



Topic Area	Topic	Mastery Requirement*	Mastery Assessment
General	Lean Six Sigma Defined	UN	Describe Nature and purpose of Lean Six Sigma
	Integration of Lean and Six Sigma	UN	Compare and contrast focus and approaches (Process Velocity and Quality)
	Y=f(X) Input Determines Output	EV	Express business processes as a transfer function
	The Business Case for Lean Six Sigma	AP	Describe value proposition of Lean Six Sigma as a methodology
	Origins of Lean and Six Sigma	UN	Understand historical perspective and evolution
	DMAIC – The Lean Six Sigma Improvement Process	AP	Apply DMAIC methodology at varying levels of complexity based on project requirements and mix of “Lean” vs. “Variation Reduction” activities
	Thought Process Mapping	AN	Employ Question → Action → Answer approach to guide critical thinking
Project Management	Organizing for Success	UN	Understand critical organizational success factors
	Working Relationships & Responsibilities	UN	Understand typical work role definitions and structure
	Balanced Scored Analysis	AP	Develop high level metrics to present comprehensive representation of performance across critical dimensions
	Project Selection	AP	Select projects based on systematic analysis of key organizational performance metrics, comparing actual to imperative to identify gaps
	Project Charter	CR	Create projects charter with compelling business case, clear objectives, and appropriate scope of action
	Project Tracking	EV	Systematically plan and execute project work activities
	Leading Project Teams	AP	Provide positive leadership energy to accomplish project goals through people: communicate, convince, coordinate, and compel
	Leading Change	AP	Apply change management techniques to accomplish project objectives
	Stakeholder Analysis – RACI Matrix	AP	Recognize stakeholders, their needs, possible conflicts or resistance, and plan and communicate accordingly



Topic Area	Topic	Mastery Requirement*	Mastery Assessment
Define Phase of DMAIC	Process Thinking and The Value Stream	UN	Define high level value streams
	Process Mapping – Overview	AN	Understand alternate forms of process mapping and apply criteria to select the appropriate type of map for the situation
	SIPOC Maps	AP	Construct SIPOC map incorporating relevant elements
	Process Flow Charts and Swim Lanes	AP	Construct Flow Chart using standard symbols and with activities identified by department or function
	Value-Added Flow Charts (7/8 Wastes)	AP	Construct Flow Chart which identifies non-value-added activities
	Spaghetti Charts	AP	Construct chart to map the physical flow of materials or virtual flow of information
	Value Stream Mapping (Current State, Takt Time)	AP	Construct Value Stream Map of current/future process state, showing order flows, processing time by step, inventories, delays, set-up times, tact time, and overall cycle time (lead time), waste and bottlenecks
	Voice of The Customer	UN	Express importance of customer-driven activities
	Understanding Customer Requirements (Kano Model)	AP	Apply Kano Analysis to identify opportunities to “delight” customers
	Sources of Customer Data	UN	Recognize sources for VOC data
	Conducting Surveys	UN	Recognize situations calling for a survey to collect customer data
	Surveys – Sampling Frame	AP	Incorporate sample frame considerations to achieve representative sample
	Structuring Survey Questions	AP	Structure survey questions to achieve desired results and avoid bias
	The Degree of Uncertainty in Sampling	AP	Factor uncertainty into survey analysis
	Guideline for Margin of Error	AP	Incorporate margin of error into analysis of survey results
	Affinity Diagram Toolset	AP	Use affinity Diagram to sort and group customer data
	CTQC Tree Diagram	AP	Develop Tree Diagram to refine general customer requirements into Critical To Quality Requirements
	Operational Definitions	CR	Craft operational definitions to express customer requirements in clear and objective terms
	Voice Of The Customer as Specifications	AN	Translate customer requirements into internal process/product specifications
	Quality Function Deployment (QFD)	EV	Employ Quality Function Deployment to develop the internal process parameters necessary to meet customer requirements
Define Phase Tollgate Review	EV	Review critical questions for the Define Phase to ensure that answers have been developed	



