

Course guide

320068 - RSTM - Environmental Risk, Safety and Technology

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Xavier Colom

Others: Xavier Colom
Gemma Molins

PRIOR SKILLS

In order to successfully achieve the objectives of this subject, it is recommended to have passed the ENVIRONMENTAL TECHNOLOGIES AND SUSTAINABILITY subject

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

4. CHE: ability to analyse, design, simulate and optimise processes and products.

5. CHE: Knowledge of material and energy balances, biotechnology, the transfer of materials, separation operations, chemical reaction engineering, the design of reactors, and the reuse and transformation of raw materials and energy resources.

Transversal:

1. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

TEACHING METHODOLOGY

In order for students to meet the objectives and acquire the competencies described above, this subject is organised in three different types of sessions:

- Face-to-face lecture and applied sessions.
- Distance independent-learning sessions.
- Distance teamwork sessions.

Face-to-face lecture and applied sessions:

In the lectures, the lecturer will introduce the theoretical fundamentals of the subject, concepts, methods and results, which will be illustrated with relevant examples to facilitate their understanding.

Most of the topics will be covered in the following types of classes:

- Lectures, with problem-solving examples.
- Lecturer-led problem-solving.
- Problem-solving in small groups (2-3 students) or individually. The lecturer will mark some of the problems assigned in class and return them to the students, so that they may track their progress over the course of the semester. These problems will count towards students' final marks.

Students' understanding of the content will be assessed over the course of two two-hour sessions.

Distance independent-learning sessions:

Students are expected to spend time outside of class studying the theoretical content in order to understand it and apply it correctly. Students should divide this time between the study of theoretical foundations and the application of these foundations to solve problems assigned by the lecturer. The lecturer will mark some of the assigned problems and return them to the students, so that they may track their progress over the course of the semester. These problems will count towards students' final marks.

Distance teamwork sessions:

Students are expected to spend time outside of class working in teams of at least four students to solve one of the exercises assigned by the lecturer. Using appropriate bibliographical sources, each student will have to search for instructions on how to correctly carry out the practical, draft a protocol, and orally present the protocol to the other students and the lecturer.

Each team will have tutoring/consulting time with the lecturer prior to the oral presentation.

The subject has been designed to ensure that students attain Level 2 of the independent learning, oral and written expression and teamwork competencies, although the last of these will not be assessed.

Students will receive communications and notifications by means of the UPC Virtual Campus, which is currently available to lecturers and students.

LEARNING OBJECTIVES OF THE SUBJECT

In this subject, students will learn to do the following:

- Identify the main pollutants associated with industrial activities, processes and services, as well as the potential environmental impacts that they generate.
- Identify the most significant environmental problems derived from industrial activities, processes and services and propose solutions to these impacts.
- Apply the knowledge acquired to prevent and minimise pollution in the treatment of sewage, waste, air and energy.
- Identify and apply various renewable energy sources and the principles of energy saving and efficiency.
- Apply environmental management systems: EMAS and ISO 14001. Environmental impact assessment Environmental audits. Lifecycle analysis.
- Identify the hazards associated with industrial facilities and jobs.
- Apply hazard-analysis techniques and regulatory compliance protocols for occupational hazard prevention.
- Identify European, Spanish, regional and local environmental regulations.
- Ensure compliance with the applicable regulations in all activities.

STUDY LOAD

| Type | Hours | Percentage |
|--------------------|-------|------------|
| Hours large group | 45,0 | 30.00 |
| Hours medium group | 15,0 | 10.00 |
| Self study | 90,0 | 60.00 |

Total learning time: 150 h

CONTENTS

INTRODUCTION

Description:

Conceptes bàsics de la tecnologia ambiental i anàlisi de riscos i seguretat.

Specific objectives:

On completing this topic, students will be able to:

- Identify and correctly interpret laws in order to comply with applicable environmental regulations.

Full-or-part-time: 5h

Theory classes: 2h

Self study : 3h

TOPIC 2: Waste Water Treatment

Description:

- The various wastewater treatment methods.
- Primary wastewater treatment.
- Secondary wastewater treatment.
- Tertiary wastewater treatment.
- Wastewater treatment unit processes.
- Parameters/criteria for selecting a treatment type.

