CQE Training & Consultancy PLT (Reg. No. : LLP0003668-LGN)

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THE ASQ CERTIFIED QUALITY ENGINEER (CQE) - TRAINING LESSON PLAN (TLP)

Day	Module	Topic	Body of Knowledge / Contents / Syllabus	Trainer
1	I - Management & Leadership	ASQ CQE Introduction + Quality Philosophies & Foundations	• **What is ASQ CQE? Certified Quality Engineer expectation.** • **Examination format, structure & requirements, marking scheme and results notification.** • **ASQ membership and CQE certification fees.** • **Reference materials and useful learning websites** • **Preparation for ASQ CQE examination (DOs and DON'Ts)** • **Quality Philosophies and Foundations** Definition of Quality Explain how modern quality has evolved from quality control through statistical process control (SPC) to total quality management and leadership principles (including Deming's 14 points), and how quality has helped form various continuous improvement tools including lean, six sigma, theory of constraints, etc.	Eddie Kuang
2	I – Management & Leadership	Quality Management Systems (1)	• **The Quality Management System (QMS)** ○ **Strategic planning** Identify and define top management's responsibility for the QMS, including establishing policies and objectives, setting organization-wide goals, supporting quality initiatives, etc. ○ **Deployment techniques** Define, describe, and use various deployment tools in support of the QMS: benchmarking, stakeholder identification and analysis, performance measurement tools, and project management tools such as PERT charts, Gantt charts, critical path method (CPM), resource allocation, etc. • **ASQ Code of Ethics for Professional Conduct** Determine appropriate behavior in situations requiring ethical decisions. • **Leadership Principles and Techniques** Describe and apply various principles and techniques for developing and organizing teams and leading quality initiatives. • **Facilitation Principles and Techniques** Define and describe the facilitator's role and responsibilities on a team. Define and apply various tools used with teams, including	Eddie Kuang

			brainstorming, nominal group technique, conflict resolution, force-field analysis, etc. • **Communication Skills** Describe and distinguish between various communication methods for delivering information and messages in a variety of situations across all levels of the organization. • **Customer Relations** Define, apply, and analyze the results of customer relation measures such as quality function deployment (QFD), customer satisfaction surveys, etc. • **Supplier Management** Define, select, and apply various techniques including supplier qualification, certification, evaluation, ratings, performance improvement, etc. • **Barriers to Quality Improvement** Identify barriers to quality improvement, their causes and impact, and describe methods for overcoming them.	
3	I – Management & Leadership	Quality Management Systems (2)	• **The Quality System** ○ **Elements of the Quality System** Define, describe, and interpret the basic elements of a quality system, including planning, control, and improvement, from product and process design through quality cost systems, audit programs, etc. (ISO9001:2000 QMS, TS16949:2002, etc…) ○ **Documentation of the Quality System** Identify and apply quality system documentation components, including quality policies, procedures to support the system, configuration management and document control to manage work instructions, quality records, etc. ○ **Quality Standards and Other Guidelines** Define and distinguish between national and international standards and other requirements and guidelines, including the Malcolm Baldrige National Quality Award (MBNQA), and describe key points of the ISO 9000 series of standards and how they are used. [Note: Industry-specific standards will not be tested.]	Eddie Kuang

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4	II – The Quality System	Quality Auditing	• **Quality Audits** ○ **Types of audits** Describe and distinguish between various types of quality audits such as product, process, management (system), registration (certification), compliance (regulatory), first, second, and third party, etc. ○ **Roles and responsibilities in audits** Identify and define roles and responsibilities for audit participants such as audit team (leader and members), client, auditee, etc. ○ **Audit planning and implementation** Describe and apply the steps of a quality audit, from the audit planning stage through conducting the audit, from the perspective of an audit team member. ○ **Audit reporting and follow up** Identify, describe, and apply the steps of audit reporting and follow up, including the need to verify corrective action.	Eddie Kuang
5	II – The Quality System	Quality Information System + Cost of Quality	• **Quality Information System & Cost of Quality** ○ **Quality information system (QIS)** Identify and define the basic elements of a QIS, including who will contribute data, the kind of data to be managed, who will have access to the data, the level of flexibility for future information needs, data analysis, etc. ○ **Cost of Quality (COQ)** Identify and apply COQ concepts, including cost categories, data collection methods and classification, and reporting and interpreting results.	Eddie Kuang
6	III – Product & Process Design	Reliability & Risk Management	• **Product and Process Design** ○ **Classification of Quality Characteristics** Define, interpret, and classify quality characteristics for new products and processes. [Note: The classification of product defects is covered in IV.] ○ **Design Inputs and Review** Identify sources of design inputs such as customer	Eddie Kuang

