MET-2410: QUALITY CONTROL AND LEAN MANUFACTURING

Cuyahoga Community College

Viewing: MET-2410 : Quality Control and Lean Manufacturing
Board of Trustees:
January 2020

Academic Term:
Fall 2020

Subject Code
MET - Mech Eng/Manuf Ind Eng Tech

Course Number:
2410

Title:
Quality Control and Lean Manufacturing

Catalog Description:
Introduction to quality control fundamentals, probability and statistics, process capability, control chart applications. Also covers principles and practices of lean manufacturing.

Credit Hour(s):
3

Lecture Hour(s):
3

Requisites

Prerequisite and Corequisite
MATH-1530 College Algebra; and MET-1240 Machine Tools and Manufacturing Processes or concurrent enrollment; or departmental approval: work experience.
*Note: MATH-1521 College Algebra completed with "C" or higher prior to Fall 2016 will also be accepted to meet prerequisite requirements for this course.

Outcomes
Course Outcome(s):
Explain the basic definitions of quality and the prevalent quality philosophies.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Examine the history of quality.
2. Explain the definitions of various quality terms and topics.
3. Evaluate the relationship of quality to business and manufacturing.
4. Explain the prevalent quality philosophies.
5. Distinguish the basic principles of Total Quality Management.

Course Outcome(s):
Apply control charts for quality control of manufacturing and business processes.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Construct and use control charts for attributes.
2. Perform process capability studies.
3. Study computer/software applications.
4. Apply acceptance sampling plans for attributes, variables and continuous production.
5. Use and investigate case studies to learn how to develop and apply acceptance sampling plans.
6. Explain and apply acceptance sampling systems.
7. Explain the basic definitions of reliability and apply reliability.
8. Investigate various methods used to control quality such as design of experiments, quality function deployment and quality audits.
9. Construct and use control charts for variables.

Course Outcome(s):

Demonstrate an understanding of how to apply statistics and probability to the control of quality.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Evaluate confidence intervals, sample size and statistical interference.
2. Construct frequency distributions, charts and graphs to organize and present data.
3. Apply measures of central tendency, dispersion and position to data analysis.
4. Apply probability concepts and probability distributions to quality control issues.

Course Outcome(s):

Describe Lean Enterprise concepts and explain the interaction between the Lean elements, rules, and tools.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Explain how Lean concepts can be applied to the different operational departments of a business, why the organization culture must change and why the lean process must be institutionalized.
2. Recognize how the application of Lean principles can substantially improve the operating and financial performance of any business.

Course Outcome(s):

Develop a road map and an implementation plan for Lean Manufacturing.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

Objective(s):
1. Explain Policy Deployment and why this is a critical part of any Lean implementation process.

Course Outcome(s):

Apply the fundamentals of the Kaizen process to aid in Lean implementaiton.

Objective(s):
1. Identify the aspects of Lean implementation where Kaizen process will be appropriate.
2. Explain how Kaizen is used to aid Lean implementation and how it is used to change the culture.

Course Outcome(s):

Demonstrate the application of tools, concepts, and technology of Lean to develop and implement Lean Manufacturing.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Explain the concept of Design for Manufacture and Assembly and how it influences cost.
2. Explain the concepts of 5S.
3. Discuss Single Minute Exchange of Dies (Quick Change) effects on Lean.
4. Explain Total Productive Maintenance (TPM).
5. Explain Kanban and its roles in Lean implementation.
6. Explain Visual Workplace.
7. Discuss Error-Proofing of manufacturing systems.
8. Explain the roles technologies of Scheduling in Lean environment.
9. Discuss the application of Six-Sigma and how Lean Enterprise and Six-Sigma are complimentary processes that are used to improve manufacturing.

Course Outcome(s):

Describe the role of accounting in the Lean implementation process.

Objective(s):

1. Describe how Lean metrics must replace traditional metrics.
2. Determine how metrics drive behavior.
3. Explain how cost of quality impacts business performance.

