Cambridge College
New England Institute of Business

Course Syllabus

QSM408: Lean Six Sigma and Special Topics in Quality Management

Syllabus Overview

This syllabus contains all relevant information about the course: its objectives and outcomes, the grading criteria, the texts and other materials of instruction, and weekly topics, outcomes, assignments, and due dates. Consider this your roadmap for the course. Please read through the syllabus carefully and ask questions if you would like anything clarified. Please print a copy of this syllabus for reference.

Course Description

3 Credits

Prerequisites:

PJM 210 (Project Management)

QSM408 is an in-depth study of Lean and Six Sigma. Lean thinking and application to the workplace is emphasized. The foundations of Six Sigma will be studied, including its statistical basis. QSM408 students will focus on the Six Sigma DMAIC five-phased methodology for process improvement and apply graphical and statistical tools that support Lean and DMAIC methods. From problem identification, project selection and team formation through to implementation of change, students will gain hands on expertise in problem solving and process improvement using DMAIC. QSM408 will prepare students for their Bachelor's Capstone Project and for optionally taking the Green Belt Lean Six Sigma Certification exam.

Course Outcomes

At the completion of this course, students should be able to:

- Recognize the value of, and when to use, Six Sigma or Lean Six Sigma.
- Define and describe various lean concepts.
- Construct process maps and value stream maps.
- Describe the statistical foundation of Six Sigma and what six sigma quality means.
- Describe the five phases and key deliverables of the DMAIC methodology.
- Construct and interpret various graphs used in process improvement.
- Identify statistical concepts such as graphical analysis, probability distributions, correlation, regression, hypothesis testing, and sampling.

- Interpret the role of Statistical Process Control in Lean Six Sigma.
- Apply Lean Six Sigma techniques to case studies.

Communication with Your Instructor

You will receive a welcome email from your instructor prior to the start of class. This email will contain your instructor's contact information. Your instructor will also be communicating with you via several methods in the course, including:

- **Announcements** – This communication tool, located on the navigation menu within your course in Canvas, contains important updates. Be sure to check for new announcements from your instructor each time you access your course.
- **Q&A** – Use this discussion board, located on the Home screen in your course, to communicate with your instructor and classmates regarding general course questions (i.e. missing links, assignment clarification, etc.).
- **Inbox** – Use the Inbox, located in the top right corner of Canvas, to send a message to your instructor or classmates.

Required Materials and Resources

Required Resources: *Your instructor may add additional cases or materials such as videos to supplement your learning.*

1. **TEXT**:
   Council for Six Sigma Certification. (2018). *A complete step-by-step guide: A complete training and reference guide for White Belts, Yellow Belts, Green Belts, and Black Belts.* Buffalo, WY: Council for Six Sigma Certification. *Available as a **FREE download** from https://www.sixsigmacouncil.org/wp-content/uploads/2018/08/Six-Sigma-A-Complete-Step-by-Step-Guide.pdf*

2. **CASE STUDY:**
   Bohn, R. (2006). Kristen's Cookie Company (A). Harvard Business School Case Study, Product ID 686-093. Available in your purchased Harvard Course Pack: https://.instructure.com/courses/722391/pages/harvard-coursepack-links

3. **CASE STUDY:**
   West, J. (2000), Delamere Vineyard. Harvard Business School Case Study, Product ID 9-698-051. Available in your purchased Harvard Course Pack: https://.instructure.com/courses/722391/pages/harvard-coursepack-links

4. **Video (part of case study)***:*
   Delamere Vineyard. Available in your purchased Harvard Course Pack: https://.instructure.com/courses/722391/pages/harvard-coursepack-links

Supplemental Resources:

- American Psychological Association. (2009). Publication manual of the American Psychological Association (6th ed.). Washington, DC: American Psychological Association. ISBN 13: 978-1433805615 (softcover).
- Resource for writing and APA: https://owl.english.purdue.edu/owl/resource/560/01/
- Resource for checking APA format requirements: www.apastyle.org
- Tague, N. R. (2005). *The quality toolbox*. 2nd edition. Milwaukee, WI: ASQ. ISBN: 978-0-87389-639-9

Library Services

Detailed information about the eLibrary can be found in the Student Resource Center. This is a resource that all students have access to during their academic career.

Canvas Help Desk and Technical Questions

If you experience technical issues in your course, please contact the Canvas Help Desk by clicking the Help link (top right corner within Canvas). There are 3 ways to contact them:

- Phone (888-628-2749)
- Live chat
- Report a problem (submit a ticket)

Be sure to notify your instructor of any technical difficulties you are experiencing.

