# LEAN SIX SIGMA BLACK BELT

**Professional Certification in Lean Six Sigma Black Belt Methodology**
**Course Code: M047/25**

**Duration:** 12 Days

**Delivery Format:** Hybrid

**Target Audience:**

- Individuals seeking professional development
- Organizations aiming to improve their processes and efficiency through Lean Six Sigma methodologies.

**Program Outcomes:**

Upon completion of this program, participants will be able to:

- Learn the basic definitions and terminologies of Lean Six Sigma System.
- Visualize how Lean Six Sigma is deployed within an organization and understand why it's a proven methodology that helps to save cost while improving quality and sustaining the success.
- Understand the five phases of a Lean Six Sigma initiative: Define Phase, Measure Phase, Analyze Phase, Improve Phase and the Control Phase.
- Apply the tools and techniques within each phase (Define, Measure, Analyze, Improve, Control) to lead and manage Lean Six Sigma projects.

**Detailed Syllabus**

**Module 1: Define Phase**

**Outcome:** Participants will be able to define a Lean Six Sigma project, identify key stakeholders, understand customer requirements, and develop a project charter. They will also grasp the fundamentals of Lean Six Sigma, its implementation strategies, and relevant metrics.

**Topics:**

The Basics of Six Sigma

- Meanings of Six Sigma
- General History of Six Sigma & Continuous Improvement Initiatives
- Deliverables of a Lean Six Sigma Project
- The Problem-Solving Strategy of $Y = f(x)$
- Voice of the Customer, Business and Employee
- Six Sigma Roles & Responsibilities

The Fundamentals of Six Sigma

- Defining a Process
- Critical to Quality Characteristics (CTQ's)
- Cost of Poor Quality (COPQ)
- Pareto Analysis (80:20 rule)
- Basic Six Sigma Metrics

Selecting Lean Six Sigma Projects

- Building a Business Case & Project Charter
- Developing Project Metrics
- Financial Evaluation & Benefits Capture

Strategies of Implementing Lean and Six Sigma in an organization

- Difference and Similarities between Lean and Six Sigma
- An example of implementing Six Sigma for the whole enterprise.
- Other Models of Implementing Six Sigma

**Activities:**

- Lean and Six Sigma Implementation Case Study
- Project Charter Case Study

**Assessments:**

- Quiz on Lean Six Sigma fundamentals and Define phase concepts.
- Evaluation of a developed project charter.

**Module 2: Measure Phase**

**Outcome:** Participants will be able to define and map processes, identify potential causes of variation, understand basic statistical concepts, assess process capability, and evaluate the reliability of measurement systems.

**Topics:**

Process Definition

- Cause & Effect / Fishbone Diagrams
- Process Mapping, SIPOC, Value Stream Map
- X-Y Diagram
- Failure Modes & Effects Analysis (FMEA)

Introduction to Minitab

Six Sigma Statistics

- Basic Statistics
- Descriptive Statistics
- Normal Distributions & Normality
- Graphical Analysis

Measurement System Analysis

- Precision & Accuracy
- Bias, Linearity & Stability
- Gage Repeatability & Reproducibility
- Variable & Attribute MSA

Process Capability

- Capability Analysis
- Concept of Stability
- Attribute & Discrete Capability
- Monitoring Techniques

**Activities:**

- Measurement System Analysis Case Study
- Micro Process Map Case Study

**Assessments:**

- Problem-solving tasks involving process capability calculations.
- Quiz on statistical concepts and measurement system analysis.

**Module 3: Analyze Phase**

**Outcome:** Participants will be able to identify patterns of variation in data, apply inferential statistical techniques, and perform hypothesis testing to identify potential root causes of problems.

**Topics:**

Patterns of Variation

- Multi-Vari Analysis
- Classes of Distributions

Inferential Statistics

- Understanding Inference
- Sampling Techniques & Uses
- Central Limit Theorem

Hypothesis Testing

- General Concepts & Goals of Hypothesis Testing
- Significance; Practical vs. Statistical
- Risk; Alpha & Beta
- Types of Hypothesis Test

Hypothesis Testing with Normal Data

- 1 & 2 sample t-tests
- 1 sample variance
- One Way ANOVA
- Tests of Equal Variance, Normality Testing and Sample Size calculation performing tests and interpreting results

Hypothesis Testing with Non-Normal Data

- Mood's Median
- Mann-Whitney
- Kruskal-Wallis
- Friedman
- 1 Sample Sign
- 1 Sample Wilcoxon
- One and Two Sample Proportion
- Chi-Squared (Contingency Tables)

**Activities:**

- Step-by-step guidance on formulating and testing hypotheses.
- Practical exercises using statistical software to perform hypothesis tests for both normal and non-normal data.

**Assessments:**

- Problem-solving tasks requiring the application of hypothesis testing.
- Interpretation of statistical output from hypothesis tests.

**Module 4: Improve Phase**

**Outcome:** Participants will be able to use regression analysis to model relationships between variables and design experiments to identify optimal process settings.

**Topics:**

Simple Linear Regression

- Correlation
- Regression Equations
- Residuals Analysis

Multiple Regression Analysis

- Non- Linear Regression
- Multiple Linear Regression
- Confidence & Prediction Intervals
- Residuals Analysis

Designed Experiments

- Experiment Objectives
- Experimental Methods
- Experiment Design Considerations

Full Factorial Experiments

- 2k Full Factorial Designs
- Linear & Quadratic Mathematical Models
- Balanced & Orthogonal Designs
- Fit, Diagnose Model and Center Points

Fractional Factorial Experiments

- Designs
- Confounding Effects

- Experimental Resolution

**Activities:**

- Instruction on simple and multiple linear regression techniques and their interpretation.
- Introduction to the principles of Design of Experiments (DOE).

**Assessments:**

- Problem-solving tasks involving regression analysis.
- Design of a basic experiment for a given scenario.

**Module 5: Control Phase**

**Outcome:** Participants will be able to apply Lean principles to sustain improvements and implement Statistical Process Control (SPC) and control plans to monitor and maintain process stability.

**Topics:**

The Lean Enterprise

- Understanding Lean
- The History of Lean
- Lean & Six Sigma
- The Seven Elements of Waste
- 5S

Statistical Process Control (SPC)

- Data Collection for SPC
- I-MR Chart
- Xbar-R Chart
- U Chart
- P Chart
- NP Chart
- X-S chart
- Control Methods
- Control Chart Anatomy
- Subgroups, Impact of Variation, Frequency of Sampling
- Center Line & Control Limit Calculations

Six Sigma Control Plans

- Cost Benefit Analysis
- Elements of the Control Plan
- Elements of the Response Plan

**Activities:**
- Practical exercises in creating and interpreting SPC charts.
- Development of Six Sigma control plans to ensure process stability and prevent regression.

**Assessments:**
- Interpretation of SPC charts and identification of out-of-control conditions.
- Development of a control plan for a specific process improvement.