Lean Six Sigma Black Belt Curriculum

1.0 DEFINE
- **1.1 Six Sigma Overview**
  - 1.1.1 What is Six Sigma
  - 1.1.2 Six Sigma History
  - 1.1.3 Six Sigma Approach Y = f(x)
  - 1.1.4 Six Sigma Methodology
  - 1.1.5 Roles & Responsibilities
- **1.2 The Fundamentals of Six Sigma**
  - 1.2.1 Defining a Process
  - 1.2.2 VOC & CTQ's
  - 1.2.3 QFD
  - 1.2.4 Cost of Poor Quality (COPQ)
  - 1.2.5 Pareto Analysis (80:20 rule)
- **1.3 Lean Six Sigma Projects**
  - 1.3.1 Six Sigma Metrics
  - 1.3.2 Business Case & Charter
  - 1.3.3 Project Team Selection
  - 1.3.4 Project Risk Management
  - 1.3.5 Project Planning
- **1.4 Lean Fundamentals**
  - 1.4.1 Lean & Six Sigma
  - 1.4.2 History of Lean
  - 1.4.3 The Seven Deadly Muda
  - 1.4.4 Five-S (5S)

2.0 MEASURE
- **2.1 Process Definition**
  - 2.1.1 Cause & Effect Diagrams
  - 2.1.2 Cuase & Effects Matrix
  - 2.1.3 Process Mapping
  - 2.1.4 FMEA: Failure Modes & Effects Ana
  - 2.1.5 Theory of Constraints
- **2.2 Six Sigma Statistics**
  - 2.2.1 Basic Statistics
  - 2.2.2 Descriptive Statistics
  - 2.2.3 Distributions & Normality
  - 2.2.4 Graphical Analysis
- **2.3 Measurement System Analysis**
  - 2.3.1 Precision & Accuracy
  - 2.3.2 Bias, Linearity & Stability
  - 2.3.3 Gage R&R
  - 2.3.4 Variable & Attribute MSA
- **2.4 Process Capability**
  - 2.4.1 Capability Analysis
  - 2.4.2 Concept of Stability
  - 2.4.3 Attribute & Discrete Capability
  - 2.4.4 Monitoring Techniques

3.0 ANALYZE
- **3.1 Patterns of Variation**
  - 3.1.1 Multi-Vari Analysis
  - 3.1.2 Classes of Distributions
- **3.2 Inferential Statistics**
  - 3.2.1 Understanding Inference
  - 3.2.2 Sampling Techniques & Uses
  - 3.2.3 Sample Size
  - 3.2.4 Central Limit Theorem
- **3.3 Hypothesis Testing**
  - 3.3.1 Goals of Hypothesis Testing
  - 3.3.2 Statistical Significance
  - 3.3.3 Risk; Alpha & Beta
  - 3.3.4 Types of Hypothesis Test
- **3.4 Hypothesis Testing: Normal Data**
  - 3.4.1 1 & 2 sample t-tests
  - 3.4.2 1 sample variance
  - 3.4.3 One Way ANOVA
- **3.5 Hyp Testing: Non-Normal Data**
  - 3.5.1 Mann-Whitney & Mood's Median
  - 3.5.2 Kruskal-Wallis
  - 3.5.3 Moods Median
  - 3.5.4 Friedman
  - 3.5.5 1 Sample Sign
  - 3.5.6 1 Sample Wilcoxon
  - 3.5.7 1 and 2 Sample Proportion
  - 3.5.8 Chi-Squared (Contingency Tables)
  - 3.5.9 Test of Equal Variances

4.0 IMPROVE
- **4.1 Simple Linear Regression**
  - 4.1.1 Correlation
  - 4.1.2 X-Y Diagram
  - 4.1.3 Regression Equations
  - 4.1.4 Residuals Analysis
- **4.2 Multiple Regression Analysis**
  - 4.2.1 Non-Linear Regression
  - 4.2.2 Multiple Linear Regression
  - 4.2.3 Confidence Intervals
  - 4.2.4 Residuals Analysis
  - 4.2.5 Data Transformation, Box Cox
  - 4.2.6 Stepwise Regression
  - 4.2.7 Logistic Regression
- **4.3 Designed Experiments**
  - 4.3.1 Experiment Objectives
  - 4.3.2 Experimental Methods
  - 4.3.3 DOE Design Considerations
- **4.4 Full Factorial Experiments**
  - 4.4.1 2k Full Factorial Designs
  - 4.4.2 Linear & Quadratic Models
  - 4.4.3 Balanced & Orthogonal Designs
  - 4.4.4 Fit, Model & Center Points
- **4.5 Fractional Factorial Experiments**
  - 4.5.1 Designs
  - 4.5.2 Confounding Effects
  - 4.5.3 Experimental Resolution

