

SUBJECT TEACHING GUIDE

G775 - Industrial and Environmental Sustainability

Degree in Chemical Engineering First Degree in Chemical Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Chemical Engineering First Degree in Chemical Engineering			Type and Year	Compulsory. Year 3 Compulsory. Year 3
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Industrial Environmental Sustainability, Project Organisation and Management, and Technical Department Module: Compulsory Training in Common with the Industrial Branch				
Course unit title and code	G775 - Industrial and Environmental Sustainability				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web	https://campusvirtual.unican.es/Profesor/ProfesorGrado/GuiaDocenteFw.aspx				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIAS QUIMICA Y BIOMOLECULAR
Name of lecturer	MARIA MARGALLO BLANCO
E-mail	maria.margallo@unican.es
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 2. SEMINARIO S2062 (S2062)
Other lecturers	JOSE ANGEL IRABIEN GULIAS LUCIA GOMEZ COMA

3.1 LEARNING OUTCOMES

- Historical development of Sustainable Development. From the XX century to the XXI transition to the sustainable development.
- Competences to identify the fundamentals of sustainability in the production and consumption systems.
- Identification of the concept of environmental sustainability in industrial processes.
- Identification of renewable and non-renewable resources.
- Identification and management of the environmental burdens to the atmosphere.
- Identification and management of the environmental burdens to the aquatic environment.
- Main elements involved in waste management.
- Main techniques for environmental management.
- Application of the environmental sustainability concept to case of studies: BREF document and Integrated Prevention and Pollution Control.

4. OBJECTIVES

- To establish the sustainable development model and its consequences for productive and service activities . To learn the concept of Ecosystem Services.
- Identify the relationship of productive activities and services with the environment. Concepts of the use of resources and environmental loads.
- Assess, understand and design processes to control the negative consequences of environmental burdens.
- To know the main techniques of environmental management of industrial and service activities and the basics of their applications.

6. SUBJECT PROGRAM	
CONTENTS	
1	<p>PART 1. INTRODUCTION TO THE SUSTAINABILITY AND ITS IMPACT ON SCIENCE AND ENGINEERING</p> <p>1.1. The Human development in the XX Century and the Sustainable Development in the XXI Century. 1.2. The Ecosystem Services. 1.3. Population growth, use of natural resources, and environmental burdens: the Anthropocene. 1.4. The 2030 Sustainable Development Goals (SDG 2030). Goals related to the environment.</p> <p>CASES OF STUDY 1. The measurement of Sustainable Development and indicators: Human Development Index, Happiness Index and SDG Indicators.</p>
2	<p>PART 2. SUSTAINABLE MANAGEMENT OF INDUSTRIAL ACTIVITIES</p> <p>2.1. The enterprise, resources (human, material and economic) and the ecological transition of industry and services. Enabling technologies and Industry 4.0. 2.2. Environmental regulation of industrial activities. Environmental control laws. 2.3. The Environmental Impact Assessment (EIA) and the Environmental Sustainability Assessment (ESA). 2.4. Environmental management of operating activities: Environmental Management Systems, ISO 14001 and EMAS. 2.5. Life Cycle Assessment (LCA) and ISO 14.040 standards. 2.6. Chemical risk control and severe accidents.</p> <p>CASE STUDIES 2. Example of an EIA matrix. Environmental analysis of an industrial activity in operation: examples. Basic example of product LCA.</p>
3	<p>PART 3. SUSTAINABLE MANAGEMENT OF SOIL-RELATED RESOURCES</p> <p>3.1. Soil as a natural resource: land cover and land use. 3.2. Mineral resources and critical raw materials: exhaustible, scarce and critical. 3.3. Activities and land uses: environmental burdens and waste management. 3.4. Sustainable management of natural resources. Circular economy.</p> <p>CASE STUDIES 3. The influence of technologies and their efficiency on the use of natural resources : examples of material and energy balances.</p>
4	<p>PART 4. SUSTAINABLE ENERGY MANAGEMENT</p> <p>4.1. Non-renewable and renewable energy resources. Transformations. 4.2. Environmental loads with global impacts. Limits of the planet and global change. Regulatory elements and actions. 4.3. Environmental loads to the atmosphere: main impacts. Pollution. Regulatory aspects for the protection of air quality. European, state, regional and municipal frameworks.</p> <p>CASE STUDIES 4. The Anthropocene and the limits of the planet: examples of global actions and their indicators. Administrative competences of local environmental charges: EU, Spain, Autonomous Communities and municipalities.</p>
5	<p>PART 4: ENVIRONMENTAL TECHNOLOGIES</p> <p>4.1. Control of emissions to the atmosphere 4.2. Control of water quality and effluents 4.3. Waste Management 4.4 Water pollution: release and regulation 4.5. Waste management: identification and treatments</p> <p>CASES OF STUDY</p>

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Continuous tests on practical and theoretical concepts in the classroom	Written exam	Yes	Yes	30,00
Developed activities and presentation	Written exam	Yes	Yes	30,00
Portfolio	Work	No	No	20,00
Participation and interest in the course taking into account the developed work	Others	No	No	20,00
TOTAL				100,00
Observations				
Ongoing evaluation will be considered only for those student that deliver on time all the activities				
Observations for part-time students				
Partial time students may follow the theory and practical work separately				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
DT Allen, DR Shonnard, Sustainable Engineering. Concepts, Design and Case Studies PH-PTR (2012)
DT Allen, DR Shonnard, Green Engineering "Environmentally conscious design of chemical processes" . PH-PTR (2002)
Environmental engineering / Howard S. Peavy, Donald R. Rowe, George Tchobanoglous. Editorial: New York ; Madrid [etc.] : McGraw-Hill, 1985. Colección: McGraw-Hill series in water resources and environmental engineering ISBN: 0-07-049134-8