Additional resources are available in the Student Resource Center and the Canvas Guides website: https://community.canvaslms.com/docs/DOC-4121

Weekly Schedule

Note on written papers: Please use the provided MSWord APA style template which includes the proper font, margins, title page, and References page. Text should be double spaced.

Week 1	**Six Sigma Concepts**
Outcomes	• Relate sigma level and quality performance, and impact on organization results. • Recognize the importance of Voice of the Customer. • Identify the statistical basis of Six Sigma. • Describe the meaning, calculation, and relevance of basic six sigma metrics. • Compare the DMAIC and DMADV methodologies. • Describe the levels of Six Sigma certification and the role of Green Belts in the organization.

Readings	• TEXT: Council for Six Sigma Certification. (2018). A complete step-by-step guide:
	  • Chp 1 (Six Sigma) pp 9-20
	  • Chp 2 (SS History and Application) pp 21-32
	  • Chp 3 pp 41-42 "When to use Six Sigma"
	  • Chp 5 (Basic SS) pp 60-83
	  • Chp 11 (DMAIC/DMADV) pp 156-168
	• 10 reasons organizations do not use Lean Six Sigma

Lecture	Six Sigma Concepts
Multimedia	1. Overview-Six Sigma - Gemba 2. The Pareto Chart - Gemba
Optional Multimedia	• Performance & Sigma Values - Gemba • Process Capability-Introduction- Gemba • Process Capability Analysis- Gemba
Discussion	Discuss at least two of the challenges your organization faced, or would face, in implementing a Lean Six Sigma program. How might these challenges be overcome/or were overcome?
Assignment	Written Paper: Research beyond your text for an article or case study from your own company (if sharable), the Internet, the Library) and locate one project that used the DMAIC methodology, and one that used DMADV (also referred to as DFSS).

	Submit a paper as MSWord (2-3 pages), include the following: 1. Introduction (Purpose of your paper). 2. Compare DMAIC and DMADV, noting specific differences in activities. 3. Company or organization 1 (DMAIC based project) 4. Company or organization 2 (DMADV based project For each company, provide the following: a. Company name and business b. Intent of the project (problem or opportunity) c. Project goal d. Challenges faced by the project, if any e. Actions taken/process created or improved f. Results / benefits realized (specific, quantifiable information) Include a References page listing your sources, using proper APA formatting.
Quiz	Week 1 Assessment
Week 2	**Lean Concepts**
Outcomes	• Define and describe lean concepts such as the "lean house", waste, theory of constraints, value chain, flow, perfection, JIT, TAKT, TPM, the visual factory, poka-yoke, kaizen, pull, heijunko, jidoka. • Identify types of muda. • Select and apply tools and techniques for eliminating or preventing waste. • Interpret and use value stream maps to identify and analyze processes. • Contrast Lean and Six Sigma and describe their integration.
Readings	• **TEXT: Council for Six Sigma Certification**. (2018). A complete step-by-step guide: • Chp 4 (Lean Concepts) pp 43-59 • Chp 32 (Process Maps) pp 656-675 • Chp 33 (Value Stream Mapping) pp 676-691 • **CASE STUDY:** Bohn, R. Kristen's Cookie Co. (A). Harvard Business School Case Study. *In your purchased Harvard Course Pack*
Lecture	Lean Concepts
Multimedia	1. Lean vs Six Sigma - Gemba 2. Overview-Lean - Gemba 3. Process Maps - Gemba 4. TAKT Time - Gemba 5. Value Stream Overview - Gemba

Optional Multimedia & Readings	• Toyota Production System (TPS) terminology • Continuous Flow - Gemba • Developing Strategies to Sustain Operational Excellence - Gemba • Downstream Pull - Gemba • JIT Introduction - Gemba • Kaizen Overview - Gemba • Kanban Overview - Gemba • Kaizen Event - Gemba • Mapping - Gemba • Visual Management Example - Gemba • Workplace Visualization - Gemba • VSM-shapes-icons - Gemba
Discussion	What distinguishes Type I from Type II muda? Based on your experiences, or from research, discuss at least two examples of Type I Muda that you can identify in a process that you are/were a part of, or have observed.
Assignment	Written Paper: Read the Case Study "Kristen's Cookie Company". Based on information in the case study, 1. Draw a process flow diagram, including decision points, showing the cookie production process. 2. Draw a Value Stream Map (VSM), showing the cookie production process. 3. Compare these two types of diagrams and their potential use in process improvement. 4. Answer questions 1-6 on the top of page 3. You can do hand drawings, MSPowerpoint or other software, and insert the drawing into your MSWord document for submittal. Submit your work in <u>one</u> MSWord document please.
Quiz	Week 2 Assessment
Week 3	**The DEFINE Phase of DMAIC**
Outcomes	• Identify the deliverables of the Define phase of DMAIC. • Construct a project charter, including a problem statement. • Perform a project stakeholder analysis. • Describe ways to capture Voice of the Customer. • Define the scope of a project using process maps, Pareto charts, and other quality tools. • Evaluate potential projects and prioritize them based on sound criteria.
Readings	• **TEXT: Council for Six Sigma Certification**. (2018). *A complete step-by-step guide: A complete training and reference guide for White Belts, Yellow Belts, Green Belts, and Black Belts.* o Chp 6 (Approaching the Problem) pp 84-93 o Chp 9 (Project Selection) pp 126-141

