



PERSONA CIÈNCIA EMPRESA
UNIVERSITAT RAMON LLULL

COURSE: STATISTICS FOR QUALITY IMPROVEMENT

SUBJECT MATTER: Elective

MODULE: Professional Supplements

STUDIES: Degree in Chemical Engineering

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GENERAL CHARACTERISTICS

Type: Basic Formation, Compulsory, Elective

Final Degree Project, Internship

Duration: Semestral

Semester/s: 8

Number of ECTS credits: 6

Language/s: Spanish, Catalan

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION

To stay on the market, products and services offered by the industry must have a high and stable quality level. A strategy to ensure quality over time is the so-called Six Sigma (6σ) which is based on ensuring that the variability of what is produced is sufficiently small with respect to the specifications so that the proportion of defective units produced is almost null and at the same time the continuous improvement of the processes is promoted, and its costs are reduced. This strategy is based on qualitative tools and statistical techniques.

On the other hand, the profession of chemical engineer has evolved over time to include a wide range of skills such as quality management and resource planning. These skills increase the employability of chemical engineer graduates in their professional fields.

According to the above, the course introduces students to the statistical techniques used in the Six Sigma methodologies so that they can use them in their professional activity and can continue to deepen their knowledge and application as needed.

The general contents of the subject include determination of the capacity and statistical process control, design of experiment for improvement and acceptance sampling plans. Finally, the student must solve practical cases by applying knowledge related to the techniques explained in the course.

COMPETENCES

- To be able to understand and apply knowledge of Chemistry and Engineering for its application in the field of Chemical Engineering. (CB1, E2)
- Be able to analyze, integrate and interpret data and information from the field of Chemical Engineering. (CB3, E8)
- That students are able to convey information, ideas, problems and solutions to both specialized and non-specialized audiences. (CB4)
- Be able to use new chemical engineering techniques and tools. (E9)



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- Ability to integrate the contents worked on in different subjects studied in the Degree in Chemical Engineering and situate it in a real industrial framework, to be introduced into the specific tasks of a technician in an industrial company and to put into practice activities of collaboration and teamwork with other professionals from different fields and levels of responsibility in the company. (CP3)

PREREQUISITES

According to the program planning and academic regulations.

CONTENTS

1. Tools for Quality Management
 - a. Client-oriented enterprises, quality and continuous improvement
 - b. Six Sigma, data-based improvement strategy: the DMAIC cycle
 - c. Statistical techniques for Six Sigma
2. Statistical Process Control
 - a. Process in statistical control
 - b. Control charts for variables
 - c. Control charts for attributes
3. Specifications and Process Capability
 - a. Variability, capability and robustness of a process
 - b. Short-term and long-term capability
 - c. Techniques for non-normal data
4. Acceptance Sampling
 - a. Need and types of sampling
 - b. Sampling plans for attributes (MIL-STD 105 and following)
 - c. Sampling plans for variables (MIL-STD 414 and following)
5. Experimental Design and Analysis
 - a. Full- and fractional factorial designs
 - b. Plackett-Burman y Taguchi designs
 - c. Surface-response methodology and optimization

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METHODOLOGY

LEARNING ACTIVITIES

Learning Activities	Hours	ECTS Credits	Competences
Lectures	23	0.8	CB1, E2, CP3
Case and Problem-Solving Sessions	23	0,8	CB1, E2, CB3, E8, CP3
Seminars	3	0.1	CB1, E2, CB4, CB3, E8, E9
Practical & Lab Work	22	0.8	CB1, E2
Presentations	22	0,8	CB1, E2, CP3
Personal study	60	2,3	CB1, E2, CB3, E8, E9, CP3
Assessment Tasks (Exams, Continuous Assessment...)	10	0,4	CB1, E2, CB4, CB3, E8, E9
TOTAL	163	6,0	

TEACHING METHODOLOGY

The face-to-face sessions combine theoretical expositions with exercises, problems and cases where students are asked to apply the concepts explained; some of the exercises are corrected immediately in the classroom, while others are proposed as personal study activities. In this latter case, students can attend solve any question in the following classes or in office hours.

