

Competency	Performance Criteria	Evidence Guide
<p>1: Define Lean - Six Sigma</p>	<p>1.1: Explain why Lean - Six Sigma is important for business:</p> <ul style="list-style-type: none"> • Philosophy of six sigma • Overview of DMAIC (Define, Measure, Analyze, Improve, Control) • Philosophy of Lean • How Lean and Six Sigma work together 	<p>Describe the impact that Lean - Six Sigma has on a business's operations, citing the philosophies:</p> <ul style="list-style-type: none"> • Enablers of change • Measures of quality • Methodologies for improvement <p>Describe the theories of customer focus, data driven, reduction of variation and statistical methodologies.</p> <p>Identify waste in terms of:</p> <ul style="list-style-type: none"> • excess inventory • space • test inspection • rework • transportation • storage • reducing cycle time to improve throughput • skills <p>Describe project selection process and when to apply DMAIC as opposed to other problem solving tools.</p> <p>Confirm that projects support organizational goals.</p> <p>Describe how projects and kaizen events are selected, when to use Six Sigma instead of other problem-solving approaches, and the importance of aligning their objectives with organizational goals.</p> <p>Describe the roles and responsibilities of Six Sigma participants: black belt, master black belt, green belt, yellow belt, champion, process owners and project sponsors.</p>
	<p>1.2: Identify Organizational drivers and metrics:</p> <ul style="list-style-type: none"> • List key drivers for business • Explain the development of metric scorecards 	<p>Be able to describe how process inputs, outputs and feedback impact the larger organizations.</p>

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1: Define Lean - Six Sigma (cont'd)	1.3: Utilize organizational goals: <ul style="list-style-type: none"> • Project selection 	Identify Key Performance Indicators (KPIs) important to an organization. Examples include: <ul style="list-style-type: none"> • Profit • Market share • Customer satisfaction • Efficiency Understand how to create scorecards and metrics to support organizational goals.
	1.4: Describe DFSS	Describe DMADV (define, measure, analyze, design, verify) and IDOV (identify, design, optimize, verify). Describe how DMADV and IDOV relate to DMAIC, including how they help close the loop on improving the end product/process during the design phase.
2: Apply Change Management Principles	2.1: Describe the steps undertaken in a change management model.	Describe and identify selected organizational change management principles. These can include, for example: <ul style="list-style-type: none"> • Kotters 8 steps • Stefan Kolvitz principles
	2.2: Prepare a change management plan.	Document a change management plan that covers methods including: <ul style="list-style-type: none"> • Stakeholder analysis • Communications plan • Force field analysis

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2: Apply Change Management Principles (cont'd)	2.3: Define team stages and dynamics: <ul style="list-style-type: none"> • Team evolution • Identify and resolve negative dynamics 	Define and describe the stages of team evolution including: <ul style="list-style-type: none"> • Forming • Storming • Norming • Performing • Adjourning • Recognition. Identify tools which will help resolve negative dynamics such as overbearing, dominant, or reluctant participants, the unquestioned acceptance of opinions as facts, groupthink, feuding, floundering, the rush to accomplishment, attribution, discounts, plops, digressions, and tangents.
	2.4: Define team roles and responsibilities.	Describe and define the roles and responsibilities of participants on six sigma and other teams including: <ul style="list-style-type: none"> • Master black belt • Black belt • Green belt • Yellow belt • Champion • Executive • Coach • Facilitator • Team member • Sponsor • Process owner Understand the relationship between these roles. How they fit in the organization and between each other.
	2.5: Define and apply team tools.	Define and apply team tools such as brainstorming, nominal group technique, and multi-voting.
	2.6: Understand effective communication.	Identify and utilize effective and appropriate communication techniques for different situations to overcome barriers to project success.



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2: Apply Change Management Principles (cont'd)	2.7: Describe and Apply Meeting Design.	Identify and utilize effective and appropriate meeting effectiveness techniques for different situations to overcome barriers to project success.
3: Apply DMAIC for Projects - Define	3.1: Outline process elements: <ul style="list-style-type: none"> • Components • Boundaries 	Define and describe process components and boundaries. Describe how processes cross various functional areas. Identify the challenges that may result from process improvement efforts.
	3.2: Identify owners and stakeholders: <ul style="list-style-type: none"> • Process owners • Stakeholders • Internal customers • External customers • Suppliers 	Identify process owners, internal and external customers, and other stakeholders in a project.
	3.3: Collect customer data using various methods: <ul style="list-style-type: none"> • Surveys • Focus groups • Interviews • Observations • Question construction 	Define methods to collect customer data, including: <ul style="list-style-type: none"> • Surveys • focus groups • interviews • observation Identify key elements that make the above methods effective. Describe methods to ensure data-collecting questions are valid and free from issues such as bias and vagueness.
	3.4: Analyze customer data using various methods: <ul style="list-style-type: none"> • Graphical • Statistical • Qualitative and quantitative tools 	Use graphical, statistical, and qualitative tools to analyze customer feedback. Assist in translating customer feedback into project goals and objectives, including critical to quality (CTQ) attributes and requirements statements. Use voice of the customer (VOC) and voice of the business (VOB) analysis tools such as quality function deployment (QFD) to translate customer requirements into performance measures.

