10 - DAY SIX SIGMA ASQ GREEN BELT PROGRAMME

Green Belt

A Green Belt (GB) project leader is capable of leading a cross-functional team through a series of formal project steps in order to enhance process performance significantly. GB projects are short-duration (12 – 24 weeks) quick-return initiatives that result in customer satisfaction and cost savings. This is a programme outline for the internationally recognised American Society for Quality (ASQ) certified six sigma green belt (CSSGB). It contains a blend of both lean and six sigma process improvement techniques.

Programme overview

The programme starts with a preparation day with sponsors and CSSGB candidates. The objective is to have committed sponsors engaged, and CSSGB projects clearly scoped before formal CSSGB workshops begin a few weeks later. The course is facilitated in 10 highly interactive workshops. To facilitate learning-by-doing on projects, as well as study time in preparation for the ASQ examination, the workshops are blocked as three separate sessions of 3-4-3 days, approximately 3 weeks apart.

Typically, candidates sit the ASQ examination date approximately one month after finishing the formal workshops.

Workshop timing

Timing	Days	GB Project Phase
Month 1	1	Sponsor & GB induction
Month 2	3	Define topics
Month 3	4	Measure & Analyse topics
Month 4	3	Improve & Control topics

The appendix contains a detailed ASQ topic listing and examination question breakdown.

Workshop format: Video, group interactive exercises, case studies PowerPoint, A3 exercises and data analysis exercises using a software application such as Minitab. Projects are reviewed in class during the programme.

Lean

Lean enables all personnel to work in collaborative teams, to error proof and standardize process steps. Customer satisfaction grows & costs fall.

Six Sigma

Six Sigma is a team-based approach to continuous improvement that reduces variation in an organisation's processes.

In addition to the above 11 workshops, optional days are suggested as follows:
- 2 mentoring days, and
- an exam preparation day.

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Agenda

Days	Content (see attached topic listing)
1	**Sponsor and GB induction** GB course objective, curriculum, the role of the sponsor & effective sponsorship, team problems, communication, A3 planning, project selection and scope, financial evaluation of benefits, ASQ certification process, gemba visits, preparation work for course.

3	**Introduction**
	ASQ certification, dates, application, fees, & venue
	(i) Overview: Six Sigma and the Organization (15 Questions)
	    A. Six sigma and organizational goals
	    B. Lean principles in the organization
	(ii) Six Sigma – *Define* (25 Questions)
	    A. Process Management for Projects
	    B. Project management basics
	    C. Management and planning tools
	    D. Business results for projects
	    E. Team dynamics and performance
	Subtotal = 40 questions (sample exam questions are reviewed daily)

4	**(iii) Six Sigma – *Measure* (30 Questions)**
	    A. Process analysis and documentation
	    B. Probability and statistics
	    C. Collecting and summarizing data
	    D. Probability distributions
	    E. Measurement system analysis
	    F. Process capability and performance
	(iv) Six Sigma – *Analyze* (15 Questions)
	    A. Exploratory data analysis
	    B. Hypothesis testing
	Subtotal = 45 questions (sample exam questions are reviewed daily)

3	**(v) Six Sigma – *Improve & Control* (15 Questions)**
	    A. DOE
	    B. SPC
	    C. Implement and validate solutions
	    D. Control plan
	Subtotal = 15 questions (sample exam questions are reviewed daily)
	ASQ Exam format & technique, mock exam & feedback

11	**Total 100 Questions**

Learning objectives

At the end of this programme participants will be enabled to:

- Use a formal project management method and a wise variety problem solving tools to improve or eliminate process problems;

- Lead a cross-functional team through successful project completion;

- Understand the ASQ examination format, topic listing and study commitment required to pass the examination.

Who should attend?

The course is suitable for managers, supervisors, senior administrators, specialists and change agents who will be taking an active part in business process improvement. Knowledge of statistics is not required before attending the programme. The most successful participants are likely to be those who have supervisory experience, or who are well regarded as change agents within their workplace.

Reference website

www.ASQ.org

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Appendix: ASQ GB Curriculum and examination

(i) Overview: Six Sigma and the Organization (15 Questions)