	○ Chp 12 (Define) pp 169-181 • Delamere Vineyard. *Harvard Business School Case Study* *Available from your purchased Harvard Course Pack*
Lecture	The Define Phase of DMAIC
Multimedia	1. Delamere Vineyard – Video in case study – Harvard Course Pack 2. 3 Voices Scorecard - Gemba 3. Clarify the Problem - Gemba 4. Business needs assessment - Gemba 5. Objective Statement - Gemba 6. Problem Statement – Gemba 7. Project Charter - Gemba
Optional Multimedia & Readings	• Eight dimensions of quality (blog) - Gemba • Which Six Sigma metric should I use? • SIPOC Diagrams - Gemba • SMART goals - Gemba • Step-2-break-down-the-problem - Gemba • Team-meeting-facilitation - Gemba
Discussion	What does "Voice of the Customer" mean and why is it important? For your organization or company: who are your customers, what would/did you ask them, what did you (or would like to) learn from your customers, and what VOC tool would you recommend using/or have used in the past?
Assignment	Read the case study "Delamere Vineyard" and write a 3-4 (dbl spaced) paper including the following: 1. Introductory paragraph about Delamere and its business. 2. Concise description of each of the 3 projects Richardson is considering and why. Include the problem or opportunity the project would address. 3. Construct a project selection matrix. Based on what the case says about the project options, use your matrix to evaluate each of Richardson's potential projects. Which project would you rank as the highest priority and why? Include any assumptions you make about the alternatives. Hint: evaluation criteria might include cost, risk, specific benefit, or other criteria.
Quiz	Week 3 Assessment
Week 4	**Basic Statistics for Six Sigma**
Outcomes	• Recognize the value of descriptive and inferential statistics in six sigma projects. • Distinguish between types of data. • Recognize and apply basic probability and statistical concepts • Define, calculate, and interpret measures of dispersion and central tendency.

	• Identify the basis and methods for population sampling. • Describe how to perform ANOVA and a hypothesis test. • Create and interpret graphs.
Readings	**TEXT: Council for Six Sigma Certification**. (2018). *A complete step-by-step guide: A complete training and reference guide for White Belts, Yellow Belts, Green Belts, and Black Belts.* • Chp 18 (Normal Probability) pp 274-290 • Chp 19 (Correlation and Regression) pp 310-314, 321-322 (Linear Regression) pp 331-334 • Chp 21 (Hypothesis Testing) pp 372-376, 383-386 • Chp 22 (Sample size) pp 396-402 • Chp 28 (ANOVA) pp 565-566
Lecture	Basic Statistics for Six Sigma – Part 1 & 2
Required Multimedia	1. Data Types - Gemba 2. Descriptive Statistics - Gemba 3. Graphs Overview - Gemba 4. Histogram - Gemba 5. Hypothesis Testing - Gemba 6. Inferential Statistics and Sampling - Gemba 7. Introduction to Statistics - Gemba
Optional Multimedia	• Central Limit Theorem – Gemba • Normality - Gemba
Discussion	Describe an example from your workplace, or from research/interviewing someone, where inferential statistics would be useful to understand a problem. What inferential statistics technique would you apply, and why?
Assignments	Written paper. Please see separate documents in canvas for instructions and data.
Quiz	Week 4 Assessment
Week 5	**The MEASURE Phase of DMAIC**
Outcomes	• Identify the deliverables of the Measure phase of DMAIC and the tools used in creating them. • Describe how to conduct an MSA. • Perform a Failure Modes and Effects Analysis (FMEA). • Construct a data collection plan.