Evaluation activities are carried out periodically so that students can become aware of their progress in acquiring the knowledge and skills of the course. Some of these evaluations are carried out without prior notice, in order that the students follow the course up to date, but those that have more weight in the final grade (works at the end of each chapter) are notified in advance, in accordance with the calendar planned and announced at the beginning of the course.

The course also includes practical tasks, in and out of class, devoted to solving cases to consolidate and integrate the knowledge acquired along the subject.

For their personal study, the students can rely on the notes obtained in class, complementing them with the consultation of the recommended bibliography, which is available in the IQS library. Students are encouraged to practice solving a selection of proposed problems extracted from the recommended bibliography.

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ASSESSMENT

ASSESSMENT METHODS

Assessment Methods	Weight (%)	Competences
Final Exam (A)	30	CB1, E2, CB4, CB3, E8, E9
Follow-up Activities (C)	30	CB1, E2, CB4, CP3
Reports and Presentations (E)	10	CB1, E2, CB4, CB3, E8, E9, CP3
Lab or Field Work (P)	30	CB1, E2

LEARNING OUTCOMES

Students must demonstrate that they understand the concepts and know how to use the statistical techniques that constitute the contents of the course. Accordingly, the competence CB1, E2 (Ability to understand and apply technical knowledge necessary for the practice of chemical engineering), will be assessed through activities carried out in class, reports and practical applications and the final exam.

Reporting on the lab intends to promote and assess the competences CB4 (Ability to communicate effectively, both orally and in writing, to transmit knowledge and skills in the field of chemical engineering) and CP3 (Knowledge and practice of communication tools used in enterprises).

Students must demonstrate their "capacity for observation and critical analysis in a limited and specific area" (competences CB3, E8, E9), especially by carrying out the practical tasks.

QUALIFICATION

The qualification of the course is obtained from the grades obtained through four assessment methods: Follow-up Activities (C), Reports and Presentations (E), Lab or Field Work (P), Final exam (A), by weighting them according to the weights shown above (see table of assessment methods).



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In function of the EXAMINATION PERIOD:

- First examination period (ordinary).
 - If the attendance was met and the examination was not withdrawn, being A1 the grade for the final exam, the course grade (NF) is obtained applying the following formula:

$$NC = (0,3 C + 0,1 E + 0,3 P + 0,3 A1)$$

Followed by the condition:

$$\text{IF } (C \geq 3,5 \text{ y } E \geq 3,5 \text{ y } A1 \geq 3,5 \text{ y } P \geq 3,5) \text{ THEN NF=NC;}$$

$$\text{ELSE NF}=\min (C, E, A1, P)$$

- If attendance was not met: NF = "Absent (due to lack of attendance)"
- Second examination period (ordinary):
 - If the attendance was met and the examination was not withdrawn, being A2 the grade for the final exam, the course grade (NF) is obtained applying the following formula:

$$NF = (0,3C + 0,7A2)$$

- If attendance was not met: NF = "Absent (due to lack of attendance)"
- Extraordinary examinations: The grade will be the grade obtained in the final exam.

ASSESSMENT OF THE COMPETENCES

Competences CB4 and CP3 will be assessed in the reports from the lab work. Competences CB1, E2, CB3, E8 and E9 will be assessed through the practical activities and the final exam.



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BIBLIOGRAPHY

Basic

- D.C. Montgomery, G.C. Runger. Probabilidad y Estadística aplicadas a la Ingeniería 2a Ed. Limusa-Wiley, México. (2004). ISBN: 968-18-5915-6

Additional

- Montgomery, D. C. (2012). Statistical quality control. 7th Edition. Wiley. ISBN-13: 978-1118146811
- Defeo, J. (2016). Juran's Quality Handbook: The Complete Guide to Performance Excellence. 7th Edition. McGraw-Hill Education. ISBN-13: 978-1259643613
- NIST/SEMATECH e-Handbook of Statistical Methods, <http://www.itl.nist.gov/div898/handbook/>, September 12th, 2017

DOCUMENT HISTORY

PREVIOUS REVISIONS

CURRENT REVISION

May 20th, 2019, Dr. Jordi Cuadros