Winter 2018

To: ISE 4484/ME 4710 Students and SECS Faculty

From: Bill Edwards; PhD, P.E., PMP
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Subject: Syllabus for ISE 4484/ME 4710 Flexible and Lean Manufacturing Systems
Tuesdays & Thursdays; 3:30pm to 5:17pm, 275 EC

Prerequisites: Major Standing.

Text: Automation, Production Systems, & Computer-Integrated Manufacturing, Groover, 4th Edition, Pearson Publishing (ISBN-13: 978-0-13349961-2)

Supplement Text: Computer-Aided Manufacturing, C.T. Chang, R.A. Wysk and H.P. Wang, 3rd edition, Prentice-Hall, 2005 (ISBN 0-13-142919-1).
Design & Analysis of Lean Production Systems; Any Edition
Askin & Goldberg, Publisher; Wiley & Sons

Office Hours: Tuesday & Thursday, 5:30- 6:30pm

Grading: The guideline for course grade will be a weighted average of:

Homework	10%	Project & Presentation	35%
Exams (2)	40%	Participation	15%

Grader: Michael Jones, (mjjones@oakland.edu) ***– PLEASE 'CC Michael Jones on all Homework and Electronic submissions.***

There are two planned tours;

- Manufacturing in America; PLC Training
- A Local Assembly Plant

Course Objectives: The focus of the course is on the technologies used to make the manufacturing environment flexible. In order to satisfactorily complete this course, a student is expected to demonstrate competency concerning their understanding of the following.

- Define the terms of lean manufacturing and apply basic lean manufacturing tools (a, e, k).

- Calculate performance measures for the steady-state flow of parts through a simple production system (a, e, k).

- Define the terms of Group Technology (GT) and apply GT concepts in a flexible manufacturing environment (a, e, k).

- Calculate the most Economical Order Quantity when ordering supplies and their Delivery Point in Time. (a, e, k).

- Discuss the operation and application of robotic systems in a manufacturing environment; safely operate an industrial robot using its teach pendant; write and edit a robot application program (a, b, c, d, e, f, k).

- Define the terms of Programmable Logic Controllers (PLC) and apply the various programming techniques; write and debug a PLC ladder logic programs using a PLC simulator (a, b, c, d, e, k).

- Identify various types of sensors used in the manufacturing environment and describe their use (a, e).

- Define GD&T - Geometric Dimensioning and Tolerancing (a, e, k).

- Define and use Computer Simulation in a Manufacturing Environment (a, e, k).

Program Outcomes: A set of skills that assure the achievement of the program educational objectives. Before graduating, SECS students will demonstrate their skills in the following key areas:

a) an ability to apply knowledge of mathematics, science, and engineering
b) an ability to design and conduct experiments, as well as to analyze and interpret data
c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d) an ability to function on multi-disciplinary teams
e) an ability to identify, formulate, and solve engineering problems
f) an understanding of professional and ethical responsibility
g) an ability to communicate effectively
h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i) a recognition of the need for, and an ability to engage in life-long learning
j) a knowledge of contemporary issues
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Academic Conduct: Students are encouraged to discuss homework and laboratory assignments with one another for their mutual benefits. However, no form of plagiarism (for example,

copying) is permitted. Further information and examples are available from the "Academic Conduct Policy" in the *Oakland University Undergraduate Catalog*.

Supplemental Breakdown of Course Topics: (For Chairman Bob Van Til)

A Straight forward Approach to Lean & Flexible Manufacturing

Fundamentals of Production Systems & Push vs Pull. Serial vs Parallel
Characterize a Production System bases on Multiple Attributes
Planning and Forecasting
Inventory Ordering & Batch Sizes
Cost Benefits and Issues of Holding Inventory
Bull Whip Effect
Applying Principles of Lean Manufacturing to a Production System

- 5S
- Visual Management System
- 7 Waste
- Practical Problem Solving Reports, etc
- 8 D, 5 Why, Ishikawa (Fishbone Diagrams), Is/Is Not, etc

Applying the Theory of Constraints - Bottlenecks
MIFT – Move It Forward Theory
Identifying the Critical Areas in a Production Systems
One Piece Flow vs Batch Building
Work Station Analysis – Balancing Work
WIP

- Quality
- Monetary VALUE

FTC – First Time Capability Quality
BQIS – Build Quality in Station
Toyota Production System
Buffers (Accumulators)
Product Transfer; Lift & Carry, Continuous, “Skillets”, & Pallets
AS/RS
Flexible Changeover
SMED – Single Minute Exchange of Dies
GD&T -
Statistics, Quality, SPC, Process Capability, and Cpk
DOE; Full Factorial, ANOVA
Kepner Tregoe, Shainin Red X
MASS Relief v TAG Relief
CAPEX vs Piece Cost

- Fixed Burden vs Varible Burden
- Sunk Cost
- ROI
- Central Production vs Local Production

Engineering Management
Programmable Logic Controllers
Design for Assembly

Plant Tours or Field Trips

Other subsets of these topics are introduced in the class as well.