Black Belt Virtual Agenda

with Virtual Capstone

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E-Learning Courses	Time	Virtual Class	Time

Session 1 - Introducrion **April 25, 2017 6:00PM-8:00PM MDT**

Lean Six Sigma will focus improvement efforts to drive significant improvements in speed, quality and profitability. The methods and tools of lean will drive improvements in speed and productivity. The methods and tools of six sigma will drive improvements in defects and variation. Lean Six Sigma projects follow a Define - Measure - Analyze - Improve - Control methodology which has been proven to work well in all business operations including operation, administrative and service.

Learning Objectives - *the participant will:*

Understand and define the quality philosophies of Six Sigma and Lean.
Identify benefits and objectives of Lean Six Sigma.
Be able to outline the Lean Six Sigma implementation process.
Understand the project requirements and the basics of selecting and defining a project.

Tools, Templates, Forms
Process Sigma calculator,
DMAIC Roadmap
Glossary

Prerequisite E-Learning	min.
Six Sigma Introduction	60
Introduction to Lean Principles*	60
Introduction to Lean Office and Service*	45
Project Management Introduction	60
Total hrs.	3.75

Virtual class topics

Introduction to Lean Six Sigma and DMAIC Methodology
Project Management Basics

2.0

Homework
Identify value streams in your process (15 min)

0.25

Approximate time required (hrs.) 6

Session 2 - Defining the Project **May 4, 2017 5:30PM-7:30PM MDT**

Understanding process requirements is all about understanding the Voice of the Customer (VOC) and the Voice of the Business. The central philosophy of Lean Six Sigma is to measure process performance from the perspective of the customer whether internal or external. The **Define Phase** involves preparing a project charter, understanding the relationships between Suppliers-Inputs-Process-Outputs-Customer (SIPOC), translating voice of the customer into Critical-To-Quality (CTQ) requirements which are important to the customer, and developing a project charter.

Learning Objectives - *the participant will:*

Translate customer needs to critical-to-quality metrics.
Apply Dr. Kano's 4 beliefs to identifying customers requirements.
Be able to identify gaps surrounding a process.
Understand the project requirements and the basics of selecting and defining a project.
Create a project charter.
Show how the use of Kaizen Events, or Rapid Improvement Events, speeds up the execution of larger initiatives.
Learn the application, use, and interpretation of several types of process maps.
Have an understanding of the five focusing steps of the Theory of Constraints.

Tools, Templates, Forms
Project Charter
Gantt Chart
Kano Analysis
Stakeholder Analysis
CTx Matrix
SIPOC Diagram

Project Deliverable*
Project concept, or idea, submitted to the instructor
Due: end of Session 2 week

Prerequisite E-Learning	*min.*
Voice of the Customer	75
Managing the Project	55
Kaizen Event*	30
SIPOC	15
Mapping the Process	30
Introduction to the Theory of Constraints	55
Total hrs.	4.3

Virtual class topics

Project Charter
Kaizen Event
Voice of the Customer and CTX's
SIPOC Diagram
Process Mapping

2.0

Homework
Develop a SIPOC diagram for a process of your choice

0.5

Approximate time required (hrs.) 6.8

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Session 3 - Measuring the Process **May 9, 2017 5:30PM-7:30PM MDT**

The **Measure Phase** presents tools and techniques which allow the team to refine the problem and begin the search for root causes. In this session the participants will learn tools for measuring a process from a lean perspective by identifying and measuring waste in a process, and from a six sigma perspective by measuring variation. Basic statistical tools will be presented so each participant will need to have a copy of statistical software (Minitab) for data analysis.

Learning Objectives - *the participant will:*

- Describe why Eight Wastes are a primary focus area during Lean implementation.
- Construct a current state VSM.
- Know how to calculate and evaluate takt time vs. cycle time.
- Be able to identify and describe value add vs. non value add activities.
- Understand basic statistical terms and definitions.
- Understand the concept of variation and sources of variation in data.
- Learn the application of several graphical techniques for plotting and presenting data.

Tools, Templates, Forms

Value Stream Map
Capacity Model
DPMO and Sigma Level
Frequency distributions
Histogram
Dot Plot
Excel Files for exercises

Project Deliverable*

Project Charter submitted to the instructor
Due: end of Session 3 week

Homework

Basic statistics exercises using Minitab

Prerequisite E-Learning	min.
Eight Wastes*	25
Current State Value Stream Mapping*	60
Future State Value Stream Mapping*	45
Process-Based Costs	30
What is Statistics?	35
Organizing and Presenting Data	45
Total hrs.	4.0

Virtual class topics	
Eight Wastes	
Value Stream Mapping	
Calculating Process Based Costs	
Introduction to Minitab	
What is Statistics?	
Organizing and Presenting Data	
Total hrs.	2.0

	0.5
Approximate time required (hrs.)	6.5

Session 4 - Process Analysis **May 23, 2017 5:30PM-7:30PM MDT**

Descriptive statistics focus on the collection, analysis, presentation and description of a set of data. The Measure Phase focuses on understanding the current performance of the process selected for improvement and collecting any necessary data needed for analysis. It includes assessment of the measurement systems to ensure data validity.

