Syllabus
IE 7420
Flexible Manufacturing Systems

Credits: 4cr.

Course Description
A highly automated Group Technology machine cell, consisting of a group of processing stations (usually CNC machine tools), interconnected by an automated material handling and storage system, and controlled by an integrated computer system.

Prerequisites: Admission to the professional IE Program

Co-Requirements: None

Textbook and Other Required Material
Book: Automation, Production Systems, and Computer-Integrated Manufacturing
Edition: Third Edition
Author: Mikell P. Groover
Publisher: Pearson Education Inc., 2008

Course Objectives
At the end of this course, students will be able to:
- Understand the role of Flexible Manufacturing Systems (FMS) in manufacturing,
- Understand the concept of Group Technology
- Understand the concept of Cellular Mfg Systems
- 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

Learning Outcomes: Having successfully completed this module the student will be able to:
- Develop FMS using the most appropriate technique.
- Implement FMS concept in a manufacturing environment
- Use various types of sensors and actuators in PLC implementations.
- Explain the role of automation in manufacturing
- Tell the difference between Group Technology and Cellular Manufacturing.
- Classify automation equipment and assembly systems into different categories.

Topics Covered
- Flexible Manufacturing Systems - Overview
- Manual Assembly Lines
- Automated Production Lines
- Cellular Design and Manufacturing
- Lean Manufacturing Systems and Cells
- Industrial Control Systems
- Hardware Components for Automation and Process Control
- Numerical Control
CLASS SCHEDULE
Tues. & Thur. 5:30 PM to 7:20 PM

CLASSROOM: Rm. 2062 MANU

CONTRIBUTION TO PROFESSIONAL PROGRAM COMPONENTS
Engineering Topics/Design

Prepared by: Celestine C. Aguwa, PhD 1/07/14

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Course Website: http://blackboard.wayne.edu

Class Grader: “Abhinav Vatchavai” <fd2542@wayne.edu>

Grading:
Final grades will be based on the following:
1. Mid-term Exam 25%
2. Final Exam 25%
3. Homework / Journal Article Review 20%
4. Group Project 25%
5. Class Attendance and Participation 5%

- Late homework assignments will not be accepted unless the instructor is coordinated with in advance.
- Homework assignments may be discussed in groups. If homework is done in a group, please submit individual results in each student's writing.
- Individual projects, exams, and homework may be curved.
- Project reports and special assignment reports have to be typed.

References:
1. References:

Class Preparation and Participation:
Reading assignments are given for each class session. You are expected to come to class prepared to discuss the readings and the suggested questions. Your individual class participation grade will be based upon your in-class remarks during discussions.
### TENTATIVE SCHEDULE

