Universidad Zaragoza

Academic Year/course: 2024/25

60640 - Industrial Chemistry

Syllabus Information

Academic year: 2024/25
Subject: 60640 - Industrial Chemistry
Faculty / School: 100 - Facultad de Ciencias
Degree: 540 - Master's in Industrial Chemistry
ECTS: 10.0
Year: 1
Semester: Annual
Subject type: Compulsory
Module:

1. General information

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

- To know the main chemical products obtained in the industry, their methods of production and most common uses.
- To know the environmental and energy aspects related to the chemical industry.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (https://www.un.org/sustainabledevelopment/en/), so that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement: Goal 6: Clean Water and Sanitation; Goal 7: Affordable and Clean Energy; Goal 8: Decent Work and Economic Growth; Goal 9: Industry, Innovation and Infrastructure; Goal 12: Responsible Production and Consumption.

It is recommended to have a degree in chemistry, biochemistry, biotechnology, chemical engineering or other studies related to chemistry.

2. Learning results

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

- Know the most widely used industrial chemical processes, both for obtaining final products and intermediate ones from other syntheses.
- Know raw material sources as a basic factor in any process and in the implications thereof, both in terms of energy needs and waste generation.
- Know differential factors between laboratory-scale and industrial-scale synthesis: yields, selectivity, by-product and co-product, availability of raw materials, energy requirements, process evolution, etc.

The student will have acquired the following competencies, being able to:

- Describe and propose applications of various advanced methodologies in the chemical industry.
- Recognize the impact of chemical products and processes on the environment and propose methods to assess and reduce it.
- Be familiar with and know how to apply in detail advanced methods and procedures for process and product control on an industrial scale.
- Identify, analyse and define the main elements of a problem to solve it with rigor in the industrial chemistry environment.
- Develop a complex work in the industrial chemistry environment, participating in the stages of bibliographic search, planning, obtaining results and their interpretation and dissemination.
- Master the technical and management tools for research and development of processes, products and services in the chemical and related industries, including knowledge management skills and the ability to develop and apply original ideas and to lead projects.
- Manage, differentiate and select sources of bibliographic information.
- Effectively use information and communication technologies as a work tool. Use scientific English for both information gathering and information transfer.
- Know the main sources of raw materials and alternatives, as well as their origins.
- Know the applications of industrially produced chemicals and their implications on supply sources, the environment and health.
- Optimize industrial processes.

3. Syllabus

General aspects of the chemical industry

Industrial inorganic chemistry

Water and its problems

Chemical products obtained from air

Industrial production of hydrogen and derivatives.

Production of halogens and derivatives: The chlor-alkali industry. Sodium and potassium

Industrial production of nitrogen-derived compounds

Phosphorus and derived compounds

Industrial production of sulphur, sulfuric acid and sulfuric acid derivatives

Carbon and silicon. Obtaining derivatives

Alkaline earthy

Aluminium production

Iron and steel production

Other metals of industrial importance

Industrial organic chemistry

Main sources of industrial organic chemicals.

Basic products of industrial organic chemistry.

Basic chemical products derived from natural gas and oil.

Chemical products of fraction C1.

Chemical products from coal derivatives.

Chemical products from renewable sources: use of biomass.

Catalysts in the organic chemical industry.

Sectors of application of organic chemistry: most consumed organic products Fine chemistry.

An example of organic chemical industry on a large scale: plastics.

An example of fine chemistry: the pharmaceutical industry.

Other sectors: surfactants, perfumes and cosmetics, colorants and pigments, food additives, pesticides and biocides.

Seminars

4. Academic activities

Methodology:

The learning process designed for this subject is based on the development of the following activities:

- Master Classes
- Seminars developed by the student and supervised by the teachers responsible for the subject.
- Talks by professional experts from outside the university.
- Debates on topics of interest related to the subject.
- Visits to related companies, institutions, thematic fairs, etc.

In the master classes and seminars, student participation will be encouraged through questions, debates and case presentations.

Visits to the companies will be preceded by an explanation of the processes to be learned "in situ".

The conferences and seminars will be accompanied by the contribution of complementary bibliographic material. Dialogue between students and outside professionals will be facilitated through post-exposition discussions.

All training activities will be duly documented by means of bibliography, notes designed *ad hoc*, etc.

5. Assessment system

The final grade for the subject will be the best of the grades obtained by the student between two alternative formulas.

FORMULA 1:

Weighted average of a series of assessment activities detailed below:

Seminars:

Preparation, oral presentation and discussion of individual or group papers or reports on topics of the subject. Each student will present a paper in class on a previously agreed upon topic. The presentation and subsequent discussion will be assessed It will be graded between 0 and 10 points.

Contribution to the final grade: 20%.

Class participation and other activities:

The student's attitude and active participation in class and in the rest of the face-to-face activities will be considered, including the exposition of their classmates' work, lectures by experts and visits to companies. It will be graded between 0 and 10 points.

Contribution to the final grade: 5%.

Written tests:

The knowledge and skills acquired will be assessed through the completion of at least one written test at the end of each term. The tests will consist of a series of questions and theoretical and practical application exercises on the different concepts learned during the term. The questions and exercises will deal with the subject topics indicated in sections 3 and 4 and with the contents of the class seminars, expert lectures, industry visits and other learning activities. The possibility of additional written tests will be indicated at the beginning of each semester.

Written tests will be graded between 0 and 10 points.

Contribution to the final grade: 75%.

The subject will be considered as passed if the weighted average of the grades according to the indicated percentages is equal to or higher than 5. However, it is a mandatory requirement to have passed 40% of the grade in the seminar and written test sections, independently, in each of the tests taken.

FORMULA 2:

Final written test on all the contents covered in the subject, including seminars, with the characteristics described for the formula 1 written tests.

It will account for 100% of the final grade.

6. Sustainable Development Goals

6 - Clean Water and Sanitation
9 - Industry, Innovation and Infrastructure
12 - Responsible Production and Consumption