Learning Objectives - *the participant will:*

- Define the central limit theorem and understand its significance and use.
- Identify, calculate, and interpret the measures of central tendency - mean, median and mode.
- Use the characteristics of the normal curve to calculate Z scores and percentiles.
- Know how to apply a Gauge R&R study to validate the measurement system.
- Use an Attribute Agreement Analysis to determine the validity of attribute measurement systems.

Tools, Templates, Forms

Pareto Diagram
Scatter Plot
Descriptive Statistics
Gauge R&R Study
Attribute Agreement Analysis

Homework

Basic statistics exercises using Minitab

Prerequisite E-Learning	min.
Pareto Analysis	40
Scatter Diagrams	30
Measures of Central Tendency	40
Measures of Dispersion	60
Measurement System Analysis	45
5S*	30
Total hrs.	4.1

Virtual class topics	
Data and Graphical Analysis	
Validating the Measurement System	
	2.0

	0.5
Approximate time required (hrs.)	6.6

Session 5 - Baseline and Root Cause **May 30, 2017 5:30PM-7:30PM MDT**

The measure phase concludes with the establishment of the process baseline. A process capability study will provide information about the performance of the process under specified operating conditions and the data will provide a basis for improvements in later phases. In the **Analyze Phase** the team will examine the processes, data, and facts to gain an understanding of why problems occur and what improvement opportunities exist.

Learning Objectives - *the participant will:*

- Conduct process capability studies for variable and attribute data and interpret the results.
- Be able to identify improvement objectives give the performance capability.
- Use Failure Mode and Effect Analysis as a risk assessment tool.
- Understand the cause and effect principle.
- Identify, apply and analyze several root cause analysis tools.
- Understand how visual management works with 5S as a key building block for lean improvements.

Tools, Templates, Forms

Process Capability
5 Why's
Ishikawa Fishbone Diagram
CE Matrix
Root Cause Analysis
Current Reality Tree
Process FMEA
Visual Management Techniques
Error Proofing (Poke Yoke) Devices

Homework

Construct a simple Current reality Tree from a fishbone diagram

Prerequisite E-Learning	*min.*
Introduction to Process Capability	45
Process Capability Assessments	60
Cause and Effect Diagrams	40
Failure Mode and Effects Analysis	30
Visual Management*	20
Error Proofing*	20
Total hrs.	3.6

Virtual class topics	
Process Capability	
Cause and Effect Diagrams	
Failure Mode and Effects Analysis	
5S	
Visual Management	
Error Proofing	
	2.0

	1.0
Approximate time required (hrs.)	6.6

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Mentoring, Coaching Sessions - 1 hr session scheduled with each BB for project coaching, questions and additional help as needed. **Week of May 22, 2017**

Session 6 - Making Inferences — June 8, 2017 5:30PM-7:30PM MDT

Inferential statistics focus on making decisions about a large data set, or population, based on a subset, or sample. These tools are used in order to evaluate potential causes to determine their effects on key metrics and determine which causes contribute significantly to the process results and which do not. A set of analysis techniques called comparative methods is used. These methods consist of confidence intervals and hypothesis testing.

Learning Objectives - *the participant will:*

- Know the properties of discrete random variables.
- Identify the characteristics of a normal curve and use it to estimate the capability of a process.
- Be able to explain the use of confidence intervals to estimate a population parameter.
- Identify when hypothesis testing may be appropriate and apply the methodology.
- Apply the hypothesis testing procedure to test means.

Tools, Templates, Forms

Distributions - Normal, Poisson, Binomial
Hypothesis Testing
Confidence Intervals
Type I and Type II errors

Project Deliverable*

Measure Phase, process baseline submitted to the instructor
Due: end of Session 6 week

Homework

Inferential statistics exercises using Minitab

Prerequisite E-Learning	min.
Probability Distributions: Discrete Random Variables	45
Continuous Probability Distributions: Normal Curve	30
Introduction to Inferential Statistics	30
Confidence Interval for the Mean	90
Hypothesis Tests for the Mean	90
Introduction to,Probability (optional)	
Total hrs.	4.8

Virtual class topics	
Introduction to Inferential Statistics	
Distributions	
Confidence Intervals	
Total hrs.	2.0

1.0

Approximate time required (hrs.) 3.0

Session 7 - Statistical Testing 1 — June 20, 2017 5:30PM-7:30PM MDT

Hypothesis testing can be used to detect differences in a process mean, proportion or variance vs. a target, between two process mean, variances and proportions against each other, and more than two means, proportions or variances.