Specific objectives:

On completing this topic, students will be able to:

- Understand the laws that apply to wastewater and its treatment.
- Identify the various treatment types for a particular type of wastewater.
- Identify the basic steps of a wastewater treatment process.
- Identify, understand and develop the reactions involved in wastewater treatment.
- Correctly calculate the physical, chemical and biological processes involved in various types of wastewater treatment.

Full-or-part-time: 15h

Theory classes: 5h

Practical classes: 2h

Self study : 8h

TOPIC 4: GAS TREATMENT

Description:

- Various gas treatment methods.
- Gas treatment unit processes.
- Parameters/criteria for selecting a type of treatment.

Specific objectives:

On completing this topic, students will be able to:

- Understand regulations on air pollution and treatments.
- Identify air pollution impacts.
- Identify the various treatment types for a particular type of atmosphere.
- Identify the basic steps of a gas treatment process.
- Identify, understand and develop the reactions involved in gas treatment.
- Correctly calculate the physical, chemical and biological processes involved in various types of gas treatment.

Full-or-part-time: 10h

Theory classes: 3h

Practical classes: 1h

Self study : 6h

TOPIC 5: Energy Management

Description:

- Impacts associated with energy generation and consumption. Analysis.
- Renewable energy sources.
- Energy saving and efficiency.

Specific objectives:

On completing this topic, students will be able to:

- Understand the laws that apply to energy management.
- Identify the impacts of energy generation, transport and consumption.
- Identify the various sources of renewable energy.
- Assess the sustainability of renewable energy use.
- Understand and apply the mechanisms of energy-efficiency systems.

Full-or-part-time: 23h

Theory classes: 6h

Practical classes: 2h

Self study : 15h

CONTAMINACIÓ ATMOSFÈRICA I TRACTAMENT DE GASOS

Description:

Contaminació ambiental.

Emissió i immissió de contaminants.

Transport de contaminants.

Qualitat de l'aire.

Contaminants atmosfèrics.

Sistemes de control de les emissions.

Specific objectives:

Al finalitzar el tema l'alumne haurà de ser capaç de:

- Conèixer els elements tecnològics que afecten a la gestió de la contaminació atmosfèrica.
- Identificar els diferents focus contaminats de l'atmosfera.
- Conèixer els mecanismes que afecten als contaminants atmosfèrics.

Full-or-part-time: 8h

Theory classes: 3h

Practical classes: 1h

Self study : 4h

TOPIC 6: ENVIRONMENTAL MANAGEMENT SYSTEMS

Description:

- Minimisation methods and techniques.
- Modification of production processes, reuse, recycling and recovery.
- Environmental audits
- Environmental impact assessment.
- Lifecycle analysis.
- Environmental management systems: EMAS and the ISO 14000 standards.

Specific objectives:

On completing this topic, students will be able to:

- Understand and correctly apply all environmental regulations.
- Correctly apply the methods for consumption minimisation, reuse and recovery.
- Understand and systematically carry out basic environmental audits.
- Understand and systematically carry out basic environmental impact assessments.
- Understand and systematically implement EMAS and ISO 14001 in basic processes.
- Understand and systematically carry out lifecycle analyses.

Full-or-part-time: 14h

Theory classes: 3h

Practical classes: 1h

Self study : 10h

RISC EN EL TRANSPORT DE MERCADERIES PERILLOSES

Description:

Reglament Europeu sobre el transport de mercaderies perilloses (ADR)

Obligacions del consellers de seguretat

Specific objectives:

Al finalitzar el tema l'alumne ha de ser capaç de:

Classificar les mercaderies perilloses per al seu transport per carretera

Identificar les disposicions d'embalatge i transport per carretera de les mercaderies perilloses

Aplicar els procediments d'expedició de les mercaderies perilloses

Actuar com a conseller de seguretat en el transport de mercaderies perilloses d'una empresa

Full-or-part-time: 15h

Theory classes: 5h

Practical classes: 2h

Self study : 8h

TOPIC 8: WORKPLACE SAFETY. OCCUPATIONAL HAZARD PREVENTION

Description:

- The law on occupational hazard prevention.
- Safety management and occupational hazard prevention: preventive organisation, risk assessment, and the planning of measures/activities to eliminate or reduce risk.
- The OSHAS occupational hazard management system.

