

ILLINOIS STATE UNIVERSITY
Department of Technology
TEC 489.37 – Quality Tools and Analysis Techniques
Date of Proposal: 10/07

Catalog Description:

Quality Tools and Analysis Techniques

3

Quality tools and statistical analysis techniques as applied by quality professionals in business and industry.

Course Overview:

Course gives students a broad based understanding of the quality tools and statistical analysis techniques applied by quality professionals in business and industry. Students will select, construct, apply, and interpret quality tools such as: cause and effect diagrams, flow charts (process maps), check sheets, Pareto diagrams, scatter diagrams, control charts, and histograms. Descriptive and inferential statistics as applied in the quality environment will be explored using computer applications.

Student Objectives:

Through successful completion of **TEC 489.37**, students have the opportunity to develop and demonstrate knowledge, skills and competencies in the following areas:

1. Apply basic quality tools.
2. Evaluate and apply basic statistical techniques to make data based decisions.
3. Read, interpret and evaluate data sets noting trends and patterns.
4. Analyze causes of differentiation and interaction.

Topical Outline

QUALITY TOOLS

Select, construct, apply, and interpret the seven quality tools: cause and effect diagrams, flow charts (process maps), check sheets, Pareto diagrams, scatter diagrams, control charts, and histograms.

STATISTICAL TECHNIQUES

General Concepts

Use techniques such as the goal-question-metric (GQM) model and others to identify when, what, and how to measure projects and processes. Describe how metrics and data gathering methods affect people and vice-versa. -- Apply basic statistical techniques (e.g., measures of central tendency, range, variance, types of distribution, check sheet output) to data sets, charts, and other data summaries to monitor processes and make data-based decisions. -- Read and interpret data sets,

graphs, charts, etc., and identify various trends such as cyclical, seasonal, environmental, etc., and patterns such as shifts, etc. -- Differentiate between common and special causes of variation.

- **Terminology** -- Identify and differentiate between statistical terms such as population, sample, parameter, statistic, statistical process control, statistical quality control, etc.
- **Frequency distributions** -- Define and compute normal, Poisson, and binomial frequency distributions.
- **Design of experiments (DOE)** -- Define and recognize the basic elements of DOE, including terms such as blocking, randomization, etc.
- **Reliability and validity** -- Use measurement theories of reliability and validity (including content-, construct-, and criterion-based measures) to guide the development of survey instruments and to support inferences about the data gathered by them. (Analyze) -- Define concepts such as mean time to failure (MTTF), mean time between failures (MTBF), and mean time between maintenance actions (MTBMA), and recognize failure models such as bathtub curve, prediction, growth, etc.
- **Qualitative assessment** -- Identify subjective measures (e.g., verbatim comments from customers, observation records, and focus group output) and how they differ from objective measures, and determine when measurements should be made in categories rather than in terms of numeric value.
- **Survey analysis and use** -- Analyze survey results and ensure that they are interpreted and used correctly.

Calculations

- **Measures of central tendency** -- Define, compute, and interpret mean, median, and mode.
- **Measures of dispersion** -- Define, compute, and interpret standard deviation, range, and variance. **Statistical inference** -- Determine, calculate, and apply confidence levels in various situations.
- **Confidence limits** -- Determine, calculate, and apply confidence limits in various situations.
- **Probability** -- Calculate probability using the basic concepts of combinations, permutations, and area under the normal curve.
- **t test** -- Describe how and why t tests are used.
- **Analysis of variance (ANOVA)** -- Define and determine the applicability of ANOVAs.

Control Charts

- **Techniques and applications** -- Select control charts that are appropriate for monitoring or analyzing a process and explain their construction and use.
- **Control limits vs. specification limits** -- Identify and describe the different uses of control limits and specification limits.

- **Variables charts** -- Identify, select, construct, and interpret variables charts such as $\bar{\bar{x}} - R$, $\bar{\bar{x}} - s$, etc.
- **Attributes charts** -- Identify, select, construct, and interpret attributes charts such as p, np, c, u, etc.
- **Rational subgroups** -- Define and describe the principles of rational subgroups.
- **Process capability measures** -- Determine the capability of a process in terms of Cp and Cpk indices. Define the prerequisites for capability, and calculate and interpret Cp, Cpk, and capability ratio (CR) in various situations. (Analysis)
- **Machine capability measures** -- Determine machine capability in various situations, and describe its contribution to process capability.
- **PRE-control chart** -- Describe the concept of PRE-control and construct and interpret PRE-control charts.
- **Common and special cause variation** -- Interpret various control chart patterns (runs, hugging, trends, etc.) and use rules for determining statistical control to distinguish between common cause and special cause variation.
- **Data plotting** -- Identify the advantages and limitations of using this method to analyze data visually instead of numerically.

Sampling

Define and describe basic sampling techniques (e.g., random, stratified, etc.) and when sampling is appropriate.

- **Characteristics** -- Identify and define sampling characteristics such as operating characteristic (OC) curve, lot size, sample size, acceptance number, switching rules, etc.
- **Sampling types** -- Define and distinguish between fixed sampling, 100% inspection, attributes and variables sampling, etc.
- **Selecting samples from lots** -- Determine sample size (e.g., AQL), selection method, and accept/reject criteria (e.g., zero-defect sampling) in various situations

READINGS

Required Texts

Tague, N. R. *The Quality Toolbox*, Second Edition, ASQ Quality Press, 2004.

REQUIRED STUDENT TASKS/ASSIGNMENTS

4. Examinations

Midterm Exam	100 points
Final Exam	100 points
Case Study Analysis	100 points
Weekly Assignments	100 points

5. Grading Scale

90 – 100%	= A
80 – 89%	= B
70 – 79%	= C
0 – 69%	=F

Case Studies will focus on how quality tools are utilized to enhance data collection and reporting. Students will be required to write four compare and contrast papers on selected quality tools, techniques, charts, and/or systems. Each paper will require citing appropriate literature to support or corroborate approaches, tools, and interpretation of the analysis techniques and findings.

Weekly assignments will include applications and analysis of frequency distributions, design of experiments (DOE), reliability and validity, qualitative assessment, survey analysis and use, measures of central tendency, measures of dispersion, confidence limits, probability, t tests, analysis of variance (ANOVA), control charts, sampling theory, characteristics of sampling types, and selecting samples.

DISHONESTY POLICY STATEMENT:

“Students are expected to be honest in all academic work. A student’s placement of his or her name on any academic exercise shall be regarded as assurance that the work is the result of the student’s own thought, effort, and study.” Academic dishonesty is considered an offense to the department and university. Cases will be handled consistent with university policy, which specifies that “faculty members are to report all instances of academic dishonesty to Student Dispute Resolution Services.” Also, consistent with university policy, “faculty members retain authority to determine grade penalties in cases of academic dishonesty.” Departmental policy specifies that, at a minimum, a grade of zero will be issued for assignments involving academic dishonesty and additional grade penalties can be imposed including failing the course, or being removed from the program. In keeping with university policy, the incident will be reported to the Student Dispute Resolution Services office. (The complete academic honesty policy is located at www/ilstu/depts/sdrs/code_of_conduct.htm. All quoted statements in the departmental policy are from that document.)

DISABILITY CONCERNS:

Any student needing to arrange a reasonable accommodation for a documented disability should contact Disability Concerns at 350 Fell Hall, 438-5853 (voice), 438-8620 (TTY).