Universidad Zaragoza

Academic Year/course: 2020/21

60643 - Process and Product Control

Syllabus Information

Academic Year: 2020/21
Subject: 60643 - Process and Product Control
Faculty / School: 100 - Facultad de Ciencias
Degree: 540 - Master's in Industrial Chemistry
ECTS: 6.0
Year: 1
Semester: First semester
Subject Type: Compulsory
Module: ---

1. General information

1.1. Aims of the course

The subject and its expected results respond to the following approaches and objectives:

The course ?Process and Product Control? is a compulsory subject that is taught within the Master's Degree in Industrial Chemistry of the Faculty of Sciences. It is taught by faculty from the Department of Analytical Chemistry, and offers a broadening and deepening of the knowledge taught in the Degree in Chemistry related to the control of industrial processes. It enhances the role of Analytical Chemistry in the control of industrial processes and products, integrating itself into the generic content of the "Industrial Chemistry" master's degree.

In this subject, the student acquires competences to select and appropriately use work methodology used in solving real analytical problems that involve analytical determinations or characterization techniques related to the control of processes and products in the industry.

1.2. Context and importance of this course in the degree

The course studies analytical instrumental techniques that are poorly developed and seen in the subjects of the Degree in Chemistry. Their possibilities are critically evaluated and compared with more established techniques. In the case of instrumental techniques that have been previously seen in related degrees, these are addressed with the aim of designing, optimizing and operating an instrumental analysis procedure applied in the control of processes or a product. Specific problems are affected depending on the type of sample or industrial scope.

1.3. Recommendations to take this course

It is recommended to have passed the subjects of the Degree in Chemistry. Although introductions of basic aspects and instrumental analytical techniques will be carried out for all students, especially for those who come from other Degrees, the knowledge taught in the Degree in Chemistry related to the control of industrial processes, automation, will be expanded and deepened. sensors and biosensors.

2. Learning goals

2.1. Competences

Upon passing the course, the student will be more competent to ...

1. Know and know how to apply advanced methods and procedures of control of processes and products on an industrial scale

2. Identify, analyze and define the main elements of a problem to solve it rigorously in the Industrial Chemistry environment.

3. Communicate their conclusions and knowledge to specialized and non-specialized audiences in a clear and unambiguous way.

4. Manage learning skills that allow you to continue studying in a way that will be largely self-directed and autonomous.

5. Manage, discriminate and select the sources of bibliographic information.

6. Use scientific English both to obtain information and to transfer it.

7. Know and apply concepts related to the control of processes and products: automation, analyzers, physical sensors, chemical sensors, biosensors.

8. Identify analytical problems in the chemical industry to propose and choose the most appropriate analytical techniques for

their resolution.

9. Select strategies integrated into process and product control systems for simple problems that respond to quality and productivity parameters.

2.2. Learning goals

The student, to pass this course, must demonstrate the following results ...

1. Describe and apply analytical methods used in the control of processes and products in the chemical industry.

2. Correctly use the concepts related to the control of processes and products: automation, analyzers, physical sensors, chemical sensors, biosensors, management, quality, productivity.

3. Select strategies integrated into process and product control systems for simple problems that respond to quality and productivity parameters.

4. Assess the importance of Analytical Chemistry and its contribution to the quality control of the chemical laboratory and productivity.

2.3. Importance of learning goals

This course must allow students to acquire the necessary criteria to decide which should be the general design of an instrumental method or the choice of sensors based on the principles of Analytical Chemistry, in order to obtain information and optimize process control and products in the Chemical Industry, Biotechnoly or other. The student will know the main concepts of process control and will understand the basic principles of signal measurement. Through the practices of this subject the student will acquire the basic experimental skill in instrumental analysis methods and sensors and their application to the control of industrial processes. The student will also know the basic elements and systems of a feedback control system, its elements (sensors, transmitters, actuators and automatic regulators), software used and its application in different types of industries.

3. Assessment (1st and 2nd call)

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

The student must demonstrate that they have achieved the expected learning outcomes through the following assessment activities

CONTINUOUS ASSESSMENT

Controls of the different subjects of the subject will be carried out. In order for them to be averagable among them, each one of them will have to overcome a grade higher than 4 out of 10. The overcoming of these controls, together with the rest of activities in the indicated percentage, will exempt from the global examination. The percentages of the activities will be:

Controls: 60%

Group work (TP6): 15%

Laboratory practices: 10%

Problems and cases: 15%

The completion of laboratory practices and the Group Work will be compulsory to pass the course.

Students who do not opt ??for continuous assessment, who do not pass the subject by this procedure, or who want to upload a grade, must take a global test of the subject in the period established for this purpose in the academic calendar, on first or second call. (June and September). Said global test will suppose 100% of the grade, and it will examine all the activities carried out during the entire semester.

The number of official exams to which the registration entitles (2 per enrollment) as well as the consumption of these exams will be adjusted to the Rules of permanence in official degrees adapted to the European Higher Education Area at the University of Zaragoza and the Regulations of Learning Assessment Standards of the University of Zaragoza. The general regulations for the design of the tests and the grading system will also be adjusted to this last regulation and, according to it, the time, place and date in which the review will be held when publishing the grades will be made public.