Course Outcome(s):

Apply the concepts and tools of Lean Manufacturing to optimize the production of engineering parts.

Objective(s):

1. Explain how to identify and eliminate waste in Manufacturing.
2. Identify value added, non-value-added-but-required activities.
3. Explain the importance of identifying the value stream, how it is mapped and how to identify the areas that require improvement.
4. Describe the elements of Flow and Pull and how these are applied.

Course Outcome(s):

Apply the fundamentals of Standard Work to eliminate process variation.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Explain why the limit-people-and-materials rules are important and how they are integrated with the Lean tools to eliminate waste.

Methods of Evaluation:

1. Quizzes and assignments
2. Projects and Case Studies
3. Final examination

Course Content Outline:

1. Introduction and Review of Quality
    a. Historical review
    b. Basic definitions
    c. Prevalent quality philosophies

2. Fundamentals of Statistics
   a. Measurements, distributions, charts and definitions
   b. Measures of central tendency, dispersion and other measures
   c. Population and sample
   d. The normal curve
   e. Control charts for variables - applications
   f. Computer applications
3. Fundamentals of Probability
   a. Basic concepts
   b. Discrete Probability Distributions
   c. Continuous Probability distributions
   d. Control charts for attributes - applications
   e. Computer applications
4. Confidence intervals and sample size
5. Process Capability
   a. Process capability studies
   b. Computer applications
6. Acceptance Sampling Systems
   a. Principles and concepts
   b. Lot-by-lot acceptance sampling by attributes
   c. Acceptance sampling plans for continuous production
   d. Acceptance sampling for variables
   e. Computer applications
7. Introduction to Reliability
   a. Fundamental statistical aspects.
   b. Life and reliability testing plans
   c. Computer applications
8. Quality control tools and techniques
1. a. Lean Tools Overview
      i. Kaizen
      ii. 5S
      iii. TPM
      iv. SMED
      v. Process Mapping
      vi. Takt Time
      vii. Line /Work Balancing
      viii. Kanban
      ix. Mistake Proofing
      x. Autorotation
      xi. DFMA
      xii. Visual Workplace
      xiii. 5 Why
      xiv. One-Piece-Flow
      xv. Spider Charts
      xvi. Spaghetti Charts
      xvii. U-Shaped/Continuous Flow Cells
      xviii. Six Sigma
      xix. Focused Factory
2. Lean skills
   a. Analyze manufacturing processes to identify needs for lean implementation
   b. Select lean tools needed for lean implementation
   c. Apply lean tools to improve manufacturing systems/processes
   d. Perform applicable calculations in lean implementation
   e. Selecting and applying lean concepts suitable to candidate manufacturing processes
   f. Develop lean implementation plans
   g. Implement lean plans and evaluate manufacturing processes/systems for lean operation
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Resources

Devor, Richard, Tsong-how Chang and John Sutherland. *Statistical quality design and control : contemporary concepts and methods.* 2nd Ed. Upper Saddle River, NJ., 2007.

Smith, Gerald. *Statistical Process Control and Quality Improvement.* 5th Ed. Upper Saddle River, NJ., 2004.

Besterfield, Dale H. *Quality Control.* 8th Ed. Upper Saddle River, NJ., 2009.

McKeeking, Robert. "Journal of Statistical Mechanics: Theory and Experiment" Quarterly. 2007-10-01 00:00:00.0.

Myerson Paul A. *Lean and Technology: Working Hand in Hand to ENable and ENergized Your Global Supply Chain*. Pearson, 2017.

Viki, Tendayi, Craig Strong, and Sonja Kresojevic. *The Lean Product Lifecycle: A Playbook for making Products People Want*. Pearson, 2018.

Montgomery, Douglas. *Introduction to Statistical Quality Control, 8e Enhanced eText with Abridged Print Companion*. 8th ed,. Wiley, 2019.

Resources Other
1. Handouts.
2. Application software

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