

**CMBB**

# CERTIFIED MASTER BLACK BELT



Quality excellence to enhance your career  
and boost your organization's bottom line

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The Global Voice of Quality®

Certification from ASQ is considered a mark of quality excellence in many industries. It helps you advance your career and boosts your organization's bottom line through your mastery of quality skills. Becoming certified as a Master Black Belt confirms your commitment to quality and the positive impact it will have on your organization.



## Certified Master Black Belt

The Certified Master Black Belt (CMBB) is aimed at individuals who possess exceptional expertise and knowledge of current industry practice. Master Black Belts have outstanding leadership ability, are innovative, and demonstrate a strong commitment to the practice and advancement of quality and improvement. Obtaining an ASQ Master Black Belt is acceptance and recognition from your peers.



### CMBB

Computer Delivered – The Master Black Belt certification is a two-part examination administered over five-and-a-half hours. The first portion consists of 110-multiple-choice questions. Of these questions, 100 are scored and 10 are unscored. The first portion is three hours long, is offered in English only, and has an open-book format.

The second portion is a performance-based assessment that measures comprehension of the CMBB Body of Knowledge. It includes situation-specific materials that candidates will be directed to evaluate and respond to. This portion is two-and-a-half hours long and is also an open book format.

For comprehensive exam information on the Master Black Belt certification, visit [asq.org/cert](https://asq.org/cert).



## Required Experience

To become certified as an ASQ MBB, a candidate must successfully meet all requirements. To be eligible to apply for the MBB examination, a candidate must hold a current ASQ Certified Six Sigma Black Belt (CSSBB) certificate. In addition, a candidate must have either of the following experience levels.

1. At least five years of experience in the role of a SSBB or MBB.

**OR**

2. Completion of 10 Six Sigma Black Belt projects.

Candidates must be able to meet these minimum eligibility requirements to have their portfolio reviewed.

## Portfolio Review

Once a candidate has met the eligibility requirements, the next step in the process is a portfolio review of the candidate's body of SSBB or MBB work. When the review panel approves a candidate's portfolio, the candidate will be eligible to register for and take the MBB examination. Only after successfully completing all requirements and passing the examination will candidates receive MBB certification.

The Master Black Belt also requires a portfolio application. Visit [asq.org/cert/resource/docs/2017/Master%20BB%202017%20Version.pdf](https://asq.org/cert/resource/docs/2017/Master%20BB%202017%20Version.pdf) to acquire this application.



Your portfolio must include the following topics to be reviewed by a panel of expert MBBs showing evidence of: teaching, coaching, mentoring, occupational experience and responsibility, technical experience, and innovation.

Candidates must meet the *minimum* scoring requirements for each of the three key performance indicators.

- Teaching, coaching, mentoring
- Occupational experience and responsibility
- Technical experience/innovation

The portfolio evaluation process will be conducted by a panel of subject matter experts who are Master Black Belts themselves. This panel will operate independently but under the guidance of ASQ. The panel will have ultimate responsibility for judging the quality and appropriateness of the material and evidence presented in the portfolio.

Candidates who meet the required minimums for each section of the portfolio will receive an approval letter from the review panel stating that they are eligible to take the MBB examination. Candidates who do not achieve the necessary points will receive feedback from the review panel. This feedback will include information about why the application failed resubmission requirements, additional evidence requests, etc.

# BODY OF KNOWLEDGE

## Certified Master Black Belt (CMBB)

**Topics** in this body of knowledge (BoK) include descriptive details (subtext) that will be used by the Exam Development Committee as guidelines for writing test questions. This subtext is also designed to help candidates prepare for the exam by identifying specific content within each topic that may be tested. The subtext is not intended to limit the subject matter or be all-inclusive of what might be covered in an exam but is intended to clarify how the topics relate to a Master Black Belt's role. The descriptor in parentheses at the end of each entry refers to the maximum cognitive level at which the topic will be tested. A complete description of cognitive levels is provided at the end of this document.

