

**Course Code: BUS250**

**Course Name: Six Sigma Black Belt**

**Certification: Six Sigma Black Belt – ASQ-CSSBB**

**Duration: 6 months**

**Tuition: \$3495**

### **Course Overview**

Six Sigma is a data-driven improvement strategy that views all activities within an organization as processes. Process inputs can be controlled and adjusted to effect significant improvements in process outputs. Six Sigma uses a rigorous and systematic methodology known as DMAIC (define, measure, analyze, improve, and control) and a number of qualitative and quantitative tools. Its goal is to drive process, product, and service improvements for reducing variation and defects. Lean is also an improvement methodology, but with a different focus. It aims to enhance process flow, reduce cycle time, and eliminate waste. Though Lean and Six Sigma originated in different places and under different circumstances, they are now largely seen as complementary methodologies. Organizations across various industries are striving to become faster and more responsive to customers, achieve near-perfect quality, and operate using world-class cost structures. You need both Lean and Six Sigma to achieve these goals. This course introduces Six Sigma and Lean methodologies and looks at the relationship between them. It also explores relationships among business systems and processes using some practical examples of Lean Six Sigma applications in both manufacturing and service industries. This course is aligned with the ASQ Certified Six Sigma Black Belt certification exam and is designed to assist learners as part of their exam preparation. It builds on foundational knowledge that is taught in ASQ-aligned Green Belt curriculum.

### **Course Content**

#### **Module 1 – Six Sigma Black Belt (2015 BOK): Organization-wide Planning and Deployment**

- **Lesson 1 – Fundamentals of Lean and Six Sigma and their Applications**

This lesson covers the following topics:

- sequence key developments in the evolution of continuous improvement methodologies
- recognize the impact of other continuous improvement methodologies on Six Sigma and Lean
- distinguish between the Lean and Six Sigma improvement methodologies
- recognize the best approach for integrating Lean and Six Sigma initiatives, given basic organizational conditions
- match Lean tools with the Six Sigma stages they align to
- classify a business process as a core process or support process and identify what makes it so
- categorize examples of stakeholders

- recognize how Lean Six Sigma was applied to a manufacturing process in a given scenario
- recognize characteristics and quality considerations that are unique to service organizations
- categorize examples of the three key aspects of service quality
- recognize examples of service industry activities that would be good candidates for a Lean Six Sigma initiative

- **Lesson 2 – Six Sigma Project Selection, Roles, and Responsibilities**

This lesson covers the following topics:

- distinguish between "evolutionary" and "revolutionary" improvement methodologies
- identify common reasons for deciding not to implement Six Sigma when analyzing an organization from a high level
- match each stage in a Six Sigma readiness assessment with the types of questions that would be asked
- recognize the sources and characteristics of potential Six Sigma projects
- determine whether an organization has correctly carried out the Six Sigma project selection process
- recognize conditions under which Lean kaizen events would be advantageous for an organization
- choose a Lean kaizen event project based on information gathered in the project selection process
- sequence examples of the steps for selecting a Lean kaizen event
- recognize how alternative improvement methodologies are used
- recognize how the balanced scorecard approach can be used in aligning projects with organizational goals
- recognize project metrics that align with organizational goals as represented by the balanced scorecard
- match characteristics of successful project metrics to examples
- recognize Six Sigma stakeholders from their roles and relationships
- recognize functional characteristics of the Black Belt role
- match Black Belt roles with examples of Black Belt performance
- recognize key qualities and qualifications in a Black Belt candidate

- **Lesson 3 – Six Sigma Strategic Planning and Deployment**

This lesson covers the following topics:

- identify the goals of strategic planning in Lean Six Sigma
- identify how Hoshin Kanri is applied in Six Sigma strategic planning
- sequence the steps using portfolio analysis to prioritize a potential Six Sigma project

