

# INDUSTRIAL AND ENTREPRENEURIAL ENGINEERING AND ENGINEERING MANAGEMENT

## EM 5050

### Continuous Improvement in Operations (CIO)

#### Catalog Description:

The purpose of this course is to introduce business and engineering students as well as managers to the process of kaizen (Continuous Improvement) and Total Employee Involvement.

#### Objective:

Introduce Continuous Improvement, Lean Manufacturing, Kanban, JIT and Quick Response Manufacturing (QRM) as it applies to manufacturing systems to the extent that the participants can practice these approaches in real world situations. A closer review of Toyota Production System is newly added this semester.

#### Pre-requisites:

Graduate standing. Open to upper class and graduate students.

#### Required Textbooks:

Toyota Production System - Yasuhiro Monden, CRC Press.

#### Recommended Textbooks:

1. Automation, Production System and Computer Integrated Manufacturing, Mikell Groover, Prentice Hall.
2. Factory Physics, Foundation of Manufacturing Management, Wallace J. Hopp & Mark L. Spearman, IRWIN.
3. Lean Enterprise Systems – Using IT for Continuous Improvement, by Steve Bell, Wiley Sons, Editor Andrew Sage.
4. Other materials – from a list of websites  
<http://www.industrialtimestudy.com/lean.html>  
<http://www.s3co.com/glossary/><sup>W2</sup> [en.wikipedia.org/wiki/Lean\\_manufacturing](http://en.wikipedia.org/wiki/Lean_manufacturing)  
[www.leanmanufacturingconcepts.com/](http://www.leanmanufacturingconcepts.com/); [www.lei.org](http://www.lei.org);

#### Week #

#### Topics:

#### Readings

- |   |  |
|---|--|
| <b>1.</b> Introduction, Background and Global Market, Competition & Manufacturing Environment, Continuous Improvement Philosophy – Causal Loop Diagram (CLD), 3Rs, Manufacturing Cell Design<br>Dimensions of CIO – Philosophy & mindset; Mass Production to Mass Customization<br>(Relentless pursuit to Perfection) | <i>Lecture &amp; Ch1</i><br><b>Ch. 18 (#1) HW#1</b>            |
| <b>2.</b> Important Definitions – Gemba, JIT, Kanban, Jidoka, Heijunka, Kaizen, Kaikaku, Jishuken, VSM (Value-Stream Mapping), Genchi Genbutsu, Hansei, PDCA, Lean Production 5S, 3P, 4M, 3M (Muda, Mura, Muri), PDCA, TPS, TPM, Optimizing Tools Selection   | <i>Ch 2 &amp; 3</i><br><b>Paper # 1</b><br><b>Case Study 1</b> |

3. Identify Value, NVA & NNVA activities, Value Definition, Map Value *Ch. 12 &13*  
Produce to stock vs. Produce to order (or Engineer to Order); Industrial Examples  
Visual Control, Poke-Yoke vs. Baka-yoke, 4Vs, Toyota Production System, Google,  
NUMMI, Dell Corp, UPS &FedEx **(Paper #s 2)**
4. Quick Response Manufacturing (QRM) – Cost, Quality & Delivery – *Ch 7, 11&14*  
Three dimensions of competitive advantage **(Paper # 3) Case Study 2**
5. One-Piece Production /w Kanban: Continuous Improvement Matrix (Design, Order  
Taking, Production) – Concepts & Underlying Philosophy, Tools & Techniques:  
Product Life Cycle **(Paper #4) Ch. 9**
6. ManufacturingLead Time, Work-in-progress, Capacity, Utilization, *Ch. 22 Ch.2&3*  
**(#1) HW#2**  
Cycle Time vs. Takt Time, Just-In-Time & Computation # of Kanban cards **(Paper #5)**
7. **Mid Term**  
Level Demand & Level Scheduling, Level Scheduling & Sequencing, *Ch 20*  
Forecast vs. Make-to-orders from end-customer, retailer and distributor,  
(Heijunka)
8. Implementation Steps for Toyota Production System (TPS) *Ch 2, 3 & 19 (Paper #6)*  
**Case Study 3**  
Five Steps –  
(a) Identify Value as defined by the customer *Lecture notes; Ch 21*  
(b) Establish Value Stream  
(c) Establish Flow  
(d) Introduce Pull  
(e) strive for Perfection

**Mar 9, 2015 Spring Recess Week**

**Mar 16, 2015**

9. Six-Sigma Process *Lecture notes;* **(Paper #s 7 & 8)**
10. Lean Production, Lean Consumption, Lean Provision - **(Paper #s 9 & 10)**  
**Semester Project Presentations I:**
11. Kaizen Costing: Accounting Methods *Lecture notes;* *Ch. 15*  
Hoshin Kanri – Policy Deployment, Cost **(Paper #s11 & 12)**  
Level of Automation & Implementation Policy, Autonomation  
**Semester Project Presentations II:**
12. **Final Exam**

**Semester Project:** A group of up to 4 students will identify a suitable problem to tackle as a team semester project following the domain knowledge and principle derived from the class. A half-page synopsis is due next two weeks at the class time. Each team is expected to submit a report in an acceptable format, the format posted online. Finally, the team will be scheduled for an in-class presentation on one of the three days as per the course outline.