Topic Area	Topic	Mastery Requirement*	Mastery Assessment
Measure Phase of DMAIC	Measurements and Basic Statistics	UN	Describe the role of measurements and basic statistics in the Measure phase of a DMAIC project
	Business Problem Solving Using Statistics	AN	Express practical problems as a statistical question, and translate statistical answers into practical answers
	Basic Statistical Terms	AP	Describe basic statistical terms in structuring actions to answer critical questions
	Descriptive and Inferential Statistics	AP	Differentiate between Descriptive and Inferential Statistics
	Discrete vs. Continuous Measurements	AP	Identify the most useful type of data to collect to meet project requirements
	Measurement Subjects	AP	Distinguish between type of measures subjects
	Graphical Summaries	AN	Interpret the information conveyed by graphical representations of data
	Statistical Software (Minitab, EngineRoom, JMP, or other)	AP	Demonstrate use of statistical software to analyze data
	Pareto Chart	AN	Use Pareto Charts to rank by frequency and interpret the output
	Measuring Central Tendency	AN	Calculate and interpret appropriate measures of central tendency in analyzing process performance(mean, median, mode)
	Quantifying Process Variability	AN	Calculate and interpret appropriate measures of variation in analyzing process performance(variance, standard deviation, range)
	The Normal Distribution	AN	Apply normal distribution concepts to assessments of capability and employ Z-scores to model probability
	Cause & Effect Matrix Toolset	EV	Systematically identify process inputs which potential to significantly effect output of interest
	Measurement System Analysis (MSA)	UN	Appreciate the important role of measurement system analysis
	Measurement as a Process	AP	Apply the study of measurement system capability as a process
	Requirements of Measurement Systems	AP	Execute measurement analysis to address the requirements of a reliable system
	Gauge R&R (variable data)	EV	Evaluate systems used to collect variable data
	MSA – graphing	EV	Apply graphical analysis to enhance MSA evaluation
	Attribute Measurement System Analysis	EV	Evaluate systems used to collect variable data
	Calibration of Measurement Systems	AP	Apply calibration guidelines to ensure measurement system reliability over time
	Collecting Data	EV	Develop a data collection plan
	Developing a Sampling Plan	AP	Incorporate effective sampling guidelines
	Establishing Baseline Performance	EV	Select and apply the appropriate measurement and interpret results
	Throughput Yield and Rolled Throughput Yield	EV	Calculate and interpret results
	The Process Sigma Level	EV	Calculate and interpret results
	Charting Process Behavior (SPC) Background	UN	Describe origin and purpose of Control Charts
	Trend Charts (Run Charts)	EV	Create and interpret this type of chart
	SPC Concepts & Control Limits	AP	Employ Control Limits to evaluate process stability
	Types of SPC Charts	AP	Recognize which chart should be applied in a given situation
	Rational Subgrouping	EV	Develop a rational sampling plan to represent the entire process output
	X and Moving Range Charts	EV	Create and interpret this type of chart
	Attribute Control Charts	EV	Create and interpret this type of chart
	X bar and R Charts, X bar and S	EV	Create and interpret this type of chart
Process Capability (Cp,Cpk,Pp,Ppk)	EV	Assess process capability, factoring in prerequisites of process stability and normality	
Normality Assessment, Transformation of Non-Normal Data	EV	Recognize impact of non-normality and take actions as required to transform data	



THE OHIO STATE UNIVERSITY

FISHER COLLEGE OF BUSINESS

Rapid Improvements – Leading Kalzen Events EV

Future State VSM – Line Balancing EV

MEASURE – Tollgate Review EV

Lean Six Sigma Black Belt Body of Knowledge

Organize and execute rapid improvement events (Kaizen Blitz)

Create future state Value Stream Maps, incorporating balancing of resources

Review Critical questions for the Measure Phase to ensure that answers have been developed

Topic Area	Topic	Mastery Requirement*	Mastery Assessment
------------	-------	----------------------	--------------------

