Course guide
240656 - 240656 - Chemical Processes From the Industrial Reality

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** English

LECTURER

Coordinating lecturer: Rosa Maria Darbra Roman

Others: Huisman, Ingmar Harald

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Capacity to understand and apply basic knowledge principles of general chemistry, organic and inorganic chemistry and their engineering applications.
2. Basic knowledge of industrial production systems.

Transversal:
3. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
4. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
5. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
6. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.

TEACHING METHODOLOGY

Chemical plants visits
Lectures
Practical classes
Seminars from invited speakers
Independent learning
Learning through projects, problems and case-studies (team project)

LEARNING OBJECTIVES OF THE SUBJECT

The objective of this subject is to provide an overview of the chemical industry and also about its diversity of products. Therefore, it is essential to visit chemical plants to get acquainted with the production processes that will be explained in class. Special emphasis is made on the safety and environmental aspects related to these processes.

The specific objectives of this subject are:

1- Make the student aware of the diversity of products and industries related with the industrial chemistry.
2- Identify the raw materials and intermediate products used in the chemical production at large scale.
3- Understand the different physico-chemical processes that allow the transformation of these raw materials to a final product.
4- Describe relevant processes for the chemical industry.
5- Assess the safety and environmental aspects related to the chemical processes.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	45,0	40.00
Self study	67,5	60.00

Total learning time: 112.5 h

CONTENTS

Chapter 1. Introduction to Chemical Industry

Description:
Chemical industry importance at Spanish level and at a global scale. Chemical process definition. Key aspects for its success. Environmental and safety aspects in the chemical industry.

Specific objectives:
Objectives 1 and 5.

Related activities:
Lectures (2h)
Practical exercises
1 home assigment
Practical classes on environmental aspects in the industry (2h)
1 paper to read at home about the chemical engineer studies

Full-or-part-time: 8h
Theory classes: 2h
Practical classes: 2h
Self study : 4h

Chapter 2. Raw materials used by the chemical industry

Description:
Main natural sources of raw materials for the chemical industry: litosphere, hydrosphere, atmosphere and biosphere.

Specific objectives:
Objectives 2 and 5.

Related activities:
Lectures (2h)
Practical exercices
Chemical plant visit (4h)

Full-or-part-time: 14h
Theory classes: 6h
Self study : 8h

Chapter 3. Petroleum and Petrochemical industry

Description:
Petroleum industry at global scale. Refining industry, main steps and final products. Petrochemical industry introduction. Explanation of obtention of some derivates. Uses and applications. Plastics case study.

Specific objectives:
Objectives 3, 4 and 5.

Related activities:
Lectures (4h)
Practical exercises (1h)
1 home assigment
2 papers to read at home
Chemical Plant Visit (4h)
Starting the team project preparation
Seminar from an invited speaker (2h)

Full-or-part-time: 27h 30m
Theory classes: 11h
Self study : 16h 30m

Chapter 4. Detergents industry

Description:
Detergents industry introduction. Environmental aspects. Main characteristics and functioning. Soap and synthetic detergents production. Formulations.

Specific objectives:
Objectives 2, 3, 4 and 5.

Related activities:
Lectures (3h)
Practical exercises
1 home assigment
1 chemical plant visit (4h)
Team project development

Full-or-part-time: 15h
Theory classes: 7h
Self study : 8h

Chapter 5. Fertilizers industry

Description:
Fertilizers introduction. Sulphuric acid, Phosphoric acid and Nitric acid production. Environmental and safety aspects.

Specific objectives:
Objectives 3, 4 and 5.

Related activities:
Lectures (3h)
Practical exercise
1 chemical plant visit (4h)
Team project development

Full-or-part-time: 16h
Theory classes: 7h
Self study : 9h

Chapter 6. Cement industry

Description:
Introduction to the cement industry. Raw materials characteristics. Production process. Uses and applications. Environmental and safety related issues.

Specific objectives:
Objectives 2, 3, 4 and 5.

Related activities:
Lectures (2h)
Practical exercises at class
1 paper to read at home
Practical class on safety at the industry (2h)
Final redaction of the team project report

Full-or-part-time: 15h
Theory classes: 2h
Practical classes: 2h
Self study : 11h

Chapter 7. Paper industry

Description:
Introduction to the paper importance at a global scale. Different types of paper. Manufacturing processes. Environmental aspects related to paper production.

