Instructor : Ümit Bilge (ext.7071) bilge@boun.edu.tr
Course Schedule : W 5-6, F 3-4 BUFAIM Lab

Course Description : This course is designed for introducing 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. (3 Credits / 6 ECTS)

Prerequisites: IE 306 or equivalent

Course objectives (and program outcomes):
This course aims to provide students with the skills and methods for modeling, design, control 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

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:

Topics covered:

I. Introduction: Manufacturing systems / Automation / Computer Integrated Manufacturing
   LAB WORK: SpectraCAM-Turning

II. Numerical Control Production Systems: NC and CNC / Computer Assisted Part Programming
   LAB WORK: SpectraCAM - Turning

III. Industrial Robotics: Applications / Technology / 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: Definition/ Design and Set-up Problems / Automated Guided Vehicle Systems
   LAB WORK: FMS Design using Simulation

VI. Network Communication and Enterprise Integration

Assignments, Project and Grading:

- You are asked to form your groups (2-3 students) within the first week of classes and inform the instructor.
- Attendance is required during LAB hours, time assigned for groupwork and project meetings (group as a whole) as well as lectures.
- You are required to follow general LAB rules. Improper behavior (bringing food, smoking, shouting, playing games, bringing in people other than who take the course, mis-use of equipment) and any kind of action which can disturb others will be evaluated negatively.
- Do not forget to register for groupwork in the LAB ahead of time so that assistants will keep the LAB open for you. Apart from this, assistants will be available during their office hours to help and guide you; please respect their work, and consult them only during their posted office hours.

Assistant in charge: Mert Şahinkoç, Gökalp Erbeyoğlu

Term Project (in groups) 35%
1. 20 min. Presentation + 5 min for questions (to be scheduled)
2. Final Report

Assignments (in groups same as the Term Project group)
1. Robotic Cell Control with RFID Application 20%
   Assignment presentation and report due: March 20th, Fri.

2. Real-Time Shop Floor Control Application 15%
   Assignment presentation due: Apr.10th, Fri.

Anounced quiz 15%
Final 15%

Eligibility for the final exam:
Attendance and participation is required for passing
If more than two sessions are missed (including groupwork 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