Specific objectives:

On completing this topic, students will be able to:

- Understand and correctly apply all occupational hazard prevention regulations.
- Identify and assess the various elements that may lead to occupational hazards.
- Identify prevention and/or correction measures to apply in order to minimise risk.
- Understand and correctly apply occupational hazard regulations.
- Understand with the OSHAS occupational hazard management system.

Full-or-part-time: 11h

Theory classes: 3h

Practical classes: 2h

Self study : 6h

TOPIC 9: INTEGRATED MANAGEMENT SYSTEMS

Description:

- Integration of environmental management systems with the occupational hazard management system.

Specific objectives:

On completing this topic, students will be able to:

- Understand the advantages and disadvantages of system integration.

Full-or-part-time: 17h

Theory classes: 5h

Practical classes: 2h

Self study : 10h

(ENG) ANALISI QUANTITATIVA DEL RISC

Description:

Avaluació de conseqüències: models de vulnerabilitat (Pròbit).

Arbres de fallades

Arbres d'esdeveniments

Freqüències

Specific objectives:

Al finalitzar el tema l'alumne ha de ser capaç de:

Avaluar les conseqüències dels accidents industrials mitjançant els models de vulnerabilitat.

Conèixer les metodologies que permetin quantificar el risc associat a una instal·lació industrial

Full-or-part-time: 8h

Theory classes: 3h

Self study : 5h

GRADING SYSTEM

- 1st exam: 35%
- 2nd exam: 35%
- Practical activities: 30%

Unsatisfactory results of the first exam may be redirected by a written test to be held on the day set for the final exam. This test can be accessed by students with a grade of less than 5 in this assessment act. The grade of the test will have a maximum grade of 5. The grade obtained by the application of the renewal will replace the initial grade of the first exam as long as it is higher.

For those students who meet the requirements and take the re-assessment exam, the grade of the re-assessment exam will replace the grades of all assessment acts that are face-to-face written tests (controls, partial exams and final) and the qualifications of practices, works, projects and presentations obtained during the course will be maintained.

If the final grade after the re-assessment is lower than 5.0 it will replace the initial one only if it is higher. If the final grade after the re-assessment is greater than or equal to 5.0, the final grade of the subject will be passed 5.0.

BIBLIOGRAPHY

Basic:

- Davis, Mackenzie L.; Cornwell, David A. Introduction to environmental engineering. 4th ed. Dubuque: McGraw-Hill, 2008. ISBN 9780072424119.
- Henry, J. Glynn; Heinke, Gary W. Ingeniería ambiental. 2ª ed. México: Prentice-Hall, 1999. ISBN 9701702662.
- Kiely, Gerard. Environmental engineering. Boston: McGraw-Hill, 2007. ISBN 0070634297.
- Casal Fàbregas, J. [et al.]. Anàlisi del risc en instal·lacions industrials. Barcelona: Edicions UPC, 1996. ISBN 8489636079.
- Peavy, H.S.; Rowe, D.R.; Tchobanoglous, G. Environmental engineering. New York: McGraw-Hill, 1985. ISBN 0070491348.

Complementary:

- Torres López, A.; Capdevila, I. Medi ambient i tecnologia: guia ambiental de la UPC [on line]. Barcelona: Edicions UPC, 1998 [Consultation: 12/05/2020]. Available on: <http://hdl.handle.net/2099.3/36198>. ISBN 8483012782.
- Casal Fàbrega, J. Evaluation of the effects and consequences of major accidents in industrial plants. Amsterdam: Elsevier, 2008. ISBN 9780444530813.
- Metcalf & Eddy. Wastewater engineering: treatment and reuse. 4th ed. Boston: MacGraw-Hill, 2003. ISBN 0070418780.
- Edzwald, James K. Water quality and treatment: a handbook on drinking water. 6th ed. New York: McGraw-Hill, 2011. ISBN 9780071630115.
- Dorf, Richard C. Technology, humans and society: toward a sustainable world [on line]. San Diego: Academic Press, 2001 [Consultation: 03/10/2022]. Available on: <https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780122210907/technology-humans-and-society>. ISBN 9780122210907.