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### I. Enterprise-wide Planning (20 Questions)

#### A. Strategic Plan Development

Describe and use strategic planning tools and methods such as Hoshin Kanri, X Matrix, SWOT, PEST, PESTLE, Ansoff Matrix, Porter's Five Forces, TQM, Business Process Reengineering, Balanced Scorecard, and business excellence models (Baldrige, EFQM, ISO, Shingo) and their utilization in developing enterprise planning. (Apply)

#### B. Strategic Plan Alignment

##### 1. Strategic deployment goals

Describe how to develop strategic deployment goals. (Apply)

##### 2. Project alignment with strategic plan

Describe how to align projects to the organizational strategic plan. (Analyze)

##### 3. Project alignment with business objectives

Describe how to align projects with business objectives. (Analyze)

### C. Infrastructure Elements of Improvement Systems

Describe how to apply the following key infrastructure elements. (Apply)

1. **Governance** (quality councils or process leadership teams)
2. **Assessment** (organizational readiness and maturity models)
3. **Resource planning** (identify candidates and costs/benefits)
4. **Resource development** (train and coach)
5. **Execution** (deliver on project results)
6. **Measure and improve the system** (drive improvement into the systems, multiphase planning)

### D. Improvement Methodologies

Demonstrate an advanced understanding of the following methodologies, including their associated tools and techniques. (Apply)

1. **Six Sigma (DMAIC)**
2. **Design for Six Sigma (DMADV)**
3. **Lean (PDCA, Kaizen)**
4. **Theory of constraints**

5. **Business systems and process management**
6. **Other problem-solving methods (8 disciplines, root cause analysis)**

## E. Opportunities for Improvement

### 1. Project identification

Facilitate working sessions to identify new project opportunities that can be prioritized. (Apply)

### 2. Project qualification

Determine the elements of a well-defined project (e.g., business case, charter), the process for approving these projects, and tools used in project definition (process maps, value stream maps, QFD, FMEA, critical-to-x where x can be customer, design, cost, and quality). (Apply)

### 3. Stakeholder management

Describe how to identify, engage, and strategically align stakeholders. (Analyze)

### 4. Intervention techniques

Describe techniques for intervening across levels to prevent potential project failures. (Apply)

## 5. Creativity and innovation tools

Use creativity and innovation tools to develop concept alternatives (divergent thinking). (Apply)

## F. Pipeline Management

### 1. Pipeline creation

Create, manage, and prioritize a pipeline of potential projects for consideration. (Create)

### 2. Pipeline life-cycle management

Create a selection process that provides a portfolio of active improvement opportunities that are clearly aligned and prioritized to meet/exceed strategic goals. Monitor, re-evaluate, consolidate, and retire pipelines as needed. (Create)

### 3. Regulatory impact on pipeline

Assess the impact of regulatory statutes on prioritization/management of pipeline of potential projects. (Understand)

### 4. Pipeline risk management

Use risk management and analysis tools to analyze organizational elements, to appraise portfolios and critical projects, and to identify potential problem areas. (Evaluate)



## II. Organizational Competencies for Deployment (20 questions)

### A. Organizational Design

#### 1. Systems thinking

Apply systems thinking to anticipate the effect that components of a system can have on other subsystems and adjacent systems including emergent properties. Analyze the impact of actions taken in one area of the organization and how those actions can affect other areas or the customer, and use appropriate tools to prevent unintended consequences. (Analyze)

#### 2. Organizational culture and maturity

Describe the implications organizational culture and maturity levels can have on improvement program implementation, including potential barriers. (Analyze)

### B. Executive and Team Leadership Roles

#### 1. Executive leadership roles

Describe the roles and responsibilities of executive leaders in the deployment of improvement programs in terms of providing resources, managing change, and communicating ideas. (Analyze)

#### 2. Leadership for deployment

Create action plans to support optimal functioning of Master Black Belts, Black Belts, Green Belts, champions, and other participants in the deployment effort. Design, coordinate, and participate in deployment activities, and ensure that project leaders and teams have the required knowledge, skills, abilities, and attitudes to support the organization's improvement program. (Create)

### C. Organizational Challenges

#### 1. Organizational dynamics

Use knowledge of human and organizational dynamics to enhance project success and align cultural objectives with organizational objectives. (Apply)

#### 2. Intervention styles

Use appropriate intervention, communications, and influence styles, and adapt those styles to specific situations (i.e., situational leadership). (Apply)

#### 3. Interdepartmental conflicts

Address and resolve potential situations that could cause the program or a project to underperform. (Apply)

### D. Organizational Change Management

#### 1. Change management models

Describe different change management models (Kotter's 8 Steps, ADKAR, Competing Values Framework). (Apply)

#### 2. Techniques to gain commitment

Describe how to gain commitment from the organization's leadership for the improvement effort. (Understand)

