5.4 FMS short-range planning problems
   **LAB WORK:** FMS.NET Simulation Software

VI. **Network Communication and Enterprise Integration**
   6.1 Communication Networks
   6.2 Data Integration and Transportability
   6.3 Enterprise-wide Integration
Grading:
Term Project 35%
Assignment 1: Robotic Cell Control with RFID Application 20%
Assignment 2: Real-Time Shop Floor Control Application 15%
Announced quiz 15%
Final 15%

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 2014