	• Construct a detailed process map and identify areas where data should be collected. • Construct and interpret diagrams and charts that are designed to communicate numerical analysis.
Readings	• Council for Six Sigma Certification. (2018). *A complete step-by-step guide: A complete training and reference guide for White Belts, Yellow Belts, Green Belts, and Black Belts.* o Chp 8 (Quality) pp 113-125 o Chp 13 (Measure) pp 182-205 o Chp 32 (Process maps) – revisit pp 656-675 • It's fun to work with an F-M-E-A
Lectures	The Measure Phase of DMAIC – Part 1 & 2
Multimedia	1. Checksheet - Gemba 2. Creating Run Charts - Gemba 3. Measurement-system-analysis - Gemba 4. Performing an FMEA Part 1 - Gemba 5. Primary Metric Graph - Gemba 6. Scatter Diagram - Gemba
Optional Multimedia	• Control Chart – Gemba • Histogram - Gemba • Performing an FMEA Part 2 - Gemba
Discussion	Describe an experience you had where you were assigned a task to collect data. What was the data you collected? In terms of the data types you have learned about, describe the type of data you collected. How was the data used and displayed? Note any difficulties you had with your data collection.
Assignment	Written paper. For the case study "Kristen's Cookie Company", use an FMEA template of your choice to perform an FMEA for the cookie production process. What did the FMEA reveal to you? Submit as an MSWord document.
Quiz	Week 5 Assessment
Week 6	**The ANALYZE Phase of DMAIC**
Outcomes	• Identify the deliverables of the Analyze phase of DMAIC and the tools used in creating them. • Identify the application of quality tools in data and process analysis. • Use cause and effect diagrams, 5-Why, and other problem-solving tools to identify the root cause(s) of a problem. • Construct and interpret diagrams and charts that are designed to provide insight into root causes.

	• Describe the role of correlation, regression analysis, and hypothesis testing in root cause analysis.
Readings	**TEXT: Council for Six Sigma Certification**. (2018). *A complete step-by-step guide: A complete training and reference guide for White Belts, Yellow Belts, Green Belts, and Black Belts.* • Chp 14 (Analyze) pp 206-223 • Chp 17 (Graphical Analysis) pp 243-269
Lecture	The Analyze Phase of DMAIC – Part 1 & 2
Multimedia	1. Cause & Effect (Fishbone) Diagram - Gemba 2. Cause and Effect (C&E) Matrix template – Gemba 3. Correlation and Regression - Gemba 4. Creating-a-cause-effect-matrix - Gemba 5. Five Why - Gemba 6. Scatter Diagram - Gemba
Optional Multimedia	• Histogram - Gemba • Hypothesis Testing - Gemba • Pareto Chart - Gemba • Text Chp 19 (Correlation and Regression) • Text Chp 21 (Hypothesis Testing)
Discussion	Identify a problem in your workplace or elsewhere and perform a simple 5-why analysis. Use the question list format, not a diagram. In your replies to peers, offer additional insight into their 5-why analysis. Let's get ideas flowing!
Assignment	Written paper. Submit ONE paper with the following contents: **Part 1**. For the problem you used in this week's discussion forum, or another problem in your workplace or elsewhere, construct a fishbone diagram. Drill to at least 2-3 levels of possible causes of the problem in each category of causes (People, Materials, Machines, Measurement, Method, Environment are often used categories). Describe your technique for coming up with your potential causes (e.g. brainstorming? affinity diagram? Other method?). **Part 2**. Describe the role of correlation, regression analysis, and hypothesis testing in root cause analysis. Give specific examples of the use of these techniques. Use examples where it might apply in your workplace processes, or from research.
Quiz	Week 6 Assessment
Week 7	**The IMPROVE Phase of DMAIC**
Outcomes	• Identify the deliverables of the Improve phase of DMAIC and the tools used in creating them.

	• Identify the role of brainstorming in process improvement • Use a Solution Matrix to evaluate solutions against evaluation criteria. • Identify the purpose of design of experiments (DOE) and create a DOE. • Suggest ways for mistake proofing a process. • Describe ways to reduce cycle time. • Describe how to conduct a pilot study • Define and distinguish between kaizen and kaizen blitz. • Calculate the savings of improvement.
Readings	**TEXT: Council for Six Sigma Certification**. (2018). *A complete step-by-step guide: A complete training and reference guide for White Belts, Yellow Belts, Green Belts, and Black Belts.* ▫ Chp 15 (Improve) pp 224-233 ▫ Chp 29 (DOE) pp 593-604 ▫ Chp 31 (Brainstorming) pp 641-655
Lectures	The Improve Phase of DMAIC
Multimedia	1. Calculating-savings-of-improvement projects - Gemba 2. DOE Introduction - Gemba 3. Full Factorial DOE, Part 1 - Gemba 4. Improvement Techniques - Gemba 5. Kaizen Overview - Gemba 6. Poka Yoke Overview - Gemba
Optional Multimedia	• Kaizen Success Story - Gemba • Poka Yoke Mistake Proofing - Gemba
Discussion	There are many tools for improving a process. From the list below, research and briefly describe ONE tool and an experience where you have observed or participated in it use, or where you would recommend its use. What problem would it/did it address? 1. Cellular manufacturing 2. Downstream pull 3. Jidoka 4. Just in Time 5. Kaizen 6. Kanban 7. Poka-yoke 8. SMED 9. Visual Control/Visual Management
Assignment	Written paper. Assume that the Kristen Cookie Company is up and running and sales are good. Quality control is through inspection before boxing the cookies. However, there is a 10% reject rate due to uneven edges on some of the cookies. You and your roommate have brainstormed possible factors causing this, and narrowed it down to: 1. Mixing time (now 6 minutes) 2. Baking time (now 10 minutes)

