



PERSONA CIÈNCIA EMPRESA  
UNIVERSITAT RAMON LLULL

## COURSE: ENVIRONMENTAL TECHNOLOGY

**SUBJECT MATTER:** Environmental Technology  
**MODULE:** Core Topics of Industrial Engineering  
**PROGRAM:** Degree in Chemical Engineering

Page 1 of 6

### GENERAL CHARACTERISTICS

**Type:**  Basic Formation,  Compulsory,  Elective

Final Degree Project,  Internship

**Duration:** Semestral

**Semester/s:** 6

**Number of ECTS credits:** 4

**Languages:** Catalan, Spanish, English

### DESCRIPTION

#### SHORT DESCRIPTION AND JUSTIFICATION

Description and analysis of the ecosystems and its energy and mass fluxes, as well as an approximation to the anthropogenic pressure done over the environment. Approximation to the contamination vectors as collateral effect in human activities of transformation of material and energy resources and the environmental technologies that must be associated to those transformations with the objective of minimizing its impacts. Environmental management oriented to the prevention and control of environmental impacts as well as applying efforts during time about a continuous enhancement of the industrial processes. The course is oriented to educate students in Chemical Engineering able of identifying the environmental aspects and impacts of the industry in order to minimize, prevent and solve them.

#### COMPETENCES

- Be able to understand and apply knowledge of Chemistry and Engineering for its application in the field of Chemical Engineering. **(E2)**
- Be able to analyze, integrate and interpret data and information from the field of Chemical Engineering. **(E8)**
- Be able to assess the risks in the use of chemical and biological substances and the processes in which they are involved. **(E11)**.
- To be able to assess the impact of their professional activity on the sustainable development of society. **(T3)**.
- Basic knowledge and application of environmental technologies and sustainability. **(CRI10)**

#### PREVIOUS REQUIREMENTS

According to current academic teaching planning and regulations.



PERSONA CIÈNCIA EMPRESA  
UNIVERSITAT RAMON LLULL

## **COURSE: ENVIRONMENTAL TECHNOLOGY**

**SUBJECT MATTER:** Environmental Technology  
**MODULE:** Core Topics of Industrial Engineering  
**PROGRAM:** Degree in Chemical Engineering

Page 2 of 6

### **CONTENTS**

- 1. Sustainability**  
Define environment. Causes and origin of unsustainability. Sustainable development. Tools to evaluate the sustainability.
- 2. Environmental management tools**  
Eco-efficiency, hierarchy of the pollution prevention. Green Chemistry, Eco-design. Life Cycle Assessment. Cleaner production. Industrial ecology. Eco-design. Environmental impact assessment. Environmental management systems.
- 3. Environmental units**  
Mass concentration units. Volume/volume and Mole/Mole units. Partial pressure units. Mole/volume units. Other types of Units.
- 4. Ecosystems and Environment**  
Define ecosystem and its characteristics. Mass and energy fluxes within the ecosystems. Biogeochemical cycles.
- 5. Environmental Impacts**  
Types of impact. Impacts of the industry and of the economic activities. Acidification. Climate change. Eutrophication. Ozone problems. Energy consumption.
- 6. Atmospheric pollution treatment**  
Atmospheric pollutants. Legislation. Technologies for particle removal. Technologies of SO<sub>x</sub> removal. Technologies of NO<sub>x</sub> removal. Technologies of VOC removal.
- 7. Wastewater treatment**  
Water pollutants. Types of wastewater. Legislation. Pretreatments, Primary treatment. Secondary treatment. Activated sludge process. Tertiary treatment. Sludge processing.
- 8. Waste management**  
Concepts of waste and byproduct. Classification of wastes. Waste characteristics. Legislation. Planning of waste management. Waste management and treatment systems.
- 9. Energy**  
Production, use and power consumption. Renewable and non-renewable energy fonts. Impacts due to the use of energy.

## COURSE: ENVIRONMENTAL TECHNOLOGY

**SUBJECT MATTER:** Environmental Technology  
**MODULE:** Core Topics of Industrial Engineering  
**PROGRAM:** Degree in Chemical Engineering

Page 3 of 6

### METODOLOGY

#### LEARNING ACTIVITIES

Learning Activities	Hours	ECTS Credits	Competences
Lectures	32	1	E2, E11, T3, CRI10
Case and Problem-Solving Sessions	11	0.4	E2, E8, CRI10
Seminars		--	
Practical & Lab Work		--	--
Presentations	14	0.4	E8, E11, CRI10
Personal study	46	2.0	E2, E8, E11, T3, CRI10
Assessment Tasks (Exams, Continuous Assessment...)	6	0.2	E2, E8, E11, CRI10
<b>TOTAL</b>	<b>109</b>	<b>4.0</b>	

#### TEACHING METHODOLOGY

The exposition sessions of theoretical-practical concepts by the professor have to drive to reflections shared by the professor and the students where it will be explained the fragility about the availability of material and energetic resources. These expositions will give to the student a clear vision of the limitations of the planet to replace resources as well as giving conscience of the efforts to impulse a management economic-technical always-improved respect to the limited availability of resources.