#### 3. Techniques to overcome organizational barriers

Describe various techniques to overcome barriers to successful organizational deployment. (Apply)

#### 4. Necessary organizational structure for deployment

Develop the inherent organizational structure needed for successful deployment. (Apply)

#### 5. Communications with management

Describe elements of effective communications with management regarding organizational benefits, failures, and lessons learned. (Apply)

#### 6. Organizational culture change techniques

Assess culture of the organization and its ability to problem-solve and improve. Describe techniques for changing an organizational culture, such as rewards and recognition, team competitiveness, communications of program successes, and appropriate cascading of goals throughout the organization. (Apply)



## E. Organizational Feedback

### 1. Voice of the customer and voice of the process

Assess the appropriate collection of Voice of the Customer and Voice of the Process data, both internal and external. (Evaluate)

### 2. Capturing and assessing feedback

Develop a customer-focused strategy for capturing and assessing customer feedback on a regular basis. (Evaluate)

## F. Organizational Performance Metrics

### 1. Financial measures

Define and use financial measures, including revenue growth, market share, margin, cost of quality (COQ), net present value (NPV), return on investment (ROI), cost-benefit analysis, direct costs, indirect costs and opportunity cost, project cash flow, and breakeven time performance. (Analyze)

### 2. Business performance measures

Describe various business performance measures, including Balanced Scorecard, key performance indicators (KPIs), and the financial impact of customer loyalty, and describe how they are used for project selection, deployment, and management. (Analyze)

## III. Project Portfolio Management (15 questions)

### A. Project Management Principles and Life Cycle

#### 1. Project management principles

Oversee critical projects and evaluate them in terms of their scope, goals, time, cost, quality, human resources requirements, communications needs, and risks. (Evaluate)

#### 2. Project management life-cycle elements

Apply phases of project management life cycle (initiation, planning, execution, control, and closure). (Analyze)

### B. Project Portfolio Infrastructure and Management

#### 1. Governance methods and tools

Develop governance documents, tracking tools, and other methodologies that will support project success. (Create)

#### 2. Cross-functional project assessment

Appraise interrelated projects for scope overlap and refinement, and identify opportunities for leveraging concomitant projects. Identify and participate in the implementation of multidisciplinary redesign and improvement projects. (Evaluate)

#### 3. Executive and midlevel management engagement

Formulate the positioning of multiple projects in terms of providing strategic advice to top management and affected midlevel managers. (Create)

#### 4. Prioritization

Prioritize projects in terms of their criticality to the organization. (Evaluate)

#### 5. Performance measurement

Design, support, and review the development of an overall measurement methodology to record the progress and ongoing status of projects and their overall impact on the organization. (Evaluate)

#### 6. Monitoring

Apply appropriate monitoring and control methodologies to ensure that consistent methods are used in tracking tasks and milestones. (Analyze)

#### 7. Status communication

Develop and maintain communication techniques that will keep critical stakeholders and communities apprised of project status, results, and accountability. (Create)

#### 8. Supply/Demand management

Generate accurate project supply/demand projections, associated resource requirements analysis, and mitigate any issues. (Create)

#### 9. Corrective action

Facilitate corrective actions and responses to customers about the corrective action and its impact. (Analyze)

### C. Project Portfolio Financial Tools

#### 1. Budgets and forecasts

Assess and explain budget implications, forecasting, measurement, monitoring, risk analysis, and prioritization for portfolio level projects. (Evaluate)

#### 2. Costing concepts

Define the concepts of hard and soft dollars and use cost of poor quality, activity-based costing, and other methods to assess and prioritize portfolios. (Apply)

## IV. Training Design and Delivery (10 questions)

### A. Training Needs Analysis

Assess the current level of knowledge and skills in each target group in relation to the skills and abilities that are needed. Determine the training requirements for each target group by using tools such as a gap analysis to compare actual performance with potential or desired performance. (Evaluate)

### B. Training Plan Elements

Design training plans to close the knowledge and skills gaps. Refine the plans based on the number of people needing to be trained in a particular technique or skill, and whether multidisciplinary or multi-level competency training is appropriate. (Create)



## C. Training Materials and Curriculum Development

### 1. Training material sources

Determine whether to outsource the training or develop in-house, including considerations such as cost, availability of internal subject matter experts, and timing. (Analyze)

