**Oakton Community College**

**Introduction to Manufacturing Automation Systems**

**I.     Course Prefix/Number:** MFG 111

**Course Name:** Introduction to Manufacturing Automation Systems

**Credits:** 3 (2 lecture; 2 lab)

**II.    Prerequisite**

Recommended: Working knowledge of basic electricity and some basic physics background.

**III.   Course (Catalog) Description**

Course introduces students to the basic control systems used to automate manufacturing processes. Content includes: hydraulics and pneumatics used for motion control, PLCs programmable controllers, sensors and vision systems, robotics, and designing a computer integrated manufacturing (CIM) cell. This is a hands-on, team based, class to give students the basic concepts needed to design manufacturing automation systems using both hard automation and robots used in a CIM cell high-end automation system.

**IV.   Learning Objectives**

1.    Students will be able to identify processes that lend themselves to automation.
2.    Students will have the ability to select the proper sensor to use in an application based on the environment and type of motion or position accuracy required.
3.    Students will understand the difference between hard automation and robotic automation projects, including the ability to look at a possible applications and deciding which type of automation will have the best payback.
4.    Students will understand how to use PLCs to apply computer control to an automation project.
5.    Students will be able define a robots work cell envelope based on the type of robot used and the application that needs to be performed.
6.    Students will be able to program a 6 axis spherical arm robot to perform various applications such as; pick and place, dispensing of materials in a pattern, palletizing, and machine tending.
7.    Students will be able to set up the handshake connections between a CNC machine, Robot, and PLC system to build a CIM cell.
8.    Students will be able to layout a CIM cell to achieve the desired processes for a particular application.

**V.    Academic Integrity**

Students and employees at Oakton Community College are required to demonstrate academic integrity and follow Oakton's Code of Academic Conduct. This code prohibits:

• cheating,
• plagiarism (turning in work not written by you, or lacking proper citation),
• falsification and fabrication (lying or distorting the truth),
• helping others to cheat,
• unauthorized changes on official documents,
• pretending to be someone else or having someone else pretend to be you,
• making or accepting bribes, special favors, or threats, and
• any other behavior that violates academic integrity.

There are serious consequences to violations of the academic integrity policy. Oakton's policies and procedures provide students a fair hearing if a complaint is made against you. If you are found to have violated the policy, the minimum penalty is failure on the assignment and, a disciplinary record will be established and kept on file in the office of the Vice President for Student Affairs for a period of 3 years.
Details of the Code of Academic Conduct can be found in the Student Handbook.

**VI.   Sequence of Topics**

Manufacturing processes:
Automation of different processes including, assembly, process control, painting, dispensing, and machine tending. How to define the application, the constraints, quality level, and cost justification.

Sensor and vision system:
The different types of sensors will be discussed along with the applications they are most suited for. Electrical interfacing to control systems will also be covered.

Motion devices:
Hydraulic and Pneumatic system will be covered including cylinders, valves, pumps, distribution systems, and power requirements. Servo and stepper motor controls and positioning systems will also be covered.

PLC- Programmable logic Controller systems:
PLCs systems will be covered including electrical power systems, I/O interfacing, safety circuits, E stop circuits, and AC or DC I/O power selection. PLC types will be discussed including; the number of I/O that can be handled, math capabilities, special functions, motor control functions, and PID loop control. PLC programming will be covered including ladder logic construction, OHSA safety requirements, timers, counters, logic functions, timing loops, state diagrams, and subroutines.

Robotics:
Sections starts with defining the various configurations of robots and which applications are suited for each type of configuration. Focus will be on 6 axis spherical robot arms. How to calculate the robot’s work envelope and it’s end of arm tooling for a particular applications will be covered. Robot I/O interfacing will be discussed including interfacing to sensors and PLC I/O modules. Robot programming using a teach pendant will be cover including applications for; pick and place, dispensing, decision making, machine tending, and palletizing of product.

CIM Cell design:
The cap stone of this project will be the integration of all these technologies into a CIM cell environment. Laying out a CIM cell for a manufacturing application will be covered including; evaluating an application to see if it lends itself to a CIM cell application. Cost justifying a CIM cell project, defining the physical layout for a CIM cell, and developing the hand shake interface between the various machines and controllers that will be included in this cell.

**VII.  Methods of Instruction**

Blue prints, sample assembly process sheets, sample CNC programs.
Course may be taught as face-to-face, media-based, hybrid or online course.

**VIII. Course Practices Required**

Will be determined by the instructor.

**IX.   Instructional Materials**

**Note:** Current textbook information for each course and section is available on Oakton's Schedule of Classes.

Instructional material will be handed out as needed.

**X.    Methods of Evaluating Student Progress**

Test scores will count for 60% of final.
Quiz’s, lab projects, and robot and PLC programs will count for 40% of final.

Grading Scale:
90 – 100 = A
80 – 89 = B
70 – 79 = C
60 – 69 = D
59 & below = F

**XI.   Other Course Information**

If you have a documented learning, psychological, or physical disability you may be entitled to reasonable academic accommodations or services. To request accommodations or services, contact the Access and Disability Resource Center at the Des Plaines or Skokie campus. All students are expected to fulfill essential course requirements. The College will not waive any essential skill or requirement of a course or degree program.

**XII. Instructor:**

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