Learning Objectives - *the participant will:*

- Learn the hypothesis testing procedure for testing means and variances.
- Apply the one sample, two sample and paired t-tests and interpret the results.
- Apply one proportion, two proportion and Chi Square tests for discrete data, and interpret the results

Tools, Templates, Forms

1-sample t test
2-sample t test
1-variance test
2-variance test
1-proportion test
2-proportion test
Chi Square Test

Prerequisite E-Learning	min.
Comparing Means	75
Inferential Statistics: Self Assessment	n/a
Making Inferences about Proportions	60
Making Inferences about Variances	75
Total hrs.	3.5

Virtual class topics	
Hypothesis Tests for Meas	
Hypothesis Tests for Variances	
Hypothesis Tests for Proporations	
Sample Size	
Total hrs.	2.0

Homework

Inferential statistics exercises

1.0

Approximate time required (hrs.) 6.5

Session 8 - Statistical Testing 2 — June 27, 2017 5:30PM-7:30PM MDT

Analysis of Variance (ANOVA) is a hypothesis testing can be used to detect differences in a process means when three or more populations are tested. ANOVA will also be a fundamental test in Multiple Regression. Nonparametric tests are used in situations where parametric assumptions of normality cannot be met.

Learning Objectives - *the participant will:*

- Apply the one sample, two sample and paired t-tests and interpret the results.
- Conduct one way and two way analysis of variance tests.
- Analyze ANOVA model with residual analysis.
- Visualize ANOVA results with a multi-vari plot.
- Know the differences between parametric and nonparametric tests and when each is used
- Set up, conduct and interprest several nonparametric tests

Tools, Templates, Forms

1-way ANOVA
2-way ANOVA
General Linear Model
Residual Analysis
Multi-Vari Plot
Nonparametric tests

Prerequisite E-Learning	min.
ANOVA	60
Hypothesis Testing for Nonparametric Data	135
Total hrs.	3.3

Virtual class topics	
ANOVA	
Nonparametric statistics	
Total hrs.	2.0

Homework

Inferential statistics exercises

1.0

Approximate time required (hrs.) 6.3

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Session 9 - Correlation and Regression — **July 11, 2017 5:30PM-7:30PM MDT**

Correlation and regression analysis tools are used for building statistical models that characterize relationships between a dependent and one or more independent variables.

Learning Objectives - *the participant will:*

- Use a scatter plot to identify whether variables appear correlated and to what degree.
- Fit a least squares regression line to the data and judge the validity of the model.
- Be able to write the regression equation and perform predictions based on the model.
- Perform multiple regression and evaluate using model selection criteria.
- Understand how to select, conduct and interpret appropriate tests for nonparametric data.

Tools, Templates, Forms

- Correlation Analysis
- Fitted Line Plot
- Simple Linear Regression
- Scatter Diagram
- Multiple Regression Best Subsets

Prerequisite E-Learning	min.
Simple Linear Regression	40
Multiple Regression	40
Total hrs.	1.3

Virtual class topics	
Simple Linear Regression	2.0
Multiple Regression	1.0
Total hrs.	3.0

Homework

Regression exercises in Minitab

Approximate time required (hrs.) 4.3

Mentoring, Coaching Sessions - 1 hr session scheduled with each BB for project coaching, questions and additional help as needed. **Week of June 26, 2017**

Session 10 - Designing Experiments — **July 18, 2017 5:30PM-7:30PM MDT**

The purpose of the **Improve Phase** is to create, select and implement the solution. This often involves sorting through many factors which have an effect on the process. A designed experiment is based on simultaneously testing multiple factors that affect a product, process or service. DOE is a test or series of tests that allows the experimenter to compare two or more methods or determine levels of controllable factors to optimize a process. In complex situations where several factors have an impact on the outcome, DOE is well-suited to finding the most efficient and effective combination of factors for producing the highest quality output.

Learning Objectives - *the participant will:*

- Know the benefits and applications of DOE.
- Know how to set up and conduct an experiment.
- Set up and analyze two factor and three factor full factorial experiments.
- Set up and analyze fractional factorial experiments.

Tools, Templates, Forms

- DOE Worksheet
- Full Factorial Designs
- Fractional Factorial Designs

Prerequisite E-Learning	min.
Introduction to Design of Experiments	45
Full Factorial Designs	30
Fractional Factorial Designs	30
Total hrs.	1.8

Virtual class topics	
Introduction to Design of Experiments	2.0
Full Factorial Designs	1.0
Fractional Factorial Designs	
Total hrs.	3.0

Homework

DOE exercises in Minitab

Approximate time required (hrs.) 4.8

Session 11 - Making Improvements — **July 25 2017 5:30PM-7:30PM MDT**

When the data collection and analysis is completed and the team determines that additional analysis will not add to their understanding of the problem, it's time to move on to the **Improve Phase** and solution development. Lean tools and techniques will provide several improvement opportunities for eliminating waste and streamlining the process.

