

Course guide

295564 - 295EQ142 - Circular Chemical Process Engineering

Last modified: 02/10/2025

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

Degree: MASTER'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2019). (Optional subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer:

Others:

REQUIREMENTS

Management of Technology

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:

CGMUEQ-01. Ability to apply the scientific method and the principles of engineering and economics, to formulate and solve complex problems in processes, equipment, facilities and services, in which the matter undergoes changes in its composition, state or energy content, characteristic of the chemical industry and other related sectors among which are the pharmaceutical, biotechnological, materials, energy, food or environmental

CGMUEQ-02. To conceive, project, calculate and design processes, equipment, industrial facilities and services, in the field of chemical engineering and related industrial sectors, in terms of quality, safety, economy, rational and efficient use of natural resources and environment conservation

CGMUEQ-06. Have the capacity to analyze and synthesize the continuous progress of products, processes, systems and services using safety, economic viability, quality and environmental management criteria

CGMUEQ-07. Integrate knowledge and face the complexity of making judgments and decisions, based on incomplete or limited information, including reflections on the social and ethical responsibilities of professional practice

Transversal:

02 SCS. SUSTAINABILITY AND SOCIAL COMMITMENT. Being aware of and understanding the complexity of social and economic phenomena that characterize the welfare society. Having the ability to relate welfare to globalization and sustainability. Being able to make a balanced use of techniques, technology, the economy and sustainability.

03 TLG. 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.

TEACHING METHODOLOGY

The following activities will be carried out, either in or outside the classroom, in the development of the course:

1. Challenge driven education (CDV)
2. Lectures, conferences, workshops

Detailed project information regarding the scope, content, format, deadlines, etc., will be presented in an attached document.

The methodology designed for this course is the Challenge Driven Education. The project is envisioned to be formulated as an EU-project action where the students are responsible for work packages delivering outputs and results into the overall project. Students are responsible for planning, executing and delivering results into the fictive EU-project within pre-defined frames. Hence students will be trained to manage, plan and work in an "EU-project-manner" with support from the supervisor (from company proposing the challenge) and the academic staff as the fictive supervising partners.

Experts can be invited to support teams on issues related to the proposed challenge

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course the student will be able to:

- Demonstrate a basic understanding of the key concepts and principles, benefits, challenges and underlying philosophy associated with the efficiency of resource use under the circular economy paradigm.
- Critically assess the technical and environmental impact of the implementation of aspects of the circular economy in industrial sectors, particularly in relation to the recovery of waste for the production of materials and energy and the regeneration of water for reuse.
- Evaluate the challenges in the field of sustainability, identify and formulate hypotheses or innovative ideas and apply the scientific method to solve practical problems.

STUDY LOAD

Type	Hours	Percentage
Self study	108,0	72.00
Hours large group	42,0	28.00

Total learning time: 150 h

CONTENTS

1. The Challenge

Description:

The proposed point of departure for the overarching theme of the project is Urban Mining and Resource recovery within the context of the chemical process engineering. The project will be defined before the start of the course, and be aligned under the overarching theme. Comparative analyses of a set of technologies/solutions/business models and cross-cutting issues are addressed in the synthesis of each challenge. The final formulation of individual projects will also be linked to the priorities set by the company proposing the challenge.

Specific objectives:

- Design technological solutions for resource recovery based on a given problem formulation
- Carry out analyses of supply chain resource and energy consumption. This in turn implies that the students will need to be able to:
 - o Define relevant system boundaries for the analyses
 - o Carry out economic and thermodynamic analyses of energy systems (in needed) and assess their environmental impacts
 - o Make an informed assessment of the system with reference to energy transformation, economics and environmental impacts
- Carry out a high-level business assessment of the proposed product or service
- Describe and assess the technical, commercial and regulatory feasibility of the proposed solution

Related activities:

Project following the Challenge driven education methodology.

Full-or-part-time: 151h 40m

Theory classes: 41h 40m

Guided activities: 25h

Self study : 85h

GRADING SYSTEM

The final grade is determined according to the following equation:

$$\text{Final grade} = (D1-D4)*0.35 + D5*0.35 + PG*0.15 + OP*0.15$$

D= Deliverable (1-5)

PG= Peer grading

OP= Oral presentation

BIBLIOGRAPHY

Basic:

- Lacy, Peter; Rutqvist, Jakob. Waste to wealth : the circular economy advantage. New York: Palgrave Macmillan, 2015. ISBN 9781137530684.
- Weetman, Catherine. A circular economy handbook for business and supply chains : repair, remake, redesign, rethink. New York: Kogan Page, [2016]. ISBN 9780749476755.
- Maletz, Roman; Dornack, Christina; Ziyang, Lou (eds.). Source separation and recycling : implementation and benefits for a circular economy. Cham, Switzerland: Springer, [2018]. ISBN 9783319690711.

RESOURCES

Other resources:

- Spire Circular Economy Road-Map: <https://www.spire2030.eu/intro> />• EU Circular economy Road Map: https://ec.europa.eu/growth/industry/sustainability/circular-economy_en />• Scientific papers from different databases: Science Direct, Scopus
- Use the remote access to the UPC library: https://apps.bibliotecnica.upc.edu/discovery/bases_dades/ />• Energy Ebook Package



Springer Link: <http://link.springer.com/search?facetcontenttype=%22Book%22&package=40367&showAll=false>

- GRI (2011) "Sustainability Reporting Guidelines" Global Reporting Initiative
<https://www.globalreporting.org/resource/library/G3.1-Guidelines-Incl-Technical-Protocol.pdf>