Specific objectives:
Objectives 2, 3, 4 and 5

Related activities:
Lectures (2h)
1 home assigment
Preparation of the team project presentations
Team project presentations at class (4h)
Self study

Full-or-part-time: 17h
Theory classes: 6h
Self study : 11h

ACTIVITIES

LECTURES

Description:
Explain the contents of this subject.

Specific objectives:
To comply with those set in this subject.

Material:
Slides, exercises and papers. All the material is available on-line (atenea).

Delivery:
Home assigments. Mid-term exam and Final exam.

Full-or-part-time: 52h 30m
Theory classes: 21h
Self study: 31h 30m

VISITS

Description:
The visits to chemical plants will allow the students to have a first-hand view of the chemical processes at a large scale.

Specific objectives:
Objectives from 1 to 6.

Material:
The one provided by the company.

Full-or-part-time: 20h
Theory classes: 16h
Self study: 4h

PRACTICAL CLASSES

Description:
There will be two practical classe, one on environmental aspects in the industry and the other on safety aspects.

Specific objectives:
Objective 5

Material:
Slides on-line (atenea)

Delivery:
Final test

Full-or-part-time: 6h
Practical classes: 4h
Self study: 2h

TEAM PROJECT

Description:
Each team will focus on a different chemical product used in the every day life. The students will learn its production process from the raw material to the final product. They will explain this to the rest of the class.

Specific objectives:
The students will face a new challenge: the production of a product that it is unkown. They will have to find the way to understand and explain this process to the rest of the class.

Material:
Bibliographic research, chemical plant visits, professors inquiries, etc.

Delivery:
Final report and presentation delivery at the end of the term.

Full-or-part-time: 34h
Theory classes: 4h
Self study: 30h

GRADING SYSTEM

First-term exam: 35% of the final qualification
Second-term exam: 35% of the final qualification
Team project: 20% of the final qualification
Visits report: 10% of the final qualification
Practical classes: 10% of the final qualification

EXAMINATION RULES.

- Each exam is independent. The first-one assesses the topics explained up to mid-term and the final exam, the rest of topics until the end of the course.

- The second term exam will be done the day of the final exam.

- The reevaluation exam will only substitute the qualifications obtained in the mid-term and second-term exams. The final work, the practical classes and the visits reports are not reevaluated. The student have to do at least one evaluation event to obtain a final qualification.

- The visits to chemical plants are not compulsory, but they are another class. Therefore, their content can be asked in the exams.

BIBLIOGRAPHY

Basic:
- Austin, George T. Manual de procesos químicos en la industria. Méxic: McGraw-Hill, 1992. ISBN 9701003888.
- Calleja, G. et al. Introducción a la ingeniería química. Madrid: Sintesis, 2008. ISBN 8477386641.
- Kelly, A. ; Harris, M.J. Gestión del Mantenimiento industrial. Madrid: Fundación Repsol Publicaciones, 1998. ISBN 8492350601.
- Ramos Carpio, M.A. Refino de petróleo, gas natural y petroquímica. Madrid: Fundación Fomento Innovación Industrial, 1997. ISBN 8460567559.
- Riegel, Emil Raymond; Kent, James Albert. Kent and Riegel's handbook of industrial chemistry and biotechnology [on line]. 11th ed. , edited by James A. Kent. New York: Springer, cop. 2007 [Consultation: 13/04/2021]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=993635. ISBN 9780387278421.

Complementary:
- Vian, A. Introducción a la química industrial. 2a ed. Madrid: Reverté, 1994. ISBN 842917933X.
- Weissermel, K. Química orgánica industrial : productos de partida e intermedios más importantes. Barcelona: Reverté, 1981. ISBN

9788429179897.
- Jones, D. S. J. Elements of petroleum processing. Chichester: John Wiley & Sons, 1995. ISBN 0471964891.
- Stephenson, R.M. Introducción a los procesos químicos industriales. Mèxic: CECSA, 1974.
- Chauvel, A. Procédés de pétrochimie : caractéristiques techniques et économiques. 2a ed. Paris: Technip, 1985-1986. ISBN 2710804859.