- recognize the strategic goal of portfolio architecting
- identify examples of the kinds of questions asked during a SWOT analysis
- recognize the techniques associated with each stage of conducting a feasibility study
- recognize examples of each area of a PEST analysis
- recognize the importance of business continuity and contingency planning in strategic planning
- match Six Sigma leadership levels with examples of their roles
- recognize the performance of key enterprise leadership responsibilities in a given scenario
- distinguish between enterprise leadership roles and Six Sigma team leadership roles
- recognize accurately classified organizational roadblocks in a Six Sigma initiative
- identify examples of tactical error organizational roadblocks
- classify examples of organizational changes brought about by Six Sigma
- identify effective approaches for overcoming resistance in a given scenario
- match types of resistance to examples of people exhibiting them
- identify the strategies that should be used to continue managing a change initiative in a given scenario

## **Module 2 – Six Sigma Black Belt (2015 BOK): Organizational Process Management and Measures**

- **Lesson 1 – Impact on Stakeholders and Benchmarking for Six Sigma**

This lesson covers the following topics:

- recognize the steps in creating an action plan for analyzing Six Sigma stakeholders
- recognize the impact of Six Sigma projects on different categories of stakeholders
- distinguish realities about benchmarking from misconceptions
- recognize the goals and use of key benchmarking approaches
- characterize the source and scope of a benchmarking target
- recognize how benchmarking can benefit a Six Sigma project
- match the phases of the benchmarking process with the steps performed in them
- identify recommendations for ethical conduct in benchmarking

- **Lesson 2 – Using Business and Financial Measures in Six Sigma**

This lesson covers the following topics:

- identify the important attributes of key performance indicators
- recognize steps carried out during the three phases of a Six Sigma effort
- recognize how leading and lagging indicators are connected to organizational goals and strategies
- identify the importance of understanding the financial impact of customer loyalty
- calculate revenue growth, market share, and margin from a given dataset

- distinguish between types of project costs and benefits
- sequence the steps in cost-benefit analysis
- calculate ROI in a given Six Sigma scenario
- use the net present value (NPV) calculation to decide whether to implement a potential Six Sigma project
- match components of the present value formula to descriptions

### **Module 3 – Six Sigma Black Belt (2015 BOK): Team Management**

- **Lesson 1 – Six Sigma Team Dynamics, Roles, and Success Factors**

This lesson covers the following topics:

- determine the best team model for a given scenario
- match team types with statements describing their best applications
- recognize the team types that work best for different constraints
- recognize Belbin roles played by team members in a given scenario
- associate the nine Belbin team roles with their strengths and allowable weaknesses
- recognize good recommendations for team selection
- recognize which critical success factors need improvement in a team scenario
- match critical success factors with descriptions of how they are fulfilled in a team
- associate Six Sigma team members with the training they should receive in preparation for launching a team project
- identify activities that should be an established part of all team meetings
- identify appropriate suggestions for dealing with symptoms of team challenges in a given scenario
- associate examples of team problems with the virtual team challenges they symptomize

- **Lesson 2 – Six Sigma Team Facilitation and Leadership**

This lesson covers the following topics:

- recognize which motivation theory is guiding a team leader's assumptions in a given scenario
- distinguish between modern motivation theories
- recognize how to overcome factors that demotivate project team members
- recognize examples of theory-based motivational techniques that are applied in the organization
- recognize examples of how motivational techniques are applied to empower employees
- match situational leadership styles to examples of when they should be used
- distinguish between the basic leadership approaches
- match team members' feelings at each stage with stage-appropriate facilitation approaches

- recognize examples of good communication practices for team facilitation
- sort communications information into sections of a communications plan
- identify the scope of key types of information in a communication plan
- choose communication tools that will meet team leaders' objectives in a given scenario
- identify the characteristics of A3 reports

- **Lesson 3– Six Sigma Team Dynamics and Training**

This lesson covers the following topics:

