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COURSE: Industrial Quality Management

ACADEMIC YEAR: 2019/2020

TYPE OF EDUCATIONAL ACTIVITY: Characterizing

TEACHER: Paolo Renna

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phone: 0971 205143

mobile (optional):

Language: Italian

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ECTS: 6

n. of hours: 60  
lessons: 40  
practice: 20

Campus: Potenza  
Dept./School: Scuola di Ingegneria  
Program: Bachelor's Degree in Mechanical Engineering

Semester: I°

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#### EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

**EDUCATIONAL GOALS:** The module aims to provide the basic knowledge regarding the notions of probability and statistics and how these can be applied to the various random phenomena in engineering and in particular in industrial applications. In particular, the appropriate methodology of sample survey and / or design of field experiments; the correct summary and representation of data; the reasoned choice and application of a specific statistical analysis method, even of a complex type. These concepts are preliminary to the knowledge required for the design of the main statistical quality control tools: acceptance control, process control and robust design techniques. Finally, knowledge of quality assurance and certification systems will be provided in accordance with ISO 9000 standards.

**EXPECTED LEARNING OUTCOMES:** At the end of the course the student will have demonstrated to know the topics of statistics, descriptive, exploratory and inferential, and will have acquired the ability to analyse them. The student will acquire the knowledge of how to concretely build statistical models. Furthermore, the student will have knowledge of the problems inherent in the quality of production, the methods to be applied for process control, and the design and analysis of experiments. Finally, the student will have knowledge of industrial quality assurance systems.

**knowledge and understanding:** using the acquired statistical tools and the knowledge on quality control tools, the student will be able to analyze experimental data and design the main quality control tools and design and analysis experiments for continuous improvement in industrial environments.

**making judgements:** The student will be able, by collecting the data he will have learned to recognize as necessary and significant, to evaluate the performance of a production process and to independently identify the appropriate improvement activities.

**communication skills:** The student will acquire the necessary tools to express, communicate and support conversations on the topics concerning the subject of the course and to propose solutions to specific problems.

**learning skills:** Lo studente avrà appreso ad utilizzare gli strumenti della Statistica per integrarli alla risoluzione di problematiche aziendali relative alla qualità del prodotto. Egli sarà dunque in grado, in piena autonomia, di affrontare e approfondire le suddette problematiche e pervenire a soluzioni adeguate.

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PRE-REQUIREMENTS No pre-reequipments.

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#### SYLLABUS

##### SECTION I: Statistics ( 22h)

Introductory concepts: types of data; indexes of position, dispersion and form;

Definition of events and random variables and basic concepts of probability calculation;

The main continuous and discrete probability distributions, and engineering applications;

Hypothesis test; sample size.

Confidence interval: known and unknown variance;

Linear regression. Introduction to polynomial interpolation.

Statistical treatment of measures, errors in propagation of measurements.



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#### SECTION II: Acceptance sampling (4 h)

Statistical techniques for acceptance control: generalities, sampling plans for attributes and for variables. Multiple sampling plans.

#### SECTION III: Statistical Process Control (14 h)

Statistical techniques for process control: generalities, control charts for variables: average and range map X -R; X-S cards; control charts for individual measurements; Attribute control cards: p cards, np cards, c and u cards; control charts with standardized values. Notes on CUSUM and EMWA cards. Selection criteria and analysis of control charts. Process capacity analysis: Cp, Cpk, Cpm and Cm. Inspection policies in production processes.

#### SECTION IV: Robust design (8 h)

Statistical techniques for robust design: Generalities, Robust Design Methods, Design of Experiment and Analysis of Variance (ANOVA).

#### SECTION V: Quality Assurance and ISO 9000 (12 h)

Quality assurance systems: structure, tools and documentation. The ISO 9000: 2015 standards, the ISO 9000 certification system, the process approach and the accreditation system.

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#### TEACHING METHODS

The course includes 60 hours of teaching between lessons and exercises. In particular it is provided 40 hours of lectures and 20 hours of tutorials in the classroom / laboratory.

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#### EVALUATION METHODS

The candidates will attend a written examination and an oral examination. The written exam consists in quantitative problems to be solved in two and half hours. A minimum mark of 18 allows the candidate to access the oral examination.

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#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

##### **Reference Texts:**

- On line lectures materials on: <https://sites.google.com/site/tecnologiaunibas/>
- Douglas C. Montgomery, "Controllo Statistico della Qualità", McGraw-Hill

##### **Supplementary Material**

- Bertocco, Callegaro, De Antoni Migliorati "Ingegneria della Qualità", Città Studi Edizioni
- Piero de Risi, Progettare in Qualità, il Sole 24 Ore Libri
- UNI, Conoscere le ISO 9000:2000

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#### INTERACTION WITH STUDENTS

At the beginning of the course, after describing the objectives, program and methods of verification, the teacher provides students educational materials on the website indicated. Simultaneously, it collects a list of students who intend to enroll in the course, together with name, serial number and email.

Office hours are published on the web page <https://sites.google.com/site/tecnologiaunibas/> e <https://sites.google.com/site/paolorenna/home/didattica/orari-di-ricevimento>, with the relative indications (office or lab). The teacher is available for a contact with the students, through their email or discussion blog on the website: <http://paolorenna.blogspot.it>.

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#### EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

[11/02/2020](#), [10/03/2020](#), [14/04/2020](#), [12/05/2020](#), [23/06/2020](#), [21/07/2020](#), [19/09/2020](#), [03/11/2020](#)

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SEMINARS BY EXTERNAL EXPERTS    YES X    NO X

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#### FURTHER INFORMATION

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<sup>1</sup> Subject to possible changes: check the web site of the Teacher or the Department/School for updates.