Analyze Phase of DMAIC

	Finding The Root Cause – Basic Concepts	AP	Recognize and apply alternate methods of root cause identification and validation
	Cause & Effect Diagram	EV	Draw upon process experience to systematically identify potential root causes
	5-Why, 1-How	EV	Use sequential questions to uncover casual relationships
	Box Plots	EV	Investigate the effect of discrete inputs on continuous outputs
	Scatter Plots	EV	Evaluate correlation between variables graphically
	Correlation and Regression Analysis	EV	Evaluate correlation between variables statistically
	Multiple Regression	EV	Identify relationships between multiple inputs and a continuous output and build a mathematical model of the relationship
	Logistic Regression	EV	Identify relationships between multiple inputs and a discrete binary output and build a mathematical model of the relationship
	Estimating Population Proportion	AP	Determine required sample size to estimate population proportion
	Estimating Population Mean	AP	Determine required sample size to estimate population mean
	Hypothesis Testing: Purpose, Concepts and Language	AP	Recognize situations where a formal test of hypothesis is warranted
	Formatting the Hypothesis to be Tested	EV	Properly format null and alternate hypotheses
	Types of Error – Alpha and Beta	AN	Understanding types of error and incorporate into testing plan
	Power Analysis	AN	Design test to meet Power requirements
	Confidence Intervals	AN	Apply confidence intervals to interpret the results of a test
	Treatment Comparisons using Control Charts	EV	Recognize the role of control charts in evaluating process changes
	Comparing One Proportion to a Standard	EV	Select the correct test, structure null and alternate hypotheses, satisfy underlying assumptions, analyze for statistically significant difference, and interpret results
	Comparing Two Proportions – Z-test	EV	Select the correct test, structure null and alternate hypotheses, satisfy underlying assumptions, analyze for statistically significant difference, and interpret results
	Comparing Multiple Proportions – Chi-Square	EV	Select the correct test, structure null and alternate hypotheses, satisfy underlying assumptions, analyze for statistically significant difference, and interpret results
	Comparing One Mean to a Standard – t-test	EV	Select the correct test, structure null and alternate hypotheses, satisfy underlying assumptions, analyze for statistically significant difference, and interpret results
	Comparing Two Means – t-test	EV	Select the correct test, structure null and alternate hypotheses, satisfy underlying assumptions, analyze for statistically significant difference, and interpret results
	Comparing Multiple Means – ANOVA/F-test	EV	Select the correct test, structure null and alternate hypotheses, satisfy underlying assumptions, analyze for statistically significant difference, and interpret results
	Confidence Intervals – Least Significant Difference	EV	Employ confidence intervals to evaluate observed differences
	Comparing One Variance to a Std. – Chi-Square	EV	Select the correct test, structure null and alternate hypotheses, satisfy underlying assumptions, analyze for statistically significant difference, and interpret results
	Comparing Two Variances – F-test	EV	Select the correct test, structure null and alternate hypotheses, satisfy underlying assumptions, analyze for statistically significant difference, and interpret results
	Parametric vs. Non Parametric Tests	AN	Recognize the difference between types of hypothesis test and apply the correct test to fit the situations