- identify how teams leaders should handle groupthink or risky-shift forms of maladaptive behavior
- identify key functions of team leads in managing team behavior
- recognize issues and conditions that are likely to spark conflict
- choose the best conflict-resolution approach and recognize the steps for resolving the conflict, in a given scenario
- suggest techniques for improved management of meetings in a given scenario
- recognize key elements of team meetings
- match decision-making tools to team situations in which they should be used
- identify the Lean Six Sigma Black Belt's training responsibilities
- recognize steps involved in implementing an effective training curriculum
- identify the basic components of a training plan
- identify the essential requirements of Six Sigma training
- distinguish between modes of training
- describe key learning theories
- recognize the characteristics of Six Sigma certification
- recognize techniques to evaluate training
- recognize why it's important to get feedback on training effectiveness

#### **Module 4 – Six Sigma Black Belt (2015 BOK): Define**

- **Lesson 1 – Determining Requirements by Listening to the Voice of the Customer in Six Sigma**

This lesson covers the following topics:

- match the voice of the customer (VOC) strategy tasks to their descriptions
- identify how to perform different aspects of a customer-segmentation analysis in a given scenario
- identify examples of the three main customer-segmentation criteria
- recognize considerations associated with gathering customer data
- determine the most appropriate customer data collection method to use in a given scenario
- recognize key concepts related to the measures for ensuring validity and reliability of data collection outcomes

- identify the definitions of key terminology associated with validity, reliability, and margin of error in data collection
- recognize how various tools are used to identify and analyze customer requirements
- identify the characteristics of CTx requirements
- classify CTx requirements in a given scenario
- categorize elements of a process improvement project within a SIPOC diagram

- **Lesson 2 – Six Sigma Business Case, Project Charter, and Tools**

This lesson covers the following topics:

- recognize steps in developing a business case for Six Sigma project charter
- determine whether a problem statement adequately describes the problem and recommend changes for improvement if needed
- identify the best practices for determining project scope
- assess project goal statements using the SMART criteria
- identify examples of considerations related to the key performance measurement areas in a Six Sigma project
- match the steps in a Six Sigma project performance review to their related activities
- identify key concepts related to Six Sigma project tracking tools
- recognize how to organize a work breakdown structure
- identify the purposes of the work breakdown structure
- assign roles and responsibilities using the RACI model
- select analytical tools for team use in a given scenario

## **Module 5 – Six Sigma Black Belt (2015 BOK): Measure**

- **Lesson 1 – Process Flow Metrics and Analysis Tools for Six Sigma**

This lesson covers the following topics:

- calculate rankings and match input variables to their relative significance
- use the formula for calculating process cycle efficiency (PCE)
- calculate the desired amount of work in process (WIP) and predict the consequent improvement in PCE
- identify the benefits of reducing WIP
- match value flow concepts to definitions
- calculate takt time and determine the best option for streamlining a process to meet customer demand, in a given scenario
- recognize examples of how "hidden factories" negatively impact organizational processes
- identify steps for creating a spaghetti diagram
- recognize best practices for using a gemba walk
- match process analysis tools to descriptions of their use

- sequence activities involved in conducting a value stream analysis
- interpret elements of a value stream map

- **Lesson 2 – Data Types, Sampling, Collection, and Measurement in Six Sigma**

This lesson covers the following topics:

- determine what type of data to collect in a given scenario
- match measurement tool categories to descriptions
- recognize an example of the correct application of the rule of ten
- match measurement scales to associated statistical analysis tools
- match sampling methods with applications suitable to their use
- recognize appropriate applications of subgroup and block sampling
- recognize the use of best practices for ensuring data accuracy and integrity in data collection
- label types of measurement system studies according to whether they test accuracy or precision
- recognize the use of best practices for ensuring data accuracy and integrity in data collection
- sequence the steps in a process for cleaning data
- identify the advantages of automated data collection
- sequence the steps in the data mining process

- **Lesson 3 – Six Sigma Measurement Systems and Metrology**

This lesson covers the following topics:

- classify the source of error in a measurement scenario
- recognize the components and meaning of measurement error
- recognize how an instrument's attributes should be considered when setting calibration intervals
- recognize the appropriate consideration of required elements for developing a traceability document
- use agreement values to interpret measurement data, in a given scenario
- calculate and interpret bias as a percentage of tolerance, in a given scenario
- interpret a linearity plot
- assess the stability status of a measurement system based on an  $\bar{x}$  and R chart
- use the formulas for repeatability and reproducibility to evaluate a measurement system, in a given scenario
- match examples of performance measures to functional areas
- identify considerations related to measurement in a service context

