Universidad Zaragoza

Year : 2020/21

29939 - Instrumental Analysis for Quality Control in the Industry

Syllabus Information

Academic Year: 2020/21
Subject: 29939 - Instrumental Analysis for Quality Control in the Industry
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 435 - Bachelor's Degree in Chemical Engineering
ECTS: 6.0
Year: 4
Semester: Second semester
Subject Type: Optional
Module: ---

1.General information

1.1.Aims of the course

The course's aim is that student interprets the fundamental concepts of:

- Quality control in chemical plants: analytical process and process analysers as a basis for quality assurance.
- Management Systems Quality. Manuals, standards and procedures.
- Characterization of solid particles.

Therefore, it provides key insights for the development of their future professional activity.

These approaches and objectives are aligned with some of the Sustainable Development Goals, SDGs, of the 2030 Agenda (https://www.un.org/sustainabledevelopment/en/) and certain specific goals, in such a way that the acquisition of the Learning outcomes of the subject provide training and competence to the student to contribute to a certain extent to their achievement:

- Goal 9: Industry, innovation and infrastructure

  Target 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

1.2.Context and importance of this course in the degree

The course ?Instrumental analysis for quality control in the industry (29939)? belongs to module of ?elective training? and is located in the second semester of the senior year. This subject is taught when the student already has basic knowledge of chemical analysis and statistics.

1.3.Recommendations to take this course

Highly recommended to have studied the subject Chemistry II (29909): «Ampliación de química I».

Class attendance, continued study and day-to-day work are essential for the student to reach successfully the proposed learning. Students should note they have availability of professor advice and group tutorial for academic counselling.

2.Learning goals

2.1.Competences

To pass this course, students will be more competent to...

Generic skills

- C03 - Ability to combine basic knowledge and the more engineering specialized to generate innovative and competitive proposals for professional activity.
- C04 - Ability to solve problems and make decisions with initiative, creativity and critical thinking.
- C05 - Ability to apply the Information and Communications Technologies to engineering.
- C06 - Ability to communicate and transmit knowledge, skills and abilities in Spanish.
- C11 - Ability to improving learning, as well as to develop independent learning strategies.

Specific skills

- C39 - Ability to design and operation of chemistry industry facilities.

2.2.Learning goals

- Be able to plan and implement a Quality Management System.
- Acquire basic skills for implementation and evaluation of quality of analytical methods and their application to industrial process control.
- Be able to properly apply the theoretical concepts in the development of chemical processes in the laboratory.
- Be able to characterize solids.
- Be able to differentiate and select the most suitable chemical analyser for a studied chemical processes.

2.3.Importance of learning goals

Learning outcomes of this course are essential for successfully future of the student professional activity. The chemical engineering plays a key role in the design, maintenance, evaluation, optimization, simulation, planning, construction and operation of plants in the process industry, which is related to the production of compounds and products whose production requires sophisticated chemical-physical matter transformations. All these tasks are difficult to carry out without a basic knowledge of both, quality systems that ensure the proper functioning of the different steps, and the instrumental resources that allow to control from raw material to finished product.

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

Option 1:

Continuous assessment that will include the validation of student work from the two viewpoints: theory and practice. To do that, it will be held:

- **Theory exam**. Will represent **25%** of the course's grade and is based on the response to open-ended questions and objective tests (test type). This examination will take place at the semester's end in the dates fixed in the examination timetable drawn up by the centre. The maximum duration will be of three hours.
- **Continuous monitoring of the laboratory work**: It will mean **35%** of the course's grade and is based on the observation of individual work in the laboratory, including terms as practice preparation, aptitude, attitude, punctuality...
- **Evaluation reports**: It will mean **40%** of the course's grade. Experimental and calculated results during work on the practical sessions will be evaluated, as well as the various presentations (individual and group ones) performed by students.

Option 2:

Students, who do not wish to carry out the evaluation according to option 1, may choose to fulfil the final exam (**100%** of the final mark) that includes both theoretical and practical part described in option 1. This test will place on the dates indicated in the examination timetable drawn up by the centre and will have a maximum duration of 3 hours.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning process will take place simultaneously at two levels: classroom lectures (supported by the new information and communications technologies) and practical work, with a gradually increasing of student implication.