5.0 CONTROL
- **5.1 Lean Controls**
  - 5.1.1 Control Methods for 5S
  - 5.1.2 Kanban
  - 5.1.3 Poka-Yoke (Mistake Proofing)
- **5.2 Statistical Process Control (SPC)**
  - 5.2.1 Data Collection for SPC
  - 5.2.2 I-MR Chart
  - 5.2.3 Xbar-R Chart
  - 5.2.4 U Chart
  - 5.2.5 P Chart
  - 5.2.6 NP Chart
  - 5.2.7 X-S chart
  - 5.2.8 CumSum Chart
  - 5.2.9 EWMA Chart
  - 5.2.10 Control Methods
  - 5.2.11 Control Chart Anatomy
  - 5.2.12 Subgroups, Variation, Sampling
  - 5.2.13 Center Line & Control Limits
- **5.3 Six Sigma Control Plans**
  - 5.3.1 Cost Benefit Analysis
  - 5.3.2 Elements of the Control Plan
  - 5.3.3 Elements of the Response Plan

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Design for Six Sigma Curriculum

1.0 INTRODUCTION
- 1.1 What is DFSS
- 1.2 Why use DFSS
- 1.3 DFSS Overview
  - 1.3.1 Define
  - 1.3.2 Measure
  - 1.3.3 Analyze
  - 1.3.4 Design
  - 1.3.5 Verify

2.0 DEFINE
- 2.1 Define Overview
- 2.2 Project Initiation
  - 2.2.1 DFSS Project Charter
  - 2.2.2 DFSS Program Plan
    - 2.2.2.1 Team Selection
    - 2.2.2.2 Stakeholder Assessment
    - 2.2.2.3 Governance & Tollgates
- 2.3 Define Design Specifications
  - 2.3.1 Voice of the Customer (VOC)
    - 2.3.1.1 What is VOC
    - 2.3.1.2 Importance of VOC
- 2.4 Collecting VOC
  - 2.4.1 Indirect VOC Gatering
  - 2.4.2 Direct VOC
- 2.5 Understanding VOC
  - 2.5.1 Affinitizing VOC
  - 2.5.2 CTQ to Requirements
  - 2.5.3 Kano
- 2.6 Define Summary

3.0 MEASURE
- 3.1 Measure Overview
- 3.2 CTQ Definitions & Specifications
- 3.3 QFD
  - 3.3.1 House of Quality (HOQ)
  - 3.3.2 HOQ Define Design Attributes
  - 3.3.3 HOQ Design Characteristics
  - 3.3.4 HOQ Customer & Tech. Requirem
  - 3.3.5 HOQ Importance of Attributes
  - 3.3.6 HOQ Performance Standards
- 3.4 Measure Summary

4.0 ANALYZE
- 4.1 Analyze Overview
- 4.2 Performance Standards
  - 4.2.1 Define Desired Performance Leve
  - 4.2.2 Measuring Performance Levels
  - 4.2.3 Estimating Performance Levels
  - 4.2.4 Performance Levels vs. Satisfactic
- 4.3 Concept Generation
- 4.4 High Level Designs
  - 4.4.1 High Level Process Flows
- 4.5 Design Evaluation (Pugh)
- 4.6 Analyze Summary

5.0 DESIGN
- 5.1 Design Overview
- 5.2 Detailed Design
  - 5.2.1 Functional Process Flow
  - 5.2.2 Detailed Process Flow
- 5.3 Design Performance
  - 5.3.1 Define PerformanceSpecifications
  - 5.3.2 Design Capability
  - (simulation using Discover Sim from Sig
- 5.4 Design Summary

6.0 VERIFY
- 6.1 Verify Overview (1 page, learning objec
- 6.2 Implementation Plan
- 6.3 Training Plan
- 6.4 Measure & Control Plan
- 6.5 Verify Summary