IE 6000: Digital Automation (4 Credits)

Description: This course is focused on technical and engineering aspects of Automation and Production Systems applied to manufacturing. The course is divided into four parts as follows: Overview of Manufacturing; Automation and Control Technologies; Material Handling and Identification Technologies and Manufacturing Systems. It covers the major cutting-edge technologies of production automation and material handling, and how these technologies are used to construct modern manufacturing systems. Manufacturing Operations; Industrial Control Systems; Sensors, Actuators, and Other Control System Components; Numerical Control; Industrial Robotics; Discrete Control Using Programmable Logic Controllers and Personal Computers; Material Transport Systems; Storage Systems; Automatic Data Capture.

Course Objectives:
- Understand the role of automation in manufacturing,
- Understand the benefits of automation,
- Know types of manufacturing industries,
- Be familiar with organization and information processing in manufacturing,
- Have a basic knowledge of automation equipment,
- Understand logic control and associated technologies
- Be familiar with fundamental concepts of industrial robot programming,
- Know basic programming knowledge of CNC machines

Learning Outcomes: Having successfully completed this module the student will be able to:
- Develop interactive PLC programs using the most appropriate technique.
- Select a PLC for a particular task.
- Draw logic circuits using relays and create truth tables,
- Use I/O mapping of a PLC in interfacing hardware,
- Write programs in ladder logic and implement them using software,
- Use various types of sensors and actuators in PLC implementations,
- Install a simple PLC system.
- Describe the uses of proximity sensors of different types.
- Describe the uses of transducers and bridge type signal conditioning systems.
- Explain the principles of proportional pneumatics and hydraulics and their applications.
- Explain the role of automation in manufacturing
- Tell the difference between different types of automation systems,
- Classify manufacturing industries into different categories,
- Explain information processing functions in a manufacturing facility,
- Classify automation equipment and assembly systems into different categories,
- Classify industrial robots into categories based on geometric configuration,
- Be able to program an industrial robot,

Instructor: Dr. Celestine C. Aguwa
Classroom: 0537 SCLB
Class Hours: 5:30 – 7:20 PM
Office Hours: 5:00 – 5:30 PM (Mondays)
Contact Info: e-mail: bd4891@wayne.edu
Office Location: 0537 SCLB
Course Website: http://blackboard.wayne.edu

Prerequisites: NONE

Textbooks
References:
1. Programmable Logic Controllers, An Engineers Guide, EA Parr, Newnes, 1994,
3. Industrial Automation and Process Control by Jon Stenerson

Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>Homework Assignments</td>
<td>20 pts</td>
</tr>
<tr>
<td>Midterm Exams</td>
<td>20 pts</td>
</tr>
<tr>
<td>Final Exams</td>
<td>30 pts</td>
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<tr>
<td>Project Assignment</td>
<td>30 pts</td>
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Total 100 pts

Individual projects, exams, and special assignments might be curved
All exams will be closed book and open notes exams.
Project reports and special assignment reports have to be typed.
Homework late by one class will be evaluated at 90% and more than one class at 70%.

Guidelines for assigning grades: A = 95%+, A– = 90%+, B+ = 87%+, B = 83%+, B– = 80%+, C+ = 77%+, C =73%+, C– = 70%+, D+ = 65%+, D = 60%+, D– = 55%+, E = less than 55%

General Policy: Student Conduct: It is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavors. Thus, a student should not falsely claim the work of another as his/her own, or misrepresent him/herself so that the measures of his/her academic performance do not reflect his/her own work or personal knowledge. In this regard, cheating will not be tolerated. Cheating includes (but is not limited to) any communication (written or oral) during examinations and sharing of work, such as using the same models or computer programs or copying work. All homework and projects must be an individual effort unless specifically noted. STUDENTS WHO CHEAT ON ANY ASSIGNMENT OR DURING ANY EXAMINATION WILL BE ASSIGNED A FAILING GRADE FOR THE COURSE. Therefore, avoid all appearance of improper behavior! Students who witness cheating should report the incident to the instructor as soon as possible. Students are also welcome to discuss any concerns related to cheating with the Chair of Industrial & Manufacturing Engineering.

Educational Accessibility Services: If you feel that you may need an accommodation based on the impact of a disability, please feel free to contact me privately to discuss your specific needs. Additionally, the Office of Educational Accessibility Services (EAS) coordinates reasonable accommodations for students with documented disabilities. The office is located in the Student Center Building, Room 583, Phone: 313-577-1851 (Voice)/577-3365(TTY).