			needs, regulatory requirements, etc. and how they translate into design concepts such as robust design, QFD, and Design for X (DFX, where X can mean six sigma (DFSS), manufacturability (DFM), cost (DFC), etc.). Identify and apply common elements of the design review process, including roles and responsibilities of participants. ○ **Technical Drawings and Specifications** Interpret technical drawings including characteristics such as views, title blocks, dimensioning, tolerancing, GD&T symbols, etc. Interpret specification requirements in relation to product and process characteristics. ○ **Design Verification** Identify and apply various evaluations and tests to qualify and validate the design of new products and processes to ensure their fitness for use.	
7	III – Product & Process Design	Reliability & Risk Management	• **Product and Process Design** ○ **Reliability and Maintainability** ▪ **Predictive and preventive maintenance tools** Describe and apply these tools and techniques to maintain and improve process and product reliability. ▪ **Reliability and maintainability indices** Review and analyze indices such as, MTTF, MTBF, MTTR, availability, failure rate, etc. ▪ **Bathtub curve** Identify, define, and distinguish between the basic elements of the bathtub curve. ▪ **Reliability / Safety / Hazard Assessment Tools** Define, construct, and interpret the results of failure mode and effects analysis (FMEA), failure mode, effects, and criticality analysis (FMECA), and fault tree analysis (FTA).	Eddie Kuang
8	IV – Product & Process Control	Acceptance Sampling Plan	• **Product and Process Control** ○ **Tools** Define, identify, and apply product and process control	Eddie Kuang

			methods such as developing control plans, identifying critical control points, developing and validating work instructions, etc. ○ **Material Control** ▪ **Material identification, status, and traceability** Define and distinguish these concepts, and describe methods for applying them in various situations. [Note: Product recall procedures will not be tested.] ▪ **Material segregation** Describe material segregation and its importance, and evaluate appropriate methods for applying it in various situations. ▪ **Classification of defects** Define, describe, and classify the seriousness of product and process defects. ▪ **Material review board (MRB)** Identify the purpose and function of an MRB, and make appropriate disposition decisions in various situations. ○ **Acceptance Sampling** ▪ **Sampling concepts** Define, describe, and apply the concepts of producer and consumer risk and related terms, including operating characteristic (OC) curves, acceptable quality limit (AQL), lot tolerance percent defective (LTPD), average outgoing quality (AOQ), average outgoing quality limit (AOQL), etc.	
9	IV – Product & Process Control	Acceptance Sampling Plan	• **Product and Process Control** ▪ **Sampling standards and plans** Interpret and apply ANSI/ASQ Z1.4 and Z1.9 standards for attributes and variables sampling. Identify and distinguish between single, double, multiple, sequential, and continuous sampling	Eddie Kuang

			methods. Identify the characteristics of Dodge-Romig sampling tables and when they should be used. ▪ **Sample integrity** Identify the techniques for establishing and maintaining sample integrity.	
10	IV – Product & Process Control	Measurement, Metrology & Calibration	• Measuurement, Metrology & Calibration o **Measurement and Test** ▪ **Measurement tools** Select and describe appropriate uses of inspection tools such as gage blocks, calipers, micrometers, optical comparators, etc. ▪ **Destructive and nondestructive tests** Distinguish between destructive and nondestructive measurement test methods and apply them appropriately. o **Metrology** Identify, describe, and apply metrology techniques such as calibration systems, traceability to calibration standards, measurement error and its sources, and control and maintenance of measurement standards and devices. o **Measurement System Analysis (MSA)** Calculate, analyze, and interpret repeatability and reproducibility (Gage R&R) studies, measurement correlation, capability, bias, linearity, etc., including both conventional and control chart methods.	Eddie Kuang
11	V – Continuous Improvement	Quality Control Tools, Quality Mgmt & Planning Tools	• **Continuous Improvement** o **Quality Control Tools** Select, construct, apply, and interpret tools such as 1) flowcharts, 2) Pareto charts, 3) cause and effect diagrams, 4) control charts, 5) check sheets, 6) scatter diagrams, and 7) histograms. o **Quality Management and Planning Tools** Select, construct, apply, and interpret tools such as 1) affinity diagrams, 2) tree diagrams, 3) process decision program charts (PDPC), 4) matrix diagrams, 5)	Eddie Kuang

