

## 60643 - Process and Product Control

### Syllabus Information

**Academic year:** 2024/25

**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

The subject "**Process and Product Control**" is a compulsory subject of the Master's Degree in Industrial Chemistry taught by teacher from the analytical chemistry area, which broadens and deepens the knowledge of the Degree in Chemistry related to industrial process control. The student acquires competences to select and use analytical methodology to solve real problems or for characterization techniques related to the control of processes and products in the industry.

These approaches and objectives are aligned with the following **Sustainable Development Goals (SDGs)** of the United Nations Agenda 2030 (<https://www.un.org/sustainabledevelopment/es/>) in such a way that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement:

Objective 4: Quality education.

Objective 6: Clean water and sanitation.

Goal 7: Affordable and non-polluting energy.

### 2. Learning results

Upon completion of the subject, the student will be able to:

-Know and apply procedures for the control of processes and products on an industrial scale.

-Use the appropriate terminology on concepts related to process and product control: control loops, automation, process analysers, physical sensors, chemical sensors, biosensors.

-Know the most suitable instrumental analytical techniques, biosensors and process analysers for the different applications of process control in the chemical industry.

-Identify and define the main elements of real industrial problems in order to propose the most appropriate analytical techniques and control elements to solve them.

-Design the analytical methodology according to the different applications of process control in the chemical, biotechnological and food industries, or in industries related to the biomedical, clinical and environmental fields.

-Manage, distinguish and select the most appropriate sources of scientific information.

-Use scientific English, both to obtain information and to transfer knowledge.

-Summarize and communicate scientific findings and knowledge to specialized and non-specialized audiences.

### 3. Syllabus

#### 1. CONTROL OF INDUSTRIAL PROCESSES

Introduction, concepts and terminology. Control loops. Instrumentation. Automation.

#### 2. ANALYTICAL CONTROL OF OFF-LINE PROCESSES

Automation levels. Laboratory analyzers. Automatic instrumental titrators.

#### 3. INDUSTRIAL ANALYZERS FOR GENERAL USE AND BASED ON UV-Visible EAM.

Analytical problems in process control. LIMS. Analyzers that are based on global measurements: Density, Refractive index, Conductivity. Tools for the application of molecular techniques in processes: Kubelka-Munk model and multivariable methods. Study of analyzers based on the UV-visible zone: Gas analysis, indirect analysis in liquid phase and color measurement.

#### 4. INDUSTRIAL ANALYZERS BASED ON INFRARED MOLECULAR SPECTROMETRY.

Molecular absorption in the near IR: Multivariable methods applied to solids (food. Drugs) and gases (TDL systems). Molecular absorption in the measured IR: equipment based on Gas Filter Correlation and Fourier Transform. Raman spectrometry: application in the biotechnology and polymer industries; Portable equipment for drug and explosives control is being studied.

#### 5. INDUSTRIAL ANALYZERS BASED ON OTHER TECHNIQUES.

Analyzers based on X-ray Fluorescence and Neutron Activation for solid samples. Analyzers based on potentiometry: different types of pH electrodes (ISFET). In-line and on-line chromatographic techniques: ion chromatography, gas chromatography (instrumentation for controlling the composition of Natural Gas) and molecular exclusion chromatography (polymer industry).

## 6. SENSORS AND BIOSENSORS IN THE CONTROL OF INDUSTRIAL AND BIOTECHNOLOGICAL PROCESSES.

General aspects (sensor concept, components and properties). Sensors for gases: flammability, toxicity and O<sub>2</sub> level (different types of sensors depending on their operating basis). Biosensors: immunoassay-based lateral flow sensors and enzymatic sensors.

## 7. APPLICATIONS OF ANALYTICAL CHEMISTRY IN THE CONTROL OF INDUSTRIAL PROCESSES.

Examples of process control in the chemical industry, agri-food industry, pharmaceutical industry and biotechnology. Trends and emerging areas.

## 4. Academic activities

**Teaching-learning tasks (6 ECTS):**

- **TP1 type activities**(30 h.): lectures that complete the theoretical program of the subject.
- **TP2 type activities**(25 h.): study of problems and real cases of control in manufacturing processes in the chemical industry.
- **TP6 type activities**(5 h.): small groups will work on a specialized topic on the contents of the subject. The activity includes the search and reading of bibliographic information, writing of a report, preparation of a summary presentation with the most essential information and public presentation. Personalized tutoring with the teacher will be provided.
- **Assessment controls**(5 h.): set of continuous assessment controls both written and oral.
- Student´s autonomous work**(85 h.): study of the subject´s topics and completion of assignments and reports.

## 5. Assessment system

The student must demonstrate that they has achieved the expected learning results through the following **assessment activities**:

### CONTINUOUS ASSESSMENT

There will be exams on the different topics of the subject, whose grades will be averaged provided that, individually, they are higher than 4 out of 10. If the student passes these exams, along with the rest of the activities in the indicated percentage, they will not need to write the global assessment exam. The percentages of the assessment of the subject´s topics will be:

Assessment controls: **70%**

Group work (TP6 activity):**15%**

Problem solving and case studies:**15%**

The completion of the **group work** (activity TP6) will be mandatory to pass the subject.

### GLOBAL ASSESSMENT

Students who do not opt for continuous assessment who do not pass the subject by this procedure, or who want to improve their grade, must take a **global test** of the subject in the first or second call. This global test will account for 100% of the grade, and it will cover all the activities of the subject on the dates provided by the examination calendar of the Faculty of Sciences.

## 6. Sustainable Development Goals

- 4 - Quality Education
- 6 - Clean Water and Sanitation
- 7 - Affordable and Clean Energy