### 2. Adult learning theory

Develop or select training methods and resources that adhere to adult learning theories. (Analyze)

### 3. Integration

Ensure that the training harmonizes and leverages other tools and approaches being used and that it is aligned with the organization's strategic objectives and culture. (Evaluate)

### 4. Training delivery

Monitor and measure training to ensure that it is delivered effectively and efficiently by qualified individuals. (Apply)

## D. Training Program Effectiveness

Develop an evaluation plan to assess, verify, and improve the acquisition of required knowledge and skills within schedule, budget, and other constraints. (Create)

## V. Coaching and Mentoring Responsibilities (10 questions)

### A. Executives and Champions

#### 1. Scoping and resourcing

Collaborate with executives and champions on scoping projects and selecting individuals and assignments for various projects. (Evaluate)

#### 2. Executive reviews

Collaborate with executives and champions on reviewing projects, including timing, questions to ask, and setting expectations for project timing and completion. (Create)

### 3. Leadership and communication

Coach executives and champions on the need for constancy of purpose and message, and the importance of using clear communication techniques and consistent messages. (Evaluate)

### 4. Feedback

Use constructive techniques to provide feedback to champions and executives. (Evaluate)

### B. Teams and Individuals

#### 1. Belt coaching and mentoring

Develop a career progression ladder for belts. Assess their progress and provide constructive feedback to enable them to work effectively on team projects. Use coaching, mentoring, and intervention skills as needed, including canceling or reassigning projects if necessary. (Create)

#### 2. Project reviews

Create guidelines and expectations for project reviews, and perform them in a timely manner. Assist project leaders in selecting appropriate content for presentation to management. (Create)

#### 3. Team facilitation and meeting management

Practice and teach meeting control, analyze team performance at various stages of team development, and support appropriate interventions for overcoming team challenges, including floundering, reviewing, and diagnosing failing projects. (Create)

#### 4. Non-belt coaching and mentoring

Develop information that will help non-belt project participants to advance their understanding of improvement initiatives and develop the necessary skills and knowledge to become effective belts. (Evaluate)

## VI. Advanced Data Management and Analytic Methods (25 questions)

### A. Measurement Systems Analysis (MSA), Process Capability, and Control

#### 1. Propagation of errors

Use propagation of errors to evaluate measurement systems based on calculated values from multiple inputs. (Evaluate)

#### 2. Attribute (discrete) measurement systems

Use appropriate tools and methods (e.g., percent agreement, Kappa, Kendall, intra-class correlation coefficient) to analyze and interpret discrete measurement systems. (Evaluate)

#### 3. Variables (continuous) measurement systems

Use appropriate tools and methods (e.g.,  $\bar{X}-R$ ,  $\bar{X}-s$ , individual and moving range) based on control samples to analyze and interpret continuous measurement systems. (Evaluate)

#### 4. Destructive measurement systems

Use appropriate tools and methods to assess a destructive measurement system. (Analyze)

#### 5. Process capability for non-normal data

Calculate capability using Weibull and other methods for non-normal data. (Apply)

#### 6. Automated process control (APC) and statistical process control (SPC)

Recognize when to use APC instead of or in conjunction with SPC. (Understand)

### B. Measuring and Modeling Relationships Between Variables

#### 1. Autocorrelation and forecasting

Identify autocorrelated data, including time-series modeling (e.g., ARIMA) and forecasting. (Analyze)

#### 2. Multiple regression analysis

Apply and interpret multiple regression analysis, including using variance inflation factors (VIFs) to identify collinearity issues. (Analyze)

#### 3. Logistic regression analysis

Apply and interpret logistic regression analysis, including binary, ordinal, and nominal data considerations. (Analyze)

#### 4. Model fitting for nonlinear models

Apply and interpret fits of models that are nonlinear in the parameters. (Apply)

#### 5. General linear models (GLM)

Apply and interpret GLMs such as ANOVA results (crossed, nested, and mixed models), simple linear regression, multiple regression, ANCOVA (analysis of covariance) and continuous MSA. (Apply)

#### 6. Components of variation

Select, calculate, and interpret components of variation and nested design studies. (Evaluate)

#### 7. Simulation

Apply simulation tools such as Monte Carlo, dynamic process simulation, and queuing theory. (Apply)

#### 8. Linear programming

Understand how linear programming principles, such as critical path analysis, can be used in modeling diverse types of problems (e.g., planning, routing, scheduling, assignment, design) to optimize system performance. (Understand)