			interrelationship digraphs, 6) prioritization matrices, and 7) activity network diagrams.	
12	V – Continuous Improvement	Continuous Improvement Techniques, Corrective & Preventive Actions	• **Continuous Improvement** ○ **Continuous Improvement Techniques** Define, describe, and distinguish between various continuous improvement models: total quality management (TQM), kaizen, plan-do-check-act (PDCA), six sigma, theory of constraints (TOC), lean, etc. ○ **Corrective Action** Identify, describe, and apply elements of the corrective action process including problem identification, failure analysis, root cause analysis, problem correction, recurrence control, verification of effectiveness, etc. ○ **Preventive Action** Identify, describe, and apply various preventive action tools such as error-proofing/poka-yoke, robust design, etc., and analyze their effectiveness.	Eddie Kuang
13	VI – Quantitative Methods & Tools	Inferential Statistics & Distribution (1)	• **Quantitative Methods and Tools** ○ **Collecting and Summarizing Data** ▪ **Types of data** Define, classify, and compare discrete (attributes) and continuous (variables) data. ▪ **Measurement scales** Define, describe, and use nominal, ordinal, interval, and ratio scales. ▪ **Data collection methods** Describe various methods for collecting data, including tally or check sheets, data coding, automatic gaging, etc., and identify their strengths and weaknesses. ▪ **Data accuracy** Describe the characteristics or properties of data (e.g., source/resource issues, flexibility, versatility, etc.) and various types of data errors or poor quality such as low accuracy, inconsistency, interpretation of data values, and	Eddie Kuang

redundancy. Identify factors that can influence data accuracy, and apply techniques for error detection and correction.

- **Descriptive statistics**
  Describe, calculate, and interpret measures of central tendency and dispersion (central limit theorem), and construct and interpret frequency distributions including simple, categorical, grouped, ungrouped, and cumulative.
- **Graphical methods for depicting relationships**
  Construct, apply, and interpret diagrams and charts such as stem-and-leaf plots, box-and-whisker plots, etc. [Note: Run charts and scatter diagrams are covered in V]
- **Graphical methods for depicting distributions**
  Construct, apply, and interpret diagrams such as normal probability plots, Weibull plots, etc. [Note: Histograms are covered in V]

- **Quantitative Concepts**
  - **Terminology**
    Define and apply quantitative terms, including population, parameter, sample, statistic, random sampling, expected value, etc. (Analyze)
  - **Drawing statistical conclusions**
    Distinguish between numeric and analytical studies. Assess the validity of statistical conclusions by analyzing the assumptions used and the robustness of the technique used. (Evaluate)
  - **Probability terms and concepts**
    Describe and apply concepts such as independence, mutually exclusive, multiplication rules, complementary probability, joint occurrence of events, etc. (Apply)
- **Probability Distributions**
  - **Continuous distributions**
    Define and distinguish between these

			distributions: normal, uniform, bivariate normal, exponential, lognormal, Weibull, chi square, Student's t, F, etc. (Analyze) ▪ **Discrete distributions** Define and distinguish between these distributions: binomial, Poisson, hypergeometric, multinomial, etc. (Analyze)	
14	VI – Quantitative Methods & Tools	Inferential Statistics & Distribution (2)	• **Quantitative Methods and Tools** ○ **Statistical Decision-Making** ▪ **Point estimates and confidence intervals** Define, describe, and assess the efficiency and bias of estimators. Calculate and interpret standard error, tolerance intervals, and confidence intervals. ▪ **Hypothesis testing** Define, interpret, and apply hypothesis tests for means, variances, and proportions. Apply and interpret the concepts of significance level, power, type I and type II errors. Define and distinguish between statistical and practical significance. ▪ **Paired-comparison tests** Define and use paired-comparison (parametric) hypothesis tests, and interpret the results. ▪ **Goodness-of-fit tests** Define and use chi square and other goodness-of-fit tests, and interpret the results. ▪ **Analysis of variance (ANOVA)** Define and use ANOVAs and interpret the results. ▪ **Contingency tables** Define, construct, and use contingency tables to evaluate statistical significance.	Eddie Kuang
15	VI – Quantitative Methods & Tools	Inferential Statistics & Distribution (3)	• **Quantitative Methods and Tools** ○ **Relationships Between Variables** ▪ **Linear regression** Calculate the regression equation for simple	Eddie Kuang

