IE 244 – COMPUTER AIDED MANUFACTURING SYSTEMS (2 2 3)
2010-2011 Spring
Course Syllabus

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Course Description: This course is designed to highlight the major automation-related subjects within the scope of manufacturing system. Special emphasis will be given on industrial robotics, robot programming, and flexible manufacturing systems (FMS). Laboratory exercises will deal with robotic programming and experiment with FMS systems. The elements of a flexible manufacturing environment such as CNC machines, robots, conveyors are modeled and operated via OpenCIM software package.

Course Objective: This course is designed to provide a comprehensive technical knowledge about production automation and the role of the computer in modern manufacturing systems. The students will:
1. have knowledge of production systems and how automation is used in these systems.
2. comprehend the issues and parameters in manufacturing operations and be proficient in estimating manufacturing lead time, capacity, utilization, work in process, and their relationships.
3. understand basic elements of automation.
4. be able to apply cellular manufacturing, process planning principles.
5. apply group technology concepts for the analysis and design of flexible manufacturing systems.
6. analyze automated materials handling systems. understand industrial robots their applications.
7. develop and execute industrial robot programs.
8. be able to use computer aided manufacturing applications used in virtual manufacturing environment.
Course Material: Text book and the reference books are listed in the second page. Additionally, lecture notes are to be provided via the web site of the course (possibly before the lecture hour) as pdf files. These files will include PowerPoint slides presented in the class. It is recommended that the student review the topics from reference books listed below for complete understanding of the subjects.

Examinations: There will be 2 mid-term and 1 final examinations. The exams are closed book type and will include problems, short answered review questions, true-false type questions, definition matching questions. Any formulas (except for the very basic ones, such as the volume of a cylinder) and tables that are to be used in the solutions of the problems will be given in the exams.

Laboratory work: The lab work is an integral part of the course and follows a sequence in order to provide complete information on industrial robots and computer aided manufacturing. Hence, attendance to each laboratory session is expected from each student. Laboratory work is concentrated on mainly two topics; industrial robot applications using RoboCell and ACL, and computer aided manufacturing applications using OpenCIM. Roughly, the first half of the semester is dedicated to industrial robot applications, and the second half is dedicated to computer aided manufacturing applications. Students will practice on the industrial robot in Flexible Manufacturing Systems Laboratory (Scorbot ER 5 plus) in groups of 3 or 4 in scheduled hours. At the end of each topic, there will be laboratory exams. First laboratory exam will be on developing a robot program using the language Scorbase on RoboCell environment. Second laboratory exam will be on running a virtual manufacturing environment using OpenCIM.

Attendance: According to the university regulations, students must attend at least 70 % of the lecture hours and 80 % of the recitation/laboratory hours. Otherwise, the student gets NA (Not attended) from the course. Valid excuses are not counted in computation of these percentages.

Apart from the university regulations, it is of student's benefit to attend the lecture and recitation/laboratory hours. However, if such a class is missed, it is the student's responsibility to find out what happened in class that day and to come to the next class prepared to participate actively.

Grading: Assuming each grading item has 100 points of weight, final grades over 100 will be computed according to the following rule:

20 % x MT-1 exam grade
20 % x MT-2 exam grade
30 % x Laboratory work
+ 30 % x Final exam grade
Final grade over 100

Laboratory work will be graded according to the following rule:
25 % x Practice on SCORBOT ER 5 plus
25 % x Exam on RoboCell
+ 50 % x Exam on OpenCIM
Laboratory grade over 100

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Books Listing:

Text Book:

• Automation, Production Systems, and Computer-Integrated Manufacturing, 2E, M. P. Groover, Prentice Hall, 2001

Reference Books:

• Computer-Aided Manufacturing, 2E, T.C. Chang,R.A. Wysk, H.P. Wang, Prentice-Hall, 1998.
• Computer-Integrated Manufacturing,3E, J.A Regh, H.W.Kraebber, Prentice-Hall, 2005.
• Principles of Computer-Integrated Manufacturing, S.K. Vajpayee, Prentice-Hall, 1995.
• The Design of The Factory with a Future, J.T. Black, McGraw-Hill, 1991.
• Making Manufacturing Cells Work, L.R. Nyman (edt) Society of Manufacturing Engineers, McGraw-Hill, 1992.

Week	Topic(s)
1	Introduction
2	Production System Facilities
3	Automation in Production Systems
4	Product/Production Relationship
5	Production Concepts and Mathematical Models
6	Introduction to Industrial Robotics/Robot Constructions/ Examples of Grippers
7	Robot Classification/Applications of Industrial Robot
8	Robot Programming
MT 1	
9	Introduction to Manufacturing Systems/Classification of Manufacturing Systems
10	Single Station Manufacturing Cells
11	Group Technology and Cellular Manufacturing
MT 2	
12	Flexible Manufacturing Systems
13	Flexible Manufacturing Systems
14	Manual Assembly Lines

Laboratory:

1. Components of the robot (manipulator, end-effector, controller)
2. Coordinate Systems (Joint Coordinates, Cartesian Coordinates),
3. Recording positions using TP and ATS, Basic path analysis
4. Scorbase and RoboCell: Industrial robot programming and simulation of industrial robots.

(Practice on Scorbot ER 5 plus, Exam on RoboCell)

5. OpenCIM: Virtually setting up CIM cells, simulating CIM cells

(Exam on OpenCIM)

6. SpectraCAM: A Computer aided manufacturing application, automatic generation of part programs.
7. Manufacturing of a sample part in Flexible Manufacturing Systems laboratory without human intervention.