#### 9. Reliability modeling

Use reliability modeling and tools to enhance reliability of a product or process. (Apply)

#### 10. Qualitative analysis

Use appropriate qualitative analysis tools (affinity diagrams, force field analysis) and analyze the results. (Analyze)



## C. Design of Experiments (DOE)

### 1. Factor relationship diagram

Apply and interpret factor relationship diagrams. (Apply)

### 2. Complex blocking structures

Recognize other designs for handling more complex blocking structures, including Latin squares and balanced incomplete block designs (BIBD). (Understand)

### 3. DOE approaches

Recognize when to apply approaches such as screening designs (including Definitive Screening Designs), response surface methodology (RSM), mixture experiments, evolutionary operations (EVOP), split-plot designs, Taguchi designs, and computer-generated designs (e.g. D-optimal designs). (Understand)

## D. Data Management and Analytics

### 1. Enterprise data management

Recognize and understand data management elements

such as data governance, data architecture, data life-cycle management, data quality (accuracy, timeliness, consistency, completeness, uniqueness, validity, conformity, precision), meta data, master data, data privacy, and data security. (Understand)

### 2. Data analytics

Recognize when to apply predictive analytic approaches such as decision trees (including random forest, boosted forest), neural networks, partial least squares, text analytics, image recognition, and pattern recognition (structured and unstructured data). (Understand)

## E. DFSS (Design for Six Sigma)

DFSS tools: Recognize and understand tools such as QFD, TRIZ, morphology box, and axiomatic design to generate design concepts. (Understand)

## Topics for Performance-based Section of Certified Master Black Belt

For this part of the examination, candidates will be presented with a situation in which an organization is considering various improvement projects to implement. Typically, background information about the parent company will be provided as well as documents containing key details of the projects. Open-ended questions will be asked about this organization and the projects.

**For example, candidates might be expected to:** evaluate projects in terms of organization-wide goals, create presentations with content that is appropriate for a specific audience, communicate with staff at various levels in the organization, analyze output from projects at various stages, and determine whether to continue supporting projects or close them out.

This portion of the test will be developed and scored using the descriptions and cognitive levels outlined in the performance-based (PB) entries of the BoK, as described here.

### **PB-1. Enterprise-wide Planning**

Apply project selection criteria to select and prioritize potential improvement projects using strategic planning tools, immediate- and long-term business goals, executive-level directives, and risk analysis results. Develop and deliver formal presentations that support the project selection process, identify progress, and explain its status at conclusion.

### **PB-2. Organizational Competencies for Deployment**

Use feedback and process data from various sources to identify or develop improvement projects that will respond to customer needs, eliminate process barriers, or streamline processes, especially for managing projects that cross boundaries either within or between organizations. Use appropriate communication methods that are sensitive to specific audiences when explaining projects or solutions, encouraging participation, or resolving issues that arise between interorganizational groups.

### **PB-3. Project Portfolio Management**

Develop and manage the scope, schedule, cost, and risk of improvement projects using various project management tools to ensure proper monitoring, milestone achievement, and project success. Recognize when intervention steps must be taken to bring a project back on track or terminate it based on analysis of internal or external events.

### **PB-4. Training, Coaching, and Mentoring**

Identify situations that require training or mentoring for all levels of participants in improvement projects, from executive-level champions to non-belt participants. Develop, review, and deliver information, training, or mentoring as needed for a variety of improvement projects, based on needs analysis, participant requests, or recognition of situations that require intervention.

# LEVELS OF COGNITION

*Based on Bloom's Taxonomy—Revised (2001)*

In addition to **content** specifics, the subtext for each topic in this BoK also indicates the intended **complexity level** of the test questions for that topic. These levels are based on “Levels of Cognition” (from Bloom’s Taxonomy—Revised, 2001) and are presented below in rank order, from least complex to most complex.

**REMEMBER** | Recall or recognize terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, etc.

**UNDERSTAND** | Read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.

**APPLY** | Know when and how to use ideas, procedures, methods, formulas, principles, theories, etc.

**ANALYZE** | Break down information into its constituent parts and recognize their relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario.

**EVALUATE** | Make judgments about the value of proposed ideas, solutions, etc., by comparing the proposal to specific criteria or standards.

**CREATE** | Put parts or elements together in such a way as to reveal a pattern or structure not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn.

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