



University of Puerto Rico. Mayagüez Campus
College of Engineering.
Industrial Engineering Department



General Information

Course Number: InIn 5009
Course Title: **Lean Six Sigma**
Credit-Hours: Three

Course Description

Discussion of the basic principles of Lean and Six Sigma methodologies to maximize the value of a product or service focusing primarily on customer satisfaction. Use of the DMAIC methodology as a structured way to integrate the tools of industrial engineering to solve problems related to processes and systems improvement.

Prerequisites

ININ 4078: **Statistical Quality Control**
ININ 4039: **Production Planning and Control I**

Textbook and References

http://www.qualitycouncil.com/lss_p.asp#ss

- [T1] *The Six Sigma Black Belt Primer*, Quality Council of Indiana, Third Edition, 2012.
- [T2] Peter Hines, Pauline Found, Gary Griffiths, Richard Harrison; *Staying Lean: Thriving, not just Surviving*, , Lean Enterprises Research Center, Cardiff University, 2008
- [R1] Thomas Pyzdek, *The Six Sigma Handbook*, Third Edition, McGraw-Hill, 2009.
- [R2] Dee Jacobs, Suzan Bergland and Jeff Cox, *Velocity*, Free Press, 2010.
- [R3] David Mann, *Creating a Lean Culture*, CRC Press, 2010.
- [R4] Bob Spoull, *The Ultimate Improvement Cycle: Maximizing Profits through the Integration of Lean, Six Sigma and Theory of Constraints*, CRC Press, 2009
- [R5] D.H. Stamatis, *Essentials for the Improvement of Healthcare Using Lean & SixSigma*, CRC Press, 2010

Purpose

This course is designed to provide students with the latest process improvement methodologies used in industry. This course is motivated by remarks made by the Industrial Engineering department's Industrial Advisory Board highlighting that Industrial Engineering students need to develop problem solving analysis skills and be able to have knowledge of contemporary issues and "buzzwords".

Course Goals

At the end of this course students should be able to:

1. Solve a problem in a structured manner.
2. Identify the information that is relevant when solving a problem.
3. Develop methodologies to collect and analyze data.
4. Integrate Industrial Engineering tools through the DMAIC process.
5. Comprehend and implement concepts of Lean Six Sigma in any type of business or industry.
6. Consider the system-wide impact of a localized decision.

Requirements

All students are expected to come to class all the time, on time, and prepared; do all assigned readings and related homework; actively participate in class discussions; and satisfy all assessment criteria to receive credit for the course.

Department/Campus Policies

Class attendance: Class attendance is compulsory. The University of Puerto Rico, Mayagüez Campus, reserves the right to deal at any time with individual cases of non-attendance. Professors are expected to record the absences of their students. Frequent absences affect the final grade, and may even result in total loss of credits. Arranging to make up work missed because of legitimate class absence is the responsibility of the student. (Bulletin of Information Undergraduate Studies)

Absence from examinations: Students are required to attend all examinations. If a student is absent from an examination for a justifiable reason acceptable to the professor, he or she will be given a special examination. Otherwise, he or she will receive a grade of zero or "F" in the examination missed. (Bulletin of Information Undergraduate Studies)

Final examinations: Final written examinations must be given in all courses unless, in the judgment of the Dean, the nature of the subject makes it impracticable. Final examinations scheduled by arrangements must be given during the examination period prescribed in the Academic Calendar, including Saturdays. (see Bulletin of Information Undergraduate Studies).

Partial withdrawals: A student may withdraw from individual courses at any time during the term, but before the deadline established in the University Academic Calendar. (see Bulletin of Information Undergraduate Studies).

Complete withdrawals: A student may completely withdraw from the University of Puerto Rico, Mayagüez Campus, at any time up to the last day of classes. (see Bulletin of Information Undergraduate Studies).

Disabilities: All the reasonable accommodations according to the Americans with Disability Act (ADA) Law will be coordinated with the Dean of Students and in accordance with the particular needs of the student.

Ethics: Any academic fraud is subject to the disciplinary sanctions described in article 14 and 16 of the revised General Student Bylaws of the University of Puerto Rico contained in Certification 018-1997-98 of the Board of Trustees. The professor will follow the norms established in articles 1-5 of the Bylaws.

General Topics

Topic	Ref.	Hrs.
Introduction to DMAIC process (Workshop), Lean 6s concepts, Integrating Lean and Six Sigma- Management and Organizational Infrastructure:		3
Common Define Tools: Organizational structure of businesses, Voice of Customer (VOC), Voice of Business (VOB), Project charter, Pareto, Project selection, Project risks analysis, Affinity Diagrams, SIPOC Lean Perspective: Process Map, Spaghetti Diagram, Swim Lane Diagram, Value Stream Mapping Six Sigma Perspective: Cause and Effect Diagram Workshop		6
Measure: Lean Perspective: LSS metrics, Takt time, Planed cycle time, Value Stream Map (continuation)		3
Analyze: Lean Perspectives: Identification of seven wastes through VSM		1
Improve: Lean Perspective: 5S, Push vs. Pull, Design of Lean cells, Kanban, Load Leveling, Future State Map, SMED, TPM, Visual Control, and Kaizen. Workshops (Cells design, future state map, Kaizen)		6
Control: Lean Perspective: Visual Control, Trn requirements, standard work, Poka -Yoke		2
Measure: Process Capability Analysis, Gauge R&R, Kappa Analysis		3
Analyze Phase: Six Sigma Perspective: Root Cause Analysis, Hypothesis testing, Sample size calculations, ANOVA,		2
Improve Phase: Six Sigma Perspective: Design of Experiments, FMEA		3
Control: SPC, Control Plan, Design for Six Sigma, Poka-Yoke, Planning for Project Closure, Metrics and Box Score (Dashboard)		6
Integrating Workshops		8
Exams		2
Total		45

Grading System

☒ Quantifiable (letters) ☐ Not Quantifiable

A
B
C
D
F

Evaluation Policies

	Quantity	Percent
Exams	1-3	30 – 50%*
Final Exam	1	20 – 30%*
Short Quizzes	0 - 5	0 – 10%*
Oral Reports	0 - 3	0 – 10%*
Monographies		
Projects/Case Studies	1 - 3	20 – 40%*
Journals		
Other, Specify:		
TOTAL:		100%*

***The table above defines the range of all possible weights for each evaluation resource. As an element of Academic Freedom, the professor has the flexibility to assign the final weights to each evaluation resource, provided that the final weights are kept into the intervals defined and that the total sum of all final weights is exactly 100%**

Coordinator: Profs. Mercedes Ferrer (mercedes.ferrer@upr.edu) and Hector J. Carlo (hector.carlo@upr.edu) (Revised February 2014)