(LM54)

(Lecce - Università degli Studi)

Teaching MANUFACTURING QUALITY

GenCod A004628

Owner professor Massimo PACELLA

Teaching in italian MANUFACTURING QUALITY

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SSD code ING-IND/16

Reference course

Course type Laurea Magistrale

Credits 9.0

Teaching hours Ore-Attivita-frontale: 81.0

For enrolled in 2017/2018

Taught in 2017/2018

Course year 1

Language INGLESE

Curriculum PERCORSO COMUNE

Location Lecce

Semester Secondo-Semestre

Exam type Orale

Assessment Voto-Finale

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

This course provides students with the analytical and management tools necessary to solve manufacturing quality problems and implement effective quality systems. Topics include quality systems and standards, the Six Sigma problem solving methodology, process capability analysis, measurement system analysis, gauge R & R, ANOVA, statistical process control, and geometric tolerances.

REQUIREMENTS

Sufficiency probability theory and statistics.

COURSE AIMS

Learning Outcomes
*Introduce the basic definitions of quality, quality improvement, and other quality engineering terminology
*Understand the need for and gain an overview of EN 9100 certification
*Understand the international vocabulary of metrology
*Know the fundamentals of metrology devices
*Understand chance and assignable causes of variability in a process
*Calculate and properly interpret process capability ratios
*Understand some key aspects related to geometric requirements

ASSESSMENT TYPE

Examination: oral._The exam consists in the presentation and discussion of the case-study assignment results by project groups. Case Study assignments should be completed in teams of 1 or 2. Teams of 3 may be allowed provided a request is made in advance to the instructor.

OTHER USEFUL INFORMATION

Office Hours: By appointment; contact the instructor by email or at the end of class meetings.

FULL SYLLABUS

1. Quality Management System (4 hours)
Quality planning. Quality assurance. Quality control and improvement. PDCA methodology (Plan-Do-Check-Act) and other fundamental quality management principles. Six Sigma overview. The DMAIC (Define-Measure-Analyze-Improve-Control) problem solving process. Quality standards (ISO 9000, ISO 9001, ISO 9004).

2. EN 9100 – Quality System for Aerospace Manufactures (5 hours)
How to identify and interpret the requirements of EN 9100. The structure of EN 9100. The sequence of a certification audit. Quality management system implementation issues.

3. Metrology principles (27 hours)
International Vocabulary of Metrology (VIM) and the Guide to the expression of Uncertainty in Measurement (GUM) – basic and general concepts and associated terms. Quantities and units. Measurement. Devices for measurement. Properties of measuring devices. Principle of uncertainty calculation: types A and B uncertainties. Key dimensional metrology standards. Deformations and mechanical causes of errors. Marble, V-blocks, gauge blocks, and dial gauges. Vernier calipers. Micrometer or Palmer. Example of a laboratory model. Coordinate-measuring machine (CMM). Commonly-used geometric models in dimensional metrology. Description of styli and types of probing. Software and computers supporting the CMM. Statistical issues in geometric feature inspection using CMMs. Sample size. Sample location. Measurement errors. Introduction to measurement by optical methods.

4. Statistical Process Control (SPC) (18 hours)
Modeling process quality: describing variation. Important continuous distributions. Probability plots. Some useful approximations. Control chart for variables: chance and assignable causes of quality variation. Statistical basis of the control chart. Implementing SPC in a control chart for Xbar and R. Control charts for Xbar and S. The control chart for individual measurements. Procedures for Xbar, R and S charts. Case studies: applications of variables control charts.

5. Measuring Methods and Gauges (18 hours)
Process and measurement system capability analysis. Process capability analysis using a histogram or a probability plot. Process capability ratios. Estimating the natural tolerance limits of a process. Tolerance limits based on the normal distribution. Nonparametric tolerance limits. Gauge and measurement systems capability studies. Isolate the components of variability in the measurement system. Accuracy and precision of a measurement system. The ANOVA (Analysis of Variance) approach for analyzing measurement data.

6. Geometric tolerances (9 hours)
Fundamentals of Dimensional and Geometrical Tolerances According to ISO, CSA (Canada), and ANSI (USA). Geometric Product Specification (GPS) standard covering ISO/TR 14638. Envelope requirement according to ISO 8015. Maximum material principle according to ISO 2692-1988. Form tolerances. Flatness tolerances. Straightness tolerance. Roundness. Cylindricity. Orientation tolerances. Parallelism (straight line/straight line). Parallelism plane/plane (plane/straight line) on CMM. Angularity. Positioning tolerances. Tolerance of single radial flap (radial runout). Tolerance of single axial flap (axial runout).

REFERENCE TEXT BOOKS

All lecture notes, data sets, solutions, and tutorials are available on the course web page.
Grous A. (2011). Applied Metrology for Manufacturing Engineering. Wiley.
Montgomery D. C. (2013). Introduction to Statistical Quality Control, 7th Edition, Wiley.