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3: Apply DMAIC for Projects – Define (cont'd)	3.5: Outline the project charter and project statement: <ul style="list-style-type: none"> • Project elements • Problem statement 	Define and describe elements of a project charter and develop a problem statement, including baseline and improvement goals.
	3.6: Develop the project scope.	Describe project definition/scope theories including: <ul style="list-style-type: none"> • Objectives • Boundaries • In-scope • Out-of-scope
	3.7: Develop the project metrics.	Establish key project metrics that relate to the voice of the customer.
	3.8: Apply project planning tools.	Demonstrate correct usage of at least one of the following project tools: <ul style="list-style-type: none"> • Gantt charts • Critical path method (CPM) • Program evaluation and review technique (PERT) charts
	3.9: Define and utilize project risk analysis.	Describe the purpose and benefit and impacts of project risk analysis including: <ul style="list-style-type: none"> • Resources • Financials • Impact on customers and other stakeholders
	3.10 Use software to effectively analyze data and manage a project.	Describe how software is used for statistical analysis and process mapping.
	3.11: Define Tollgate review.	Present findings of the define stages in a concise manner.
4: Apply DMAIC for Projects - Measure	4.1: Identify process input and output variables.	Identify process input variables and process output variables (SIPOC), and document their relationships through cause and effect diagrams and relational matrices.
	4.2: Develop process modeling: <ul style="list-style-type: none"> • Maps • Procedures • Flow charts • Value stream mapping 	Develop and review process modeling tools such as process maps, flowcharts and value stream maps against processes.

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<p>4: Apply DMAIC for Projects – Measure (cont'd)</p>	<p>4.3: Describe basic statistical data:</p> <ul style="list-style-type: none"> • Descriptive vs inferential data concepts • Population vs sample statistics • Normality testing • Central Limit Theorem • Independence • Mutually exclusive • Multiplication rules 	<p>Distinguish between enumerative (descriptive) and analytical (inferential) studies, and distinguish between a population parameter and a sample data statistic.</p> <p>Identify types of test data for normality testing.</p> <p>Define the central limit theorem and describe its significance in the application of statistics.</p> <p>Describe and apply concepts such as independence, mutually exclusive, and multiplication rules.</p>
	<p>4.4: Use failure mode and effects analysis.</p>	<p>Define and describe failure mode and effects analysis (FMEA).</p> <p>Describe the purpose and use of scale criteria and calculate the risk priority number (RPN).</p>
	<p>4.5: Calculate process performance.</p>	<p>Calculate process performance metrics:</p> <ul style="list-style-type: none"> • defects per unit (DPU), • rolled throughput yield (RTY), • cost of poor quality (COPQ), • defects per million opportunities (DPMO) • sigma levels • process capability indices. <p>Describe the process used to track process performance measures to drive project decisions.</p> <p>Define various CTx (Critical To X) requirements:</p> <ul style="list-style-type: none"> • quality (CTQ), • cost (CTC), • process (CTP), • safety (CTS), • delivery (CTD) <p>Describe the importance of aligning projects with CTx requirements.</p>

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<p>4: Apply DMAIC for Projects – Measure (cont'd)</p>	<p>4.6: Collect and summarize data using:</p> <ul style="list-style-type: none"> • Data types and measurement scales • Data collection methods • Data assurance, accuracy and integrity techniques • Descriptive statistics • Graphical methods • Probability distributions 	<p>Identify and classify continuous (variables) and discrete (attributes) data.</p> <p>Define nominal, ordinal, interval, and ratio measurement scales.</p> <p>Apply methods for collecting data including check sheets and coded data.</p> <p>Apply techniques such as random sampling, stratified sampling, and sample homogeneity.</p> <p>Compute and interpret measures of dispersion and central tendency.</p> <p>Construct and interpret frequency distributions and cumulative frequency distributions.</p> <p>Depict relationships by constructing, applying and interpreting diagrams and charts such as:</p> <ul style="list-style-type: none"> • stem-and-leaf plots • box-and-whisker plots • run charts • scatter diagrams • Pareto charts. <p>Depict distributions by constructing, applying and interpreting diagrams including histograms and normal probability plots.</p> <p>Describe and interpret normal, binomial, and Poisson, chi square, Student's t, and F distributions.</p> <p>Use data analysis software to obtain the results of the above statistics.</p>
	<p>4.7: Implement a measurement systems analysis tool.</p>	<p>Conduct measurement system analysis for continuous and attribute data.</p>