A. **Six sigma and organizational goals**
  1. **Value of six sigma**
     Recognize why organizations use six sigma, how they apply its philosophy and goals, and the origins of six sigma (Juran, Deming, Shewhart, etc.). Describe how process inputs, outputs, and feedback impact the larger organization. (Understand)
  2. **Organizational drivers and metrics**
     Recognize key drivers for business (profit, market share, customer satisfaction, efficiency, product differentiation) and how key metrics and scorecards are developed and impact the entire organization. (Understand)
  3. **Organizational goals and six sigma projects**
     Describe the project selection process including knowing when to use six sigma improvement methodology (DMAIC) as opposed to other problem-solving tools, and confirm that the project supports and is linked to organizational goals. (Understand)
B. **Lean principles in the organization**
  1. **Lean concepts and tools**
     Define and describe concepts such as value chain, flow, pull, perfection, etc., and tools commonly used to eliminate waste, including kaizen, 5S, error-proofing, value-stream mapping, etc. (Understand)
  2. **Value-added and non-value-added activities**
     Identify waste in terms of excess inventory, space, test inspection, rework, transportation, storage, etc., and reduce cycle time to improve throughput. (Understand)
  3. **Theory of constraints**
     Describe the theory of constraints. (Understand)
C. **Design for Six Sigma (DFSS) in the organization**
  1. **Quality function deployment (QFD)**
     Describe how QFD fits into the overall DFSS process. (Understand) (Note: the application of QFD is covered in II.A.6.)
  2. **Design and process failure mode and effects analysis (DFMEA & PFMEA)**
     Define and distinguish between design FMEA (DFMEA) and process (PFMEA) and interpret associated data. (Analyze) (Note: the application of FMEA is covered in II.D.2.)
  3. **Road maps for DFSS**
     Describe and distinguish between DMADV (define, measure, analyze, design, verify) and IDOV (identify, design, optimize, verify), identify how they relate to DMAIC and how they help close the loop on improving the end product/process during the design (DFSS) phase. (Understand)

(ii)   Six Sigma – *Define* (25 Questions)

A. **Process Management for Projects**
  1. **Process elements**
     Define and describe process components and boundaries. Recognize how processes cross various functional areas and the challenges that result for process improvement efforts. (Analyze)
  2. **Owners and stakeholders**
     Identify process owners, internal and external customers, and other stakeholders in a project. (Apply)

3. **Identify customers**
   Identify and classify internal and external customers as applicable to a particular project, and show how projects impact customers. (Apply)

4. **Collect customer data**
   Use various methods to collect customer feedback (e.g., surveys, focus groups, interviews, observation) and identify the key elements that make these tools effective. Review survey questions to eliminate bias, vagueness, etc. (Apply)

5. **Analyze customer data**
   Use graphical, statistical, and qualitative tools to analyze customer feedback. (Analyze)

6. **Translate customer requirements**
   Assist in translating customer feedback into project goals and objectives, including critical to quality (CTQ) attributes and requirements statements. Use voice of the customer analysis tools such as quality function deployment (QFD) to translate customer requirements into performance measures. (Apply)

B. **Project management basics**

1. **Project charter and problem statement**
   Define and describe elements of a project charter and develop a problem statement, including baseline and improvement goals. (Apply)

2. **Project scope**
   Assist with the development of project definition/scope using Pareto charts, process maps, etc. (Apply)

3. **Project metrics**
   Assist with the development of primary and consequential metrics (e.g., quality, cycle time, cost) and establish key project metrics that relate to the voice of the customer. (Apply)

4. **Project planning tools**
   Use project tools such as Gantt charts, critical path method (CPM), and program evaluation and review technique (PERT) charts, etc. (Apply)

5. **Project documentation**
   Provide input and select the proper vehicle for presenting project documentation (e.g., spreadsheet output, storyboards, etc.) at phase reviews, management reviews and other presentations. (Apply)

6. **Project risk analysis**
   Describe the purpose and benefit of project risk analysis, including resources, financials, impact on customers and other stakeholders, etc. (Understand)

7. **Project closure**
   Describe the objectives achieved and apply the lessons learned to identify additional opportunities. (Apply)

C. **Management and planning tools**
   Define, select, and use 1) affinity diagrams, 2) interrelationship digraphs, 3) tree diagrams, 4) prioritization matrices, 5) matrix diagrams, 6) process decision program (PDPC) charts, and 7) activity network diagrams. (Apply)

D. **Business results for projects**

1. **Process performance**
   Calculate process performance metrics such as defects per unit (DPU), rolled throughput yield (RTY), cost of poor quality (COPQ), defects per million opportunities (DPMO) sigma levels and process capability indices. Track process performance measures to drive project decisions. (Analyze)

2. **Failure mode and effects analysis (FMEA)**
   Define and describe failure mode and effects analysis (FMEA). Describe the purpose and use of scale criteria and calculate the risk priority number (RPN). (Analyze)

E. **Team dynamics and performance**

1. **Team stages and dynamics**
   Define and describe the stages of team evolution, including forming, storming, norming, performing, adjourning, and recognition. Identify and 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, tangents, etc. (Understand)

2. **Six sigma and other team roles and responsibilities**
Describe and define the roles and responsibilities of participants on six sigma and other teams, including black belt, master black belt, green belt, champion, executive, coach, facilitator, team member, sponsor, process owner, etc. (Apply)

3. **Team tools**
Define and apply team tools such as brainstorming, nominal group technique, multi-voting, etc. (Apply)

4. **Communication**
Use effective and appropriate communication techniques for different situations to overcome barriers to project success. (Apply)

(iii)   Six Sigma – *Measure* (30 Questions)