			regressions and least squares estimates. Construct and interpret hypothesis tests for regression statistics. Use regression models for estimation and prediction, and analyze the uncertainty in the estimate. [Note: Non-linear models and parameters will not be tested.] ▪ **Simple linear correlation** Calculate the correlation coefficient and its confidence interval, and construct and interpret a hypothesis test for correlation statistics. [Note: Serial correlation will not be tested.] ▪ **Time-series analysis** Define, describe, and use time-series analysis including moving average, and interpret time-series graphs to identify trends and seasonal or cyclical variation.	
16	VI – Quantitative Methods & Tools	Statistical Process Control (1)	• **Quantitative Methods and Tools** ○ **Statistical Process Control (SPC)** ▪ **Objectives and benefits** Identify and explain objectives and benefits of SPC such as assessing process performance. ▪ **Common and special causes** Describe, identify, and distinguish between these types of causes. ▪ **Selection of variable** Identify and select characteristics for monitoring by control chart. ▪ **Rational subgrouping** Define and apply the principles of rational subgrouping. ▪ **Control charts** Identify, select, construct, and use various control charts, including -R, -s, individuals and moving range (ImR or XmR), moving average and moving range (MamR), p, np, c, u, and CUSUM charts.	Eddie Kuang

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			▪ **Control chart analysis** Read and interpret control charts, use rules for determining statistical control. ▪ **PRE-control charts** Define and describe how these charts differ from other control charts and how they should be used. ▪ **Short-run SPC** Identify, define, and use short-run SPC rules.	
17	VI – Quantitative Methods & Tools	Statistical Process Control (2)	• **Quantitative Methods and Tools** ○ **Process and Performance Capability** ▪ **Process capability studies** Define, describe, calculate, and use process capability studies, including identifying characteristics, specifications, and tolerances, developing sampling plans for such studies, establishing statistical control, etc. ▪ **Process performance vs. specifications** Distinguish between natural process limits and specification limits, and calculate percent defective. ▪ **Process capability indices** Define, select, and calculate Cp, Cpk, Cpm, and Cr, and evaluate process capability. ▪ **Process performance indices** Define, select, and calculate Pp and Ppk and evaluate process performance.	Eddie Kuang
18	VI – Quantitative Methods & Tools	Design of Experiment (1)	• **Quantitative Methods and Tools** ○ **Design and Analysis of Experiments** ▪ **Terminology** Define terms such as dependent and independent variables, factors, levels, response, treatment, error, and replication. ▪ **Planning and organizing experiments** Define, describe, and apply the basic elements of designed experiments, including determining the experiment objective, selecting factors,	Eddie Kuang

			responses, and measurement methods, choosing the appropriate design, etc. ▪ **Design principles** Define and apply the principles of power and sample size, balance, replication, order, efficiency, randomization, blocking, interaction, and confounding. ▪ **One-factor experiments** Construct one-factor experiments such as completely randomized, randomized block, and Latin square designs, and use computational and graphical methods to analyze the significance of results.	
19	VI – Quantitative Methods & Tools	Design of Experiment (2)	• **Quantitative Methods and Tools** ▪ **Full-factorial experiments** Construct full-factorial designs and use computational and graphical methods to analyze the significance of results. ▪ **Two-level fractional factorial experiments** Construct two-level fractional factorial designs (including Taguchi designs) and apply computational and graphical methods to analyze the significance of results.	Eddie Kuang
20	Review & discussion Session for ASQ CQE Examination			Eddie Kuang

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Six Levels of Cognition based on Bloom's Taxonomy (1956)

These levels are based on "Levels of Cognition" (from Bloom's Taxonomy, 1956) and are presented below in rank order, from least complex to most complex.

Knowledge Level
(Also commonly referred to as recognition, recall, or rote knowledge.) Being able to remember or recognize terminology, definitions, facts, ideas, materials, patterns, sequences, methodologies, principles, etc.

Comprehension Level
Being able to read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.

Application Level
Being able to apply ideas, procedures, methods, formulas, principles, theories, etc., in job-related situations.

Analysis
Being able to break down information into its constituent parts and recognize the parts' relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario.

Synthesis
Being able to put parts or elements together in such a way as to show 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.

Evaluation
Being able to make judgments regarding the value of proposed ideas, solutions, methodologies, etc., by using appropriate criteria or standards to estimate accuracy, effectiveness, economic benefits, etc.