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4: Apply DMAIC for Projects – Measure (cont'd)	4.8: Identify, describe and apply process capability and performance techniques: <ul style="list-style-type: none"> • Process capability studies • Process performance vs. specification • Process performance indices • Short-term vs. long-term capability • Process capability for attributes data 	Identify and describe the elements of designing and conducting process capability studies, including identifying characteristics, identifying specifications and tolerances, developing sampling plans, and verifying stability and normality. Distinguish between natural process limits and specification limits, and calculate process performance metrics such as percent defective. Define, select, and calculate C_p and C_{pk} , and assess process capability. Define, select, and calculate P_p , P_{pk} , C_{pm} , and assess process performance. Describe the assumptions and conventions that are appropriate when only short-term data are collected and when only attributes data are available. Describe the changes in relationships that occur when long-term data are used, and interpret the relationship between long- and short-term capability as it relates to a sigma shift. Compute the sigma level for a process and describe its relationship to C_{pk} .
	4.9: Measure Tollgate review	Present findings of the measure stages in a concise manner.
5: Apply DMAIC for Projects - Analyze	5.1: Identify potential causes	Apply tools such as root cause analysis, cause and effect, 5Whys, C and E matrix, value techniques, and Pareto to identify potential causes.

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5: Apply DMAIC for Projects – Analyze (cont'd)	5.2: Use exploratory analysis to study statistical significance.	<p>Analyze the correlation coefficient and determine its statistical significance (p-value).</p> <p>Explain the difference between correlation and causation. Interpret the linear regression equation and determine its statistical significance (p-value), histograms and box and whisker diagrams.</p> <p>Use regression models for estimation and prediction.</p>
	5.3: Undertake hypothesis testing.	<p>Explain and use the following tools:</p> <ul style="list-style-type: none"> • Basics • Tests for means, variances, and proportions • Paired-comparison tests • Single-factor analysis of variance (ANOVA) • Chi square <p>Use the above tools to define and distinguish between statistical and practical significance and apply tests for significance level, power, type I and type II errors.</p> <p>Determine appropriate sample size for various tests.</p>
	5.4: Analyze Tollgate review	Present findings of the analyze stages in a concise manner.
6: Apply DMAIC for Projects - Improve	6.1: Generate potential solutions that address root causes.	Define and use tools such as brainstorming, creative thinking techniques, matrix diagrams and benefits analysis to generate solutions to root causes.
	6.2: Pilot root cause solutions.	Apply measure tools to pilot and analyze against hypothesis.
	6.3: Apply Lean - Six Sigma tools.	Explain and apply tools such as 5S, change over reduction, layout design, line balancing, total productive maintenance against a solution of root cause.
	6.4: Define Tollgate review	Present findings of the Improve stages in a concise manner.

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7: Apply DMAIC for Projects - Control	7.1: Define and utilize Statistical Process Control (SPC): <ul style="list-style-type: none"> • Objectives and benefits • Rational grouping • Control charts • Analysis of control charts 	Describe the objectives and benefits of SPC, including controlling process performance, identifying special and common causes. Describe how rational sub-grouping is used. Interpret control charts and distinguish between common and special causes using rules for determining statistical control.
	7.2: Develop a control plan and monitoring systems.	Describe how to develop a control plan to document and hold the gains, and how to implement controls and monitoring systems such as poka yoke, mistake-proofing, and visual controls such as SOP's and training needs analysis.
	7.3: Apply project closure techniques.	Describe the objectives achieved and apply the lessons learned to identify additional opportunities. Present findings in a clear, concise manner.
	7.4: Understand Financial Review/Validation.	Describe the process of Savings/Improvement validation by an independent entity (Financial Analyst).
	7.5: Understand Project handover.	Outline the PO meeting with control plan acceptance. Document a checklist of tasks, with sign off: <ul style="list-style-type: none"> • Training • Documentation • SOP review • Map update • Reissue of charter