(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 Front activity hours: 81.0

For enrolled in 2019/2020

Taught in 2019/2020

Course year 1

Language ENGLISH

Curriculum Percorso comune

Location Lecce

Semester Second Semester

Exam type Oral

Assessment Final grade

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	**Knowledge and ability to understand.** The course aims to provide useful knowledge on engineering techniques for statistical process control and their quantitative and qualitative characteristics. Specific attention will be devoted to the evolution of techniques related to the modern availability of measuring instruments. **Ability to apply knowledge and understanding**. Through the analysis of recent scientific literature and quantitative data related to case studies in engineering, we will provide analysis tools and statistical techniques applicable in various engineering fields, particularly in manufacturing. After the course the student should be able to: i) know the techniques of statistical process control in manufacturing and process companies; ii) know the methods and techniques of experiment design and analysis of experimental data; iii) know the advanced techniques of modeling / monitoring of measurement data. **Autonomy of judgment**. Through the study of theoretical approaches and the critical evaluation of different techniques, the student will be able to improve his judgment and proposal skills in relation to the engineering problem of statistical process control. **Communication skills**. The presentation of the course topics will be carried out in such a way as to allow the acquisition of the mastery of a technical language and of an appropriate specialist terminology. The development of communication skills, both oral and written will also be stimulated through the drafting of a work project that will be presented and discussed in the classroom during the final exam. **Learning ability**. The ability to learn will be stimulated through presentations and discussions in the classroom, aimed at verifying the effective understanding of the topics covered. The ability to learn will also be stimulated by the deepening of scientific articles related to research topics of statistical process control as well as case studies typical of management engineering.
TEACHING METHODOLOGY	The course consists of lectures based on the use of slides made available to students through this portal. Classes are aimed at achieving the training objectives through the presentation of theories, models and methods as well as the discussion of case studies in manufacturing field.
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.