Learning Objectives - *the participant will:*

- Describe the primary benefits gained from Total Productive Maintenance.
- Use Overall Equipment Effectiveness (OEE) to assess the health of the process.
- Know how to create effective Workplace Design for office and manufacturing processes.
- Explain how Changeover Reduction it supports and enables Lean waste reduction.
- Provide a step---by---step guide to implementing a successful Changeover Reduction program.
- Know how to create, implement, and improve Standard Work for both office and manufacturing processes.
- Understand where to implement Pull Systems know how they enable effective flow of information and materials,
- Identify which pull system tools are best suited for various office and manufacturing environments.

Tools, Templates, Forms

- OEE Worksheet
- Visual Displays, Controls
- Error Proofing Devices
- Changeover Analysis
- Kanban

Prerequisite E-Learning	min.
Total Productive Maintenance	25
Workplace Design and Layout*	20
Changeover Reduction	60
Standard Work*	20
Flow and Pull Systems	30
Total hrs.	2.6

Virtual class topics	
Total Productive Maintenance	2.0
Workplace Design and Layout	0.0
Changeover Reduction	
Standard Work	
Flow and Pull Systems	
Total hrs.	2.0

Homework

none

Approximate time required (hrs.) 4.6

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Session 12 - Controlling the Process **August 1, 2017 5:30PM-7:30PM MDT**

The team has been collecting improvement ideas throughout the project and it time to apply a structure approach to evaluating and selecting solutions. Once the solution has resulted in measureable improvement it is time to move to the **Control Phase**. this phase focuses on creating and sustaining the improvement but establishing process monitors and controls.

Learning Objectives - *the participant will:*

- Discuss how potential savings affect a project's Return On Investment (or ROI).
- Describe the purpose and application of common tools used to generate and analyze potential solutions and to assess risk.
- Explain how all these components come together in the implementation plan.
- Explain how to identify which Control Chart type is most appropriate for monitoring a given process parameter.
- Construct and interpret control charts for variables and attributes.
- Describe the key components required for effectively closing the project, including documentation, handoff, and leverage.
- Design a Control Plan, discuss its importance, and explain how to create and implement it.

Tools, Templates, Forms

Solution Selection Matrix
Pugh Matrix
Implementation Plan
Control charts for variable data
Control charts for attribute data
Control Plan

Project Deliverable*

Project plan for the completion of the *remaining tasks, submitted to the instructor*

Due: end of Session 12 week

Homework

none

Prerequisite E-Learning	min.	*Virtual class topics*	
Selecting the Solution	30	*Selecting the Solution*	
Control Charts	45	*Control Charts*	
Controlling the Process	45	*Controlling the Process*	
	2.0		1.5

0.0

Approximate time required (hrs.) 3.5

Final Project Review - schedule based on project status and completion **TBD**

	hrs.	
ONLINE	38.9	
VIRTUAL CLASS	24.5	
TOTAL HOURS	**63.4**	*Does not include additional project work*
OPTIONAL HOMEWORK	6.8	
	70.2	

* Black Belt Certification Requirements

- Complete the 16 week virtual course and capstone project sessions.
- Complete all online courses with a minimum post-test score of 80%.
- Complete the certification exam with a minimum score of 80%.
- Complete a project and successfully present the project to the instructor and Master Black Belt.

Project Requirements:

- You can select a project for your organization or company, or for a non-profit or local charity.
- You will need to have access to the process and the data necessary to complete the project requirements.
- Several project deliverables must be completed during and after the course.
- You will need to present the project to the management team of the company or organization.
- Implementation must be planned but does not have to be fully executed.
- Several project deliverables will be scheduled during and after the course.

Project Deliverables:

The Instructor and / or Master Black Belt will review each deliverable and may return it for additional work if needed.

1. Project concept or idea, due at the end of session 2
2. Project Charter due at the end of the week of session 4

The following are guidelines and may vary depending on the complexity of the project:

3. Measure phase, project baseline, due at the end of the week of session 9
4. Project plan for completion of the remaining tasks, due at the end of the week for session 16

It will up to the Black Belt candidate to:

- Contact the instructor for additional review or assistance if needed.
- Schedule and conduct local management reviews as needed
- Provide a completed project to the instructor and arrange for a final review

The instructor will be available to guide and coach you through the project. The expectations are high and the course and project work can be demanding. The course is very rigorous and will require that you devote time each week to working on your project as well as completing the online and virtual classes. When you enroll, be sure the course fits in your calendar and can be completed with your other priorities.

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