Policy on Classroom Attendance: All students are expected to attend all lectures, quizzes, and examinations with enthusiasm. Although classroom attendance does not mathematically contribute to the final course grade, active class participation is expected of all students and may help to boost up the course grade in those “borderline” cases between failing and passing.
### Course Outline/Schedule:

#### IE 6000: Digital Automation

<table>
<thead>
<tr>
<th>Week #</th>
<th>Dates (Mondays &amp; Wednesdays)</th>
<th>Topic</th>
<th>Assignment/Comment</th>
</tr>
</thead>
</table>
| 1      | 5/5/2008 & 5/7/2008         | Chapter 1 - Introduction  
Chapters 2: Manufacturing Operations | First class will start with course strategic goals and expectations, Class introduction, group projects. etc. |
| 2      | 5/12/2008 & 5/14/2008       | Chapters 3: Manufacturing Models and Metrics  
Chapter 4: Introduction to Automation | Homework Assignments |
| 3      | 5/19/2008 & 5/21/2008       | Chapters 5: Industrial Control Systems | Homework Assignments |
Chapter 9: Discrete Control Using Programmable Logic Controllers and Personal Computers | Homework Assignments |
| 7      | 6/16/2008 & 6/18/2008       | Midterm Exam Review.  
Mid-term Exams and Group Project Update Presentation | Midterm Exams will be on 6/16/2008 during class hours, and Group Project Presentation is on 6/18/2008 |
Chapter 14: Single-Station Manufacturing Cells | Homework Assignments |
| 10     | 7/7/2008 & 7/9/2008         | Chapters 16: Automated Production Lines  
Chapter 17: Automated Assembly Systems | Homework Assignments |
| 11     | 7/14/2008 & 7/16/2008       | Chapters 19: Flexible Manufacturing Systems | Homework Assignments |
Final Exams Review |  
| 13     | 7/28/2008 & 7/30/2008       | Final Exams and Projects Presentation | Final Examination is on 7/28/2008 and Groups Final Presentation is on 7/30/2008 |

**Note** that class assignments are due on Mondays during class, or otherwise determined by the instructor. **Important**: Group project solution is preferred to consist of automation concepts discussed in the course.
Other Policy:
Withdrawals
Since the change in University grading system (Fall 2006), College policy on withdrawals is to allow any withdrawal with instructor approval. All withdrawals (WP, WF, WN) count as an attempt at a course and are counted in evaluation of allowed repeats/substandard grades. Therefore, students must be aware that a withdrawal is not a free pass. If a student feels that there are extenuating circumstances to justify their withdrawal, they should petition to me during the semester. This can be done before or after the withdrawal is requested and processed. Situations such as extended injury or illness, family responsibilities, or changes in work responsibilities that justify a withdrawal will be documented in STARS, and the associated withdrawals will not count against the allowed number of repeats.

Students may request a withdrawal up until the Reading Day of the semester. The specific date is listed in the academic calendar for each semester. Students generally expect that withdrawals will be approved by faculty unless there are limits that are detailed in the syllabus. If you have expectations on last dates for withdrawals or that students must meet with you if they wish to withdraw after a certain date, then please include this information in the syllabus.

Final Exams
College policy is that the final exam or final presentation for a course is held during the Final Exam period -- not before. University policy on final exams is as follows:

Any deviation from the final exam schedule must be initiated by the instructor, approved by the instructor's dean and scheduled through the Registration and Scheduling office. Requests for extended hours will be granted if the instructor has determined the extended hours will not cause his/her students to have conflicts with other final examinations.

Students are not required to take more than two exams in one day. A student with more than two scheduled final exams on one day may (not must) petition to the instructor of the course with the lowest number students enrolled, to arrange an alternate time for the final exam. Such petitions must be made at least one week prior to the scheduled date of the final exam.

In situations where conflicts exist between the regular day schedule and the group exam schedule, the group exam takes precedence. If there is a conflict among the regular schedule, group exam and evening schedule, the group exam takes precedence. The instructor with the fewest students in the remaining two classes will offer alternate arrangements to students.

Any student unable to take a final exam at the scheduled time due to religious convictions shall petition (notify) the instructor in advance of the final exam to arrange an alternate time.

All classes meeting at 4:00 p.m. or later will hold final exams during their regular meeting period in the final exam week and be limited to their scheduled hours. Requests for extended hours will be granted if a classroom is available and the instructor has determined that the extended hours will not cause students a conflict with their other final exams.

Please review the final exam schedule for the semester on the Registrar's web site. Your exam must be during the stated time. In cases of scheduling conflict (generally for mass-scheduled exams) or students who have more than two exams scheduled on the same day, the class with the smallest number of students is generally expected to make arrangements for the change in exam schedule.

If your class exam period is scheduled for a time that conflicts with a group exam, please be prepared to make other arrangements for students who have a time conflict. You may want to raise this issue at the beginning of the semester to identify students who will have a conflict. If you are planning on your final exam period actually being a competition or presentation, which is more difficult to reschedule, please poll your class and identify how many students will have a conflict so that you can make plans well in advance of Final Exam Week to deal with the conflict (either by rescheduling your day -- with approval -- or allowing students with conflicts an alternate scheduling opportunity).