- **Lesson 4 – Using Basic Statistics and Graphical Methods in Six Sigma**

This lesson covers the following topics:

- match measures of central tendency to their characteristic advantages and limitations
- calculate measures of dispersion in a given scenario
- construct a cumulative frequency diagram in a given scenario
- recognize how to set class intervals for frequency distributions
- predict and interpret the histogram shape that would result from a given frequency distribution
- recognize how to use normal probability plots to determine whether data is normally distributed
- identify statements that reflect correct interpretations of a complex box plot
- identify the best interpretation of a given run chart
- recognize how to use a scatter plot to find the optimum target value and tolerance zones for a process parameter
- recognize the significance of the central limit theorem for inferential statistics
- recognize the significance of central limit theorem in the application of hypothesis tests
- match tools for drawing valid statistical conclusions to descriptions of their use

- **Lesson 5 – Probability and Probability Distributions in Six Sigma**

This lesson covers the following topics:

- calculate the probability of compound events in a given scenario
- use the appropriate formula to calculate the number of combinations or permutations in a given scenario
- choose the appropriate discrete distribution for a given study
- identify equivalent approximations and conditions under which they hold true
- choose the most suitable continuous probability distribution to use for a given scenario
- recognize the characteristics and applications of lognormal, exponential, Weibull, and bivariate distributions
- choose the appropriate distribution formula and use it to find probability, for a given scenario
- use the Z-score formula and normalized Z-table to calculate cumulative probability of a value, in a given scenario
- calculate the mean and standard deviation for binomial data
- calculate probability using the hypergeometric distribution formula
- recognize whether or not the hypergeometric distribution should be used and why, in a given scenario
- match Chi-square, Student's t-distribution, and F distribution to descriptions of when they are typically applied

- **Lesson 6 – Determining Process Performance and Capability in Six Sigma**

This lesson covers the following topics:

- recognize how specification limits, process limits, and process spread help determine process capability
- calculate process performance using metrics for yield, defect, and sigma levels
- use appropriate process capability and performance indices to assess a given process
- identify suitable approaches for identifying characteristics, tolerances, and specifications in a process capability study
- match methods of testing normality to their descriptions
- recognize the characteristics of short-term and long-term capability
- recognize how to process non-normal data in a capability study
- match attribute control charts with the circumstances in which they can be used to determine process capability

## **Module 6 – Six Sigma Black Belt (2015 BOK): Analyze**

- **Lesson 1 – Measuring and Modeling Relationships between Variables in Six Sigma**

This lesson covers the following topics:

- calculate and interpret the correlation coefficient  $r$
- recognize the characteristics exhibited by a given scatter diagram
- recognize key considerations related to correlation analysis
- calculate and interpret the equation for the line of least squares in a given scenario
- use the p-value method to validate a hypothesis test for a given regression equation
- interpret graphs used to perform a residual analysis

- **Lesson 2 – Basics of Hypothesis Testing and Tests for Means in Six Sigma**

This lesson covers the following topics:

- use key hypothesis testing concepts to interpret a testing scenario
- recognize the implications of a hypothesis test result for statistical and practical significance
- use the margin of error formula to determine sample size for a given alpha risk level
- match definitions to key attributes of point estimates
- distinguish between statements expressing confidence, tolerance, and prediction intervals
- recognize how confidence intervals are used in statistical analysis
- calculate the confidence interval for the mean and interpret the results in a given scenario

- calculate the tolerance interval in a given scenario
- perform key steps in a one-sample hypothesis test for means, and interpret the result
- test a hypothesis using a two-sample test for means

- **Lesson 3 – Tests for Variances and Proportions, ANOVA, and Goodness-of-fit in Six Sigma**

This lesson covers the following topics:

- perform key steps in a hypothesis test for proportions, and interpret the results
- perform key steps in a one-sample hypothesis test for variance, and interpret the results
- distinguish between characteristics of one-sample tests for variance and two-sample tests for variance
- perform key steps in a one-way ANOVA and interpret the results
- interpret results in a two-way ANOVA
- recognize examples of business problems that warrant a two-way ANOVA
- determine whether a goodness-of-fit test was calculated and interpreted correctly
- identify business problems or organizational questions that are suitable for a goodness-of-fit test
- use a contingency table to test the relationship between two variables
- identify statements that describe the purpose of contingency tables

- **Lesson 4 – Multivariate Tools and Nonparametric Tests in Six Sigma**

This lesson covers the following topics:

- interpret factor scores as part of factor analysis (FA)
- interpret the results of a discriminant analysis
- interpret the results of a multiple analysis of variance (MANOVA)
- identify statements that define nonparametric tests
- recognize situational factors that call for a nonparametric method and choose the appropriate test, in a given scenario
- identify the limitations of nonparametric tests
- select the situation that is best suited for a Kruskal-Wallis test
- validate a hypothesis by performing a Kruskal-Wallis test
- recognize examples of business problems that are suitable for a Mann-Whitney test and identify the assumptions that must hold true
- validate a hypothesis by calculating the Mann-Whitney test statistic and interpreting the result
- recognize how the test statistic is calculated for a Mann-Whitney test

- **Lesson 5 – FMEA and Other Nonstatistical Analysis Methods in Six Sigma**

This lesson covers the following topics:

- interpret a failure modes and effects analysis (FMEA) worksheet to prioritize failures for improvement
- recognize the distinctions and relationships between Process FMEAs and Design FMEAs
- calculate the risk priority number (RPN) for a given cause of failure
- identify the purpose of gap analysis in Six Sigma
- sequence examples of the performance of each step in a gap analysis
- recognize activities performed in the scenario planning process
- identify the characteristics of scenario planning
- match suggested steps in a root cause analysis to associated activities
- identify errors made by a team conducting a 5 Whys analysis, in a given scenario
- interpret a fault tree analysis (FTA)
- classify situations as more suitable for fault tree analysis (FTA) or for failure modes and effects analysis (FMEA)
- recognize the type of waste expressed in a conventional statement and associate it with Lean Six Sigma thinking for eliminating that waste

## **Module 7 – Six Sigma Black Belt (2015 BOK): Improve**

- **Lesson 1 – Understanding DOE and Planning Experiments in Six Sigma**

This lesson covers the following topics:

- identify the purposes of design of experiments (DOE)
- match key design of experiments (DOE) concepts with examples
- recognize a balanced experiment from its design table
- recognize factors that should be blocked and randomized in a given scenario
- distinguish between reasons for using repetition and replication
- calculate the interaction effect between factors in a given scenario and determine its significance
- recognize the role of power in an experiment
- match common experimental resolution levels to descriptions
- classify the goal of an experiment, in a given scenario
- identify recommendations for choosing responses, factors, and levels in an experiment
- identify considerations related to measurement methods in DOE
- choose an experimental design in a given scenario
- recognize the differences between full and fractional factorial designs

- **Lesson 2 – Designing, Conducting, and Analyzing Experiments in Six Sigma**

This lesson covers the following topics:

- determine whether a chosen design is a full factorial design that can meet resolution requirements, in a given scenario
  - recognize the characteristics of an experiment, represented by a given run table
  - calculate the number of runs in a given experiment
  - calculate an estimate of a main effect in a full factorial experiment
  - based on results from a full factorial experiment, recognize which terms should be included in the model
  - recognize circumstances suitable for a fractional factorial design
  - recognize the design implications of a proposed fractional factorial experiment
  - interpret an interaction plot
  - identify conditions that recommend a randomized block design
  - identify the trial pattern that will fully randomize a given block design
  - identify the characteristics of Latin square designs
  - recognize which experimental factors are significant in the results of a Latin square design
- **Lesson 3 – Lean Improvement Methods and Implementation Planning in Six Sigma**  
This lesson covers the following topics:
    - identify best practices and methods associated with Lean tools
    - identify characteristics of cycle-time reduction tools and the steps in SMED
    - recognize the characteristics of heijunka
    - recognize examples of activities typically performed during each day of a kaizen blitz
    - recognize how to apply Theory of Constraints concepts to help analyze process throughput and alleviate bottlenecks
    - calculate overall equipment effectiveness (OEE)
    - determine whether best practices are followed for a pilot test, given a scenario
    - sequence the steps in conducting a simulation
    - select an optimum solution