	You have decided to run a factorial DOE to determine whether baking time or mixing time (or both) influences the shape of the cookie. Describe your experiment's (DOE) design. Include diagrams or matrices as appropriate. Submit as a written paper, MSWord.
Quiz	Week 7 Assessment
Week 8	**The CONTROL Phase of DMAIC**
Outcomes	• Identify the deliverables of the Control phase of DMAIC and the tools used in creating them. • Summarize the importance and structure of a Control Plan. • Identify, select, and interpret control charts. • Describe the theory and objectives of Statistical Process Control (SPC). • Distinguish between common and special cause variation and how these conditions can be deduced from control chart analysis.
Readings	TEXT: Council for Six Sigma Certification. (2018). A complete step-by-step guide: A complete training and reference guide for White Belts, Yellow Belts, Green Belts, and Black Belts. ▫ Chp 16 (Control) pp 234-242 ▫ Chp 17 (Graphical Analysis) – revisit pp 243-269 ▫ Chp 23 (Adv Control Charts) pp 417-424
Lectures	The Control Phase of DMAIC
Multimedia	1. Control-plans - Gemba 2. SPC-introduction - Gemba 3. Xbar - R&S Chart - Gemba
Optional Multimedia	1. I-MR Chart - Gemba 2. P-NP Chart – Gemba 3. U & C Chart - Gemba
Discussion	Every process has/or should have some aspect of monitoring and control. Describe the control method for a process with which you are familiar. Is the method formal/written such as in a control plan? Or Informal? Is there anything missing in this process control method / can it be improved in any way?
Assignment	Written paper: For the Kristen Cookie Company, identify 2-3 metrics that might apply to the production process. Use a Control Plan template, such as one of those provided (or one of your choosing) and build a Control Plan for the cookie production process. In addition, write a summary of your plan and its purpose. (As in any paper, provide an Introductory paragraph describing the intent of the paper).

Quiz	Week 8 Assessment

Grading and Evaluation

Your grades will reflect the way in which you present and support your topics and positions in the various learning activities used in this course. The grades will be based on the quality and quantity of your comments and responses in the various activities.

Be sure to review the discussion and assignment rubrics in the course for specific grading criteria.

The various graded activities are weighted as follows:

Course Element	% of Final Grade
Assignments	60%
Quizzes	20%
Discussions	17%
Reflection / Feedback	3%
Total	100%

Students will be expected to meet all the deadlines of the class as indicated throughout the course and in the syllabus. This is primarily so we don't get behind in the course. In addition, discussions cannot overlap from one week to the next. This is to ensure that all discussions and submissions take place within the week they are scheduled in order to be of value to the entire class as well as to help you not get behind. If there are extenuating circumstances, you will need to communicate that to the instructor and make arrangements accordingly, if appropriate.

Late Assignments: Exceptions are to be determined by the instructor on a case-by-case basis. There will be no opportunities for extra credit.

Learner Success Guidelines

These guidelines are provided to help you succeed in your coursework:

- Participate in the class introduction activity on the first day of class.
- Submit ALL assignments by the posted due dates and times.
- Check your emails daily.
- Contact Portal Help for logon problems or Canvas Help for technical issues with Canvas.
- Participate fully in all threaded discussions.
- Contact your instructor if you have questions about an assignment or need additional help completing your work successfully.

Academic dishonesty is grounds for dismissal from the program.

Academic Policies

The following Academic Polices can be found in the Student Resource Center.

- Grading Criteria
- Reasonable Accommodations Policy
- Student Attendance Policy
- Academic Honesty and Integrity Policy
- Student Engagement and the Granting of Academic Credit
- Copyright Policy

Caveat

The above schedule, content, and procedures in this course are subject to change. All policies are superseded by the latest College Catalog available on our website: https://www.cambridgecollege.edu/student-rights-complaints-grievances/student-code-conduct