**Another potential project topic** would be to **research a specific industry (auto, tool & die, electronics, home appliance, etc.)** and the scope should be centered around CIO program with the **objective of bringing that industry back home right here in USA**. One such recent example is from electronics industry. The project must include a comprehensive analysis of current practices, cost structure and the markups, areas of potentially significant cost savings in order to make operations (partially or wholly) viable to be made in USA.

**Two Exams:** Midterm & a Final Exam – The exams will be closed books and notes. A list of formulas as applicable can be recorded on an 8” x 11” sheet of paper one-sided.

There will be in-class activities roughly once every four weeks. A more precise date will be intimated a week ahead in time.

### **Semester Grade:**

A consolidated score will be calculated based on the following four items:

- |  |            |
|--|------------|
| 1. Homework, In-class Assignment & Case Studies, Paper Pres (10-5-10-5%) | <b>30%</b> |
| 2. Mid Term  | <b>25%</b> |
| 3. Semester Project  | <b>25%</b> |
| 4. Final Exam  | <b>20%</b> |

A final **letter grade** will be determined using the following scale

$\geq 90$	<b>A</b>
$85 < x \leq 89$	<b>BA</b>
$80 < x \leq 84$	<b>B</b>
$75 < x \leq 79$	<b>CB</b>
$< 70$	<b>C</b>

An overall score **less than 70** will earn a **letter grade of C** in the class for the semester.

### **Homework, Assignment submission & general course policy:**

1. The submitted work is required to be individually completed unless specified for the assignment.
2. All references including websites/URL used in the preparation of your solution are required be listed in the reference section at the end as well as specified at appropriate place in the text.

3. All assignments, case studies, and semester project submission are required to be on the specified date at the beginning of the class for full credit. Late submission for homework assignments will be mark late and is subject to 10% penalty for each day late.
4. Makeup exam is not an option except in documented emergency.

### **Attendance Policy:**

Attendance is mandatory. The student will receive a score of zero for any assessment item not submitted because of absence. Extreme circumstances on medical grounds with a doctor's note may be considered, however, arrangements must be made prior to the due date.

### **Quizzes & In-class Assignments**

In some sessions there may be a 20-30 minute quiz on the previously covered subject matter. During the quiz, classwork assignments and exams instructions will be given ahead of time about the usage of your notes and or computer. Quizzes & classwork assignments could be theoretical or applied. No classwork or quiz make-up is permitted.

### **Academic Honesty Policy:**

The Faculty Senate's Professional Concerns Committee recommends all instructors include the following paragraph in each syllabus they prepare. "You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate and Graduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at <http://catalog.wmich.edu> under Academic Policies, Student Rights and Responsibilities.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test."

In addition, instructors are encouraged to direct students to <http://osc.wmich.edu> and [www.wmich.edu/registrar](http://www.wmich.edu/registrar) to access the Code of Honor and general academic policies on such issues as diversity, religious observance, student disabilities, etc.

### **Disability Services for Students (DSS):**

"Both in compliance with and in the spirit of the Americans with Disabilities Act (ADA), faculty at Western Michigan University needs to know how a disability will impact student participation and his/her work in courses. Any student registered with DSS wishing to discuss accommodation for this class should contact the professor of record in a timely manner. Students with documented disabilities not yet registered with Disabilities Services for Students should call DSS at (269) 387-2116 or visit [www.wmich.edu/disabilityservices](http://www.wmich.edu/disabilityservices). Accommodations cannot be provided without

confirmation from DSS of the semester request or accommodation verification card."

### **List of Papers**

**Some paper #s are online at eLearning under Papers on Contents tab. The remaining papers are specific chapters of the textbook.**

- | <b>#</b>   | <b>Reference Title</b>  |
|------------|---|
| <b>1.</b>  | <b>Discovering New Points of Differentiation, Harvard Business Review HBR</b>                   |
| <b>2.</b>  | <b>Building the Lean Machine, Harvard Business Review HBR</b>                                   |
| <b>3.</b>  | <b>*Chapter 4: Supplier Kanban and the Sequence Schedule Used by Suppliers</b>                  |
| <b>4.</b>  | <b>Chapter 27: Respect-for- ..... JIT Production System</b>                                     |
| <b>5.</b>  | <b>*Chapter 11: Reduction of Setup Time -- Concepts &amp; Techniques</b>                        |
| <b>6.</b>  | <b>*Chapter 16: Material Handling in an Assembly Plant</b>                                      |
| <b>7.</b>  | <b>Chapter 28: Motivational and ..... Assembly Plant</b>  |
| <b>8.</b>  | <b>*Chapter 5: Smoothed Production Helps Toyota Adapt ... and Reduced Inventory</b>             |
| <b>9.</b>  | <b>Lean Consumption, Harvard Business Review HBR</b>  |
| <b>10.</b> | <b>Chapter 23: New Developments in e-Kanban</b>   |
| <b>11.</b> | <b>Beyond Toyota: How to Root Out Waste and Pursue Perfection: Harvard Business Review 1996</b> |
| <b>12.</b> | <b>Negotiating for Continuous Improvement: Harvard Business Review 2006</b>                     |