## **Module 8 – Six Sigma Black Belt (2015 BOK): Control**

- **Lesson 1 – Statistical Process Control (SPC) and Control Charts in Six Sigma**  
This lesson covers the following topics:
  - recognize the objectives of statistical process control (SPC)
  - recognize key concepts related to the use of SPC
  - recognize examples of variables that are good candidates for statistical process control
  - select the best option for rational subgrouping, in a given scenario
  - recognize the description of the rational subgrouping principle
  - identify considerations for determining appropriate subgroup size

- use the appropriate control chart to determine upper and lower limits for a given process
- recognize suitable applications for moving average charts
- calculate moving averages
- identify key concepts related to the use of short-run SPC charts
- determine appropriate corrective actions for the trend exhibited in a given control chart

- **Lesson 2 – Using Lean Control Tools and Maintaining Controls in Six Sigma**

This lesson covers the following topics:

- recognize statements that reflect the goals and features of total productive maintenance (TPM)
- sequence the steps recommended for implementing total productive maintenance (TPM)
- sequence descriptions of the stages of small group development
- recognize the basic goal of a sample element from visual controls
- recognize the advantages of using basic visual controls rather than sophisticated IT tools
- recognize how various factors influence the decision to improve a measurement system in a given scenario
- recognize why it is necessary to perform a measurement system re-analysis after a successful process improvement initiative
- recognize the effect of reduced process variation on measurement system performance metrics
- identify characteristics of a control plan
- match control plan improvement goals with tasks carried out at each stage
- recognize examples of information typically included in a control plan
- identify actions involved in transferring responsibility from the Six Sigma team to the process owner

- **Lesson 3 – Sustaining Six Sigma Improvements**

This lesson covers the following topics:

- identify the overarching benefit of conducting a postmortem analysis in a Six Sigma project
- determine what a Black Belt should have done differently in scheduling and selecting participants for a postmortem analysis, in a given scenario
- recognize the key objectives of conducting and presenting the results of a postmortem
- match examples of planning considerations to the aspect of training they help you to plan
- identify elements that enhance communication in a training session

- recognize examples of recommended presentation practices in a given training scenario
- identify good practices associated with evaluating and following up on training
- identify the characteristics of effective documentation
- rank four types of documentation according to the documentation hierarchy
- distinguish between types of documentation by recognizing examples of information suitable for each
- recognize the best strategy for ongoing evaluation
- recognize how control charts, controls plans, and lagging and leading indicators can be used in monitoring and evaluation

### **Module 9 – Six Sigma Black Belt (2015 BOK): Design for Six Sigma (DFSS)**

- **Lesson 1 – Common DFSS Methodologies, Design for X, and Robust Designs**

This lesson covers the following topics:

- match new-product terms to examples
- determine whether or not DFSS is appropriate for a given situation, and why
- identify tools and approaches that are included in DFSS methodology
- match the steps of the DMADOV methodology with the questions asked and activities performed in them
- identify key requirements of a DFX initiative
- identify the definition of Design for X (DFX)
- match design for manufacturability and producibility strategies to examples of their practical implementation
- recognize how to set and use target cost when designing for cost
- recognize valid circumstances for readjusting a target cost
- match DFX characteristics to associated strategies for design
- identify the goals of robust design
- use tolerance design calculations to determine tolerance specifications in a given scenario
- distinguish between worst-case tolerancing and statistical tolerancing approaches