The exposition of case studies and discussion must drive to a global view of the environment that stimulates in the students' criteria of responsible competitively and social progress as powerful tools of technological actions.

The activity of presentation and defense of works carried out by the students individually or working in a team must give them levels of confidence suitable to give talks in the future in front of any audience.

## COURSE: ENVIRONMENTAL TECHNOLOGY

**SUBJECT MATTER:** Environmental Technology  
**MODULE:** Core Topics of Industrial Engineering  
**PROGRAM:** Degree in Chemical Engineering

Page 4 of 6

### ASSESSMENT

#### ASSESSMENT METHODS

Assessment methods	Weight	Competences
Final Exam	40%	E2, E8, E11, CRI10
Midterm Exam/s	30%	E2, E8, E11, CRI10
Follow-up Activities	15%	E8, T3
Reports and Presentations	15%	E11, T3, CRI10
Lab or Field Work	--	--
Projects	--	--
Host Student Evaluation	--	--
Participation	--	--

The minimum mark in the final exam must be 4.

In case of retaking the exam the mark will be 100 % the grade of the retake exam.

#### LEARNING OUTCOMES

- The student must prove the knowledge and fundamentals of the environmental technologies in the practice of the Chemical and Environmental Engineering (→E2).
- The student must prove capacity to analyze, integrate and interpret the data and information in the field of the environmental technologies (→E8).
- The student must prove capacity to assess the risk of the use of chemical and biological substances to manage its use and no emission to the environment (→E11).
- The student must prove capacity to assess the impact of the chemical industry in the sustainable development of the society (→T3).
- The student must prove that has basic knowledge of the concept of sustainability and the different technologies for the pollution treatment (→CRI10).

## COURSE: ENVIRONMENTAL TECHNOLOGY

**SUBJECT MATTER:** Environmental Technology  
**MODULE:** Core Topics of Industrial Engineering  
**PROGRAM:** Degree in Chemical Engineering

Page 5 of 6

### QUALIFICATION

**RP:** Reports and Presentations (15% Final Mark). Research works and exposition of results about environmental technologies.

**CA:** Continuous Assessment Activities (15% Final Mark). Exercises related with the topics of the course. 3-4 exercises (team working) must be delivered.

**ME:** Midterm Exams (30% Final Mark). Control exams to evaluate the knowledge of the course.

**FE:** Final Exam (30% Final Mark). The final mark of the exam must be higher than 4.

The final qualification (FQ) will be calculated as follows:

$$FQ = 0.15 \cdot RP + 0.15 \cdot CA + 0.30 \cdot ME + 0.40 \cdot FE.$$

The no presentation of some of these items will led to lose the right for the final exam.

### ASSESSMENT OF THE COMPETENCES

For the evaluation of each competence, the next indicators will be used:

Competence E2: FE + ME

Competence E8: RP + FE

Competence E11: RP + ME

Competence T3: CA + FE

Competence CR110: FE

### BIBLIOGRAPHY

- Kiely, Gerard (1999). "Ingeniería Ambiental. Fundamentos, entornos, tecnologías y sistemas de gestión". McGraw-Hill, Madrid.
- Metcalf and Eddy (2002). "Wastewater Engineering: Treatment and reuse". McGraw-Hill.
- Dègremont, Gilbert "Manual técnico del agua". Urmo, Bilbao, 2009.
- Tchobanoglous, George. "Gestión integral de residuos sólidos". Mc.Graw-Hill, Madrid, 1994.
- Cooper, C.D., Alley, F.C. Air Pollution Control: A Design Approach. Waveland Press, 1994
- Wark, K, Warner, C.F. Contaminación del Aire Origen y Control. Limusa, Noriega Editores, 2000.
- De Nevers, N. Ingeniería de Control de la Contaminación del Aire. McGraw-Hill, 1998.
- Perry's Chemical Engineer Handbook.
- Ramalho, R.S. (1991). "Tratamiento de Aguas Residuales". Editorial Reverté. Barcelona
- CATEDRA UNESCO SOBRE SOSTENIBILITAT DE LA UPC.



PERSONA CIÈNCIA EMPRESA  
UNIVERSITAT RAMON LLULL

## **COURSE: ENVIRONMENTAL TECHNOLOGY**

**SUBJECT MATTER:** Environmental Technology  
**MODULE:** Core Topics of Industrial Engineering  
**PROGRAM:** Degree in Chemical Engineering

Page 6 of 6

### **DOCUMENT HISTORY**

#### **PREVIOUS REVISIONS**

7<sup>th</sup> February of 2018, Dr. Rafael González Olmos

12<sup>th</sup> September of 2017, Dr. Rafael González Olmos

#### **CURRENT REVISION**

20<sup>th</sup> February of 2019, Damià Palmer Comas, Dr. Jordi Díaz Ferrero