As indicated, and according to the Regulation of the Learning Assessment Standards of the University of Zaragoza, the student will have the right to a global test in which the skills developed in the subject will be assessed. This global test will be carried out on the date established by the examination calendar of the Faculty of Sciences.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process that has been designed for this subject is based on the following:

The course is planned to be done in person, it will take place during a semester fulfilling the credits. However, you can adapt your teaching activities into non-contact activities through the ADD / moodle (online tutorials, videoconferences, tutoring through forums and non-contact evaluations).

The course will be developed through the teaching of master classes (TP1), practical classes, seminars and problems /

cases, personalized tutorials (TP2), laboratory practices (TP3), and group work (TP6). Where possible, expert conferences and visits to industries and / or laboratories will also be held.

4.2. Learning tasks

The program offered to the student, to help him achieve the expected results, includes the following theoretical contents ...

1. INTRODUCTION TO THE CONTROL OF INDUSTRIAL PROCESSES

2. THE ANALYTICAL LABORATORY IN INDUSTRY.

3. AUTOMATION OF THE STAGES OF THE ANALYTICAL PROCESS.

4. PROCESS ANALYZERS.

5. SENSORS AND BIOSENSORS.

6. APPLICATIONS OF ANALYTICAL CHEMISTRY IN THE CONTROL OF INDUSTRIAL PROCESSES.

During the development of the course different laboratory practices will be carried out whose contents will be related to the corresponding theoretical topics.

The dedication of the student (based on the ECTS credits of the course) corresponds to the following learning activities.

- Lectures (30 hours).
- Solving problems (10 hours).
- Laboratory sessions (10 hours). The contents of these sessions will be related to the theoretical contents.
- Presentation of papers (5 hours).
- Study (85 hours).
- Visits (5 hours).
- Assessment (5 hours).

4.3. Syllabus

The theoretical program of the subject includes the following topics and content summary:

1. CONTROL OF INDUSTRIAL PROCESSES

Introduction to process control. Concepts and terminology. Definition and location of the elements of a control loop. Instrumentation and sensors. Differences between process analyzers and laboratory analysis. Types of applications. Sequential and continuous processes. Process automation.

2. THE ANALYTICAL LABORATORY IN INDUSTRY.

Laboratory information management systems (LIMS). Analytical control networks. Automation and productivity. Instrumental analytical techniques in the control of industrial processes: optical, electroanalytical and chromatographic techniques. Chemometry in the technology of the analytical process. Analytical properties. Analytical quality.

3. AUTOMATION OF THE STAGES OF THE ANALYTICAL PROCESS.

Automation of the analytical method. Laboratory analyzers. Stages to automate: sampling, sample preparation, measurement. Forms and degrees of automation. On-line, discontinuous, continuous automation. Segmented and non-segmented flow. Continuous and discontinuous online analyzers. Automatic titrators. Comprehensive automated analyzers: examples in the industry.

4. PROCESS ANALYZERS.

Total chemical analyzers. Industrial process analyzers. Analyzer types: continuous and discontinuous. Foundations and components. Classification. Sampling systems and conditioning of the sample. Types of analyzers based on physico-chemical properties. Examples of process analyzers in industry

5. SENSORS AND BIOSENSORS.

Physical sensors in the control of industrial processes. Chemical sensors and biosensors in the control of industrial and biotechnological processes. Types of transduction and (bio) recognition reagents. Immobilization procedures. Applications of sensors and biosensors in the chemical, agri-food and biotechnology industries. Acoustic sensors in the chemical industry.

6. APPLICATIONS OF ANALYTICAL CHEMISTRY IN THE CONTROL OF INDUSTRIAL PROCESSES.

Examples of process control in the chemical industry. Examples of process control in the agri-food, pharmaceutical and biotechnology industries. Examples of control of physical parameters and chemical composition. Trends in Analytical Chemistry in Process Control Technology. Emerging areas of process control applications.

4.4. Course planning and calendar

The calendar and times of the course in its face-to-face sessions can be found at: http://ciencias.unizar.es/web/horarios.do

The beginning and end of the course will be marked by the academic calendar of the Faculty of Sciences, taught during the first semester of the academic year.

The specific dates on which the different controls and delivery of work will take place throughout the course will be

communicated to the students in advance.

The global assessment tests will take place on the dates determined in the calendar of the Faculty of Sciences (consult the bulletin board or on the website: http://ciencias.unizar.es/web/horarios.do). These tests will preferably be carried out in person, although they could be carried out totally or partially through the ADD / moodle (tasks and questions) in person.

4.5. Bibliography and recommended resources

BB Bakeev, K.A., Process Analytical Technology spectroscopy tools and implementation startegies for the chemical and pharmaceutical industries, 2nd ed., Willey, 2010.

BB Mermet, J.M. Analytical chemistry: a Modern Approach to Analytical Science, 2nd ed. Wiley-Blackwell. 2014.

BR Ollero P., y Fernández E., Control e instrumentación de procesos químicos, Madrid, Síntesis, 1997.

BB Valcárcel, M. y Cárdenas, M.S., Automatización y miniaturización en Química Analítica, Barcelona, 2000.

BB Eggins,B.R., Chemical sensors and biosensors, John Wiley and sons, 2003.

BR Banica, F.C., Chemical Sensors and Biosensors: fundamentals and applications,. Wiley-Blackwell, 2012.

BR Rasooly, A., Biosensors and Biodetection: Methods and Protocols Volume 1: Optical-Based Detectors, Press/Springer, 2009.

BR Baltes, W., Rapid methods for analysis of food and food raw material, Technomic Pub, 1990.