<table>
<thead>
<tr>
<th>Week &amp; Date</th>
<th>Topic</th>
<th>Comment</th>
<th>Chapters</th>
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<tbody>
<tr>
<td>Week 1 (Jan 7 &amp; 9)</td>
<td>Class Introduction.</td>
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<td>Chapters 19</td>
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<td>Chapters 19: Flexible Manufacturing Systems</td>
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<tr>
<td>Week 2 (Jan 14 &amp; 16)</td>
<td>Chapters 19: Flexible Manufacturing Systems</td>
<td>Project Group Selection (Jan 16 - Librarian-5:30-6:30)</td>
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<td>Week 3 (Jan 21 &amp; 23)</td>
<td>Chapters 19: Flexible Manufacturing Systems</td>
<td>Report Project Summary</td>
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<td>Week 4 (Jan 28 &amp; 30)</td>
<td>Chapter 15: Manual Assembly Lines</td>
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<td>Chapter 15</td>
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<td>Week 5 (Feb 4 &amp; 6)</td>
<td>Chapter 17: Automated Assembly Systems</td>
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<td>Chapter 17</td>
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<td>Week 6 (Feb 11 &amp; 13)</td>
<td>Chapters 16: Automated Production Lines</td>
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<td>Chapters 16</td>
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<td>Week 7 (Feb 18 &amp; 20)</td>
<td>Chapters 18: Cellular Manufacturing - I</td>
<td>UPS Tour - (2/19);</td>
<td>Chapters 18</td>
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<tr>
<td>Week 8 (Feb 25 &amp; 27)</td>
<td>Chapters 18: Cellular Manufacturing - I</td>
<td>Intermediate Project Presentation I (Feb 20);</td>
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<td>Week 9 (Mar 4 &amp; 6)</td>
<td>Presentation (3/4/2014) and Midterm Exam (3/6/2014)</td>
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<td><strong>Week 10 (3/10 - 3/15)</strong></td>
<td><strong>SPRING BREAK</strong></td>
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<td>Week 11 (Mar 18 &amp; 20)</td>
<td>Chapter 5: Industrial Control Systems</td>
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<td>Chapter 5</td>
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<td>Week 13 (Apr 1 &amp; 3)</td>
<td>Chapter 7: Numerical Control</td>
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<td>Chapter 7</td>
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<td>Week 14 (Apr 8 &amp; 10)</td>
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<td>Week 15 (Apr 15 &amp; 17)</td>
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<td>Week 16 (Apr 22 and 24)</td>
<td>Study day &amp; Final Project Presentation ??? (April 22)</td>
<td>Final Exam (Apr 24)</td>
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<td>Week 17 (Apr 29)</td>
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*Materials are from the reference handbook.

**Term Project Guideline**

The course project consists of teams of students applying FMS techniques to solve a real world problem or completing a special case study. Choose a manufacturing that need re-design (preferably one that you are familiar with). The instructor will support this effort. Carry an analysis of the existing facility and then use the tools that were covered in this class to suggest layout changes to the facility. Evaluation of the project will be based on the final report, which is due the last week of class, the interim reports described below, and the project presentation. **There will be a regular project updates in class.**
Presentation Slides and Written Project Requirements:
The written project reports must be typed or computer printed (laser quality only). The length of the written report is strictly limited to 10 pages, but exhibits up to 5 additional pages may be appended. Each report must include the following information, but not necessarily in this order:

- Abstract (for report only)
- Project Timeline (Microsoft Project is preferred tool)
- Introduction and project definition/description
- Literature reviews
- Proposed work with contribution to subject matter
- Validation and/or evaluation of proposal
- Conclusion and recommendation
- Bibliography/References

Oral Presentation Requirement:
Each project team is expected to make a presentation of 15 minutes. Reports will be collected after the last presentation is completed. Each group member must be actively involved in the oral presentation. The presentations will be graded for clarity, content, and smoothness.

Each presentation will be 15 minutes with an additional 5 minutes for Q&A. The order of the presentation groups and individuals will be announced in the presentation date. Each project team needs to plan presentations to be around 15 slides. There will be a weekly update in class.

Project Teams:
In the first or second week of the course, we will form project teams based on students’ preferences. Teams’ size will be determined in class. Once you are assigned to a project team, we expect you to stay in the course for the entire term.

Journal Article Review
The objective of the article review presentations is to allow students to study a wide range of real world applications that rely on lean. You will work in teams of three or four. Each team is required to select and analyze one article from recent related journals that describe a practical application of lean process. Each team will make a weekly update and fifteen-minute presentation at the end of semester and submit overheads of presentation & names of team members.

Presentation 5-8 Overheads:
1. Problem Context
2-3 Model Structure
   ✓ Decision Variables, Objectives, Constraints, and System Scope
4-5 Model Usage -
   ✓ What issues did it address?
   ✓ What was its impact?
   ✓ Who were the model users?
6. Implementation Issues & Concerns if discussed in paper
7-8. Your lessons learned
    The analogies could relate to potential use of model or to implementation issues
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.

Student Accessibility Services:

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TTY: telecommunication device for the deaf; phone for hearing impaired students only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services’ mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

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.