Topic Area	Topic	Mastery Requirement*	Mastery Assessment	
Analyze Phase - Continued	Non Parametric Tests: Sign, Wilcoxon Signed-Ranks, Mann-Whitney-Wilcoxon, Kruskal-Wallis, Friedman	EV	Select the correct test, structure null and alternate hypotheses, satisfy underlying assumptions, analyze for statistically significant difference, and interpret results	
	Design of Experiments (DOE): Purpose, Principles	UN	Describe purpose and principles of DOE	
	DOE: Process, Components, Guidelines	AN	Recognize the correct circumstances to employ DOE and follow the experimental process in doing so	
	Selecting the Right Experimental Design	EV	Select a design to balance experimental objectives	
	DOE: Blocking	EV	Determine proper use of blocking	
	DOE: Power Analysis	EV	Use of replicates to achieve required level of Power	
	DOE: Two Level Full Factorial Designs	EV	Identify main effects and interactions, construct model, analyze model diagnostics and evaluate model quality, interpret results and relate to subject process in practical terms	
	DOE: Two Level Fractional Factorial Designs	EV	Identify main effects and interactions, construct model, analyze model diagnostics and evaluate model quality, interpret results and relate to subject process in practical terms	
	DOE: General Factorial Designs	EV	Identify main effects and interactions, construct model, analyze model diagnostics and evaluate model quality, interpret results and relate to subject process in practical terms	
	ANALYZE – Tollgate Review	EV	Review critical questions for the Analyze Phase to ensure that answers have been developed	
	Improve Phase of DMAIC	Design for Six Sigma (DFSS) Overview	UN	Recognize the complementary role of Design for Six Sigma
		Benchmarking	AN	Conduct benchmarking studies for comparative purposes
		Brainstorming	AP	Facilitate effective brainstorming
Multi-voting		AP	Employ multi-voting to prioritize actions	
FMEA		EV	Prioritize, evaluate and resolve potential risks	
Error-proofing		EV	Implement process changes to prevent the root cause of errors	
Prioritizing and Selecting a Solution		EV	Systematically select improvement solution sets	
The A3 One-Page Report		AN	Employ the A-3 approach when necessary to organize and communicate project activities	
Continuous Flow & Little’s Law		AN	Analyze and resolve constraints to move process toward continuous flow	
Quick Changeover Toolset Viewed		EV	Improve process flow by reducing changeover or set-up time	
Cellular Processing Toolset Viewed		EV	Implement work-calls to improve process flow	
Theory of Constraints (TOC) – Line Balancing		AN	Use TOC principles to identify, elevate, and resolve bottlenecks	
A-B-C Work Stratification		EV	Determine inventory levels based on stratification	
Internal Pull Systems		AN	Set up External pull to improve flow and reduce inventories	
External Pull Systems		AN	Set up external pull to improve flow and reduce inventories	
Corrective Action Matrix		AP	Organize and track improvement activities while driving accountability for implementation	
Piloting a Solution		AP	Trial and evaluate solutions on a small scale prior to full implementation	
System Dynamics		EV	Identify potential unintended consequences and while develop robust process knowledge of balancing and reinforcing forces	
IMPROVE –Tollgate Review		EV	Review critical questions for the Improve Phase to ensure that answers have been developed	



Topic Area	Topic	Mastery Requirement*	Mastery Assessment
Control Phase of DMAIC	Verifying Improvements with Control Charts	AN	Evaluate “before” vs “after” data to validate process improvements, and employ control charts for ongoing process management
	The Process Control Plan	EV	Establish a process management system for ongoing data collection, monitoring, and reaction
	Visual Control	AN	Institute visual control techniques to improve process management
	5-S Approach	AN	Apply 5-S techniques to organize and streamline the workplace
	Total Productive Maintenance	AP	Implement TPM practices to improve process reliability and eliminate downtime
	Best Practices and Lessons Learned	EV	Evaluate successful actions and proactively share lessons learned with the broader organization
	Standardized Work – Documenting Process Changes	AP	Establish and document standard work to reduce variability
	Ending the Project Viewed – Project Hand-off	AP	Employ a systematic process to transfer responsibilities to the process owner and close the project
	CONTROL – Tollgate Review	EV	Review critical questions for the Control Phase to ensure that answers have been developed

Mastery Requirement Key	
Bloom’s Taxonomy	
RE	Remember terminology, facts, and definitions
UN	Understand and explain ideas and concepts
AP	Apply information, methods, and procedures in a new way or in a different context
AN	Analyze critically to compare and contrast, discriminate through experimentation, and identify inter-relationships
EV	Evaluate to draw conclusions and reach judgments through interpretation of analytical work
CR	Create new methods, processes, systems, concepts, and ideas