A. **Process analysis and documentation**
   1. **Process modeling**
   Develop and review process maps, written procedures, work instructions, flowcharts, etc. (Analyze)
   2. **Process inputs and outputs**
   Identify process input variables and process output variables (SIPOC), and document their relationships through cause and effect diagrams, relational matrices, etc. (Analyze)
B. **Probability and statistics**
   1. **Drawing valid statistical conclusions**
   Distinguish between enumerative (descriptive) and analytical (inferential) studies, and distinguish between a population parameter and a sample statistic. (Apply)
   2. **Central limit theorem and sampling distribution of the mean**
   Define the central limit theorem and describe its significance in the application of inferential statistics for confidence intervals, control charts, etc. (Apply)
   3. **Basic probability concepts**
   Describe and apply concepts such as independence, mutually exclusive, multiplication rules, etc. (Apply)
C. **Collecting and summarizing data**
   1. **Types of data and measurement scales**
   Identify and classify continuous (variables) and discrete (attributes) data. Describe and define nominal, ordinal, interval, and ratio measurement scales. (Analyze)
   2. **Data collection methods**
   Define and apply methods for collecting data such as check sheets, coded data, etc. (Apply)
   3. **Techniques for assuring data accuracy and integrity**
   Define and apply techniques such as random sampling, stratified sampling, sample homogeneity, etc. (Apply)
   4. **Descriptive statistics**
   Define, compute, and interpret measures of dispersion and central tendency, and construct and interpret frequency distributions and cumulative frequency distributions. (Analyze)
   5. **Graphical methods**
   Depict relationships by constructing, applying and interpreting diagrams and charts such as stem-and-leaf plots, box-and-whisker plots, run charts, scatter diagrams, Pareto charts, etc. Depict distributions by constructing, applying and interpreting diagrams such as histograms, normal probability plots, etc. (Create)
D. **Probability distributions**
   Describe and interpret normal, binomial, and Poisson, chi square, Student's t, and F distributions. (Apply)

E. **Measurement system analysis**
    Calculate, analyze, and interpret measurement system capability using repeatability and reproducibility (GR&R), measurement correlation, bias, linearity, percent agreement, and precision/tolerance (P/T). (Evaluate)

F. **Process capability and performance**

1. **Process capability studies**
    Identify, describe, and apply the elements of designing and conducting process capability studies, including identifying characteristics, identifying specifications and tolerances, developing sampling plans, and verifying stability and normality. (Evaluate)

2. **Process performance vs. specification**
    Distinguish between natural process limits and specification limits, and calculate process performance metrics such as percent defective. (Evaluate)

3. **Process capability indices**
    Define, select, and calculate C_p and C_{pk}, and assess process capability. (Evaluate)

4. **Process performance indices**
    Define, select, and calculate P_p, P_{pk}, C_{pm}, and assess process performance. (Evaluate)

5. **Short-term vs. long-term capability**
    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 1.5 sigma shift. (Evaluate)

6. **Process capability for attributes data**
    Compute the sigma level for a process and describe its relationship to P_{pk}. (Apply)

(iv)   Six Sigma – *Analyze* (15 Questions)

C. **Exploratory data analysis**

1. **Multi-vari studies**
    Create and interpret multi-vari studies to interpret the difference between positional, cyclical, and temporal variation; apply sampling plans to investigate the largest sources of variation. (Create)

2. **Simple linear correlation and regression**
    Interpret the correlation coefficient and determine its statistical significance (p-value); recognize the difference between correlation and causation. Interpret the linear regression equation and determine its statistical significance (p-value). Use regression models for estimation and prediction. (Evaluate)

D. **Hypothesis testing**

1. **Basics**
    Define and distinguish between statistical and practical significance and apply tests for significance level, power, type I and type II errors. Determine appropriate sample size for various test. (Apply).

2. **Tests for means, variances, and proportions**
    Define, compare, and contrast statistical and practical significance. (Apply)

3. **Paired-comparison tests**
    Define and describe paired-comparison parametric hypothesis tests. (Understand)

4. **Single-factor analysis of variance (ANOVA)**
    Define terms related to one-way ANOVAs and interpret their results and data plots. (Apply)

5. **Chi square**
    Define and interpret chi square and use it to determine statistical significance. (Analyze)

(v) Six Sigma – *Improve & Control* (15 Questions)

A. Design of experiments (DOE)
   1. **Basic terms**
      Define and describe basic DOE terms such as independent and dependent variables, factors and levels, response, treatment, error, repetition, and replication. (Understand)
   2. **Main effects**
      Interpret main effects and interaction plots. (Apply)
B. **Statistical process control (SPC)**
   1. **Objectives and benefits**
      Describe the objectives and benefits of SPC, including controlling process performance, identifying special and common causes, etc. (Analyze)
   2. **Rational subgrouping**
      Define and describe how rational subgrouping is used. (Understand)
   3. **Selection and application of control charts**
   4. Identify, select, construct, and apply the following types of control charts: XbarR, XbarS, individuals and moving range, median p, np, c, and u. (Apply)
   5. **Analysis of control charts**
      Interpret control charts and distinguish between common and special causes using rules for determining statistical control. (Analyze)
C. **Implement and validate solutions**
   Use various improvement methods such as brainstorming, main effects analysis, multi-vari studies, FMEA, measurement system capability re-analysis, and post-improvement capability analysis to identify, implement, and validate solutions through F-test, t-test, etc. (Create)
D. **Control plan**
   Assist in developing a control plan to document and hold the gains, and assist in implementing controls and monitoring systems. (Apply)