In the classroom it will be developed the theoretical bases that make up the subject and will solve some model cases.

The practical classes will be an effective complement to the lectures, allowing verify topic's comprehension and, in turn, it helps to develop in students a point of view more engineering; furthermore, sessions will be held both in groups (maximum 3 students) as individual, where students must solve cases proposed by the professor and agreed by all students.

4.2.Learning tasks

The course includes the following learning tasks:

- **Lectures** (15 hours). Theoretical concepts about the course's issues will be exposed and will be solved model cases proposed on the blackboard.
- **Practical classes** (45 hours). Learned theoretical knowledge will be applied to real cases of industry.
- **Individual study** (87 hours, personal work). Student individual study, continuously throughout the semester, is recommended.

- **Final evaluation** (3 hours). A global test, where the theoretical and practical knowledge gained by the student will be assessed.

4.3.Syllabus

The **theory** agenda is as follows:

- Item 1. Introduction and characterization of solids (1 h)
- Item 2. Quality Management System: manuals, standards and procedures (2 h)
- Item 3. Electrical methods for quality control: ion-selective electrodes (1 h)
- Item 4. Optical methods for quality control: molecular and atomic spectrophotometry (5 h)
- Item 5. Chromatographic methods for quality control: liquid and gas chromatography (5 h)
- Item 6. Automatic systems for quality control (1 h)

For **practical sessions**, the following are proposed:

- Session 1. Finding information: Internet search engines. ISO and UNE Standards (4 h)
- Session 2. Computer tools for quality control: Chemometrics (4 h)
- Session 3. Development of analytical procedures (4 h)
- Session 4. Individual presentation and procedures choice to develop at the laboratory (3 h)
- Session 5. Physical and chemical characterization of solids (4 h)
- Session 6. Quality control in the oil industry (4 h)
- Session 7. Quality control in the metallurgical industry (4 h)
- Session 8. Quality control in the food industry (4 h)
- Session 9. Quality control in the pharmaceutical industry (4 h)
- Session 10. Quality control and analysis of pollutants (4 h)
- Session 11. Quality control of the finished product (4 h)
- Session 12. Presentation of results (2 h)

For the development of the practical sessions, students will be divided into working groups, each of which is assigned an analytical determination. Each group should find the necessary information for the planning and development of practice, always tutored by professors or responsible. After pooling, both students and professors will choose the determinations to be made in the laboratory. At the end of the session, each working group shall state the purpose, methodology, relevant results and conclusions.

4.4.Course planning and calendar

Lectures are held according to the schedule established by the EINA; each professor will inform about its tutoring hours.

The following table shows, progressively, an approximate distribution of time duration of the different issues in terms of hours of lectures and practices. It also indicates the approximate time that students must devote to these activities and their personal work.

	Face-to-face work (lectures or practical sessions)	Personal work
Item 1.	1 h	2 h
Item 2.	2 h	8 h
Item 3.	1 h	4 h
Item 4.	5 h	25 h
Item 5.	5 h	25 h
Item 6.	1 h	3 h
Practical sessions (1 to 12)	45 h	20 h
Exam		3 h
Total hours	15 h + 45 h	90 h

The 150 hours of student work will be divided into activities as follows:

- 15 hours of lectures in which the theoretical model and resolution of cases will be presented.
- 45 hours of practice. In each of the sessions, students will work individually or in a small group. Previously to

laboratory access, students will know which practice sessions must be carried out and must read the corresponding practice manual. Once at the laboratory, students will perform the experimental part of proposed practices, they will discuss the obtained results and will complete a practice report that includes the lab work done in terms of experimental results, calculations...

- 87 hours of personal study, spread throughout the semester.
- 3 hours for the final exam whose date will be fixed by the EINA.

In the EINA website, students maybe consult the academic calendar, course schedule and classrooms assigned. Dates and specific activities of course, as well as additional course information and documentation, will be published in the UZ online platform: Moodle (to access to content, the student must be enrolled in the course).

4.5.Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=29939