SUBJECT TEACHING GUIDE

1055 - Intensification and integration of processes for energy optimization

Master's Degree in Industrial Engineering
Master's Degree in chemical engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Master's Degree in Industrial Engineering Master's Degree in chemical engineering			Type and Year	Optional. Year 2 Optional. Year 1
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Optional Subjects				
Course unit title and code	1055 - Intensification and integration of processes for energy optimization				
Number of ECTS credits allocated	3	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIAS QUIMICA Y BIOMOLECULAR
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Other lecturers	EUGENIO DANIEL GORRI CIRELLA AXEL ARRUTI FERNANDEZ

3.1 LEARNING OUTCOMES
- Apply knowledge of the principles of process intensification in the design of process equipment.
- Know and be able to apply simulation tools and process optimization with intensification and sustainability objectives.
- The student should analyze the possibilities of the Intensification of Processes on concrete examples of process.
- The student should know the alternatives in the use of fossil fuels through cleaner technologies.
- The student should be able to integrate energy from renewable sources into processes.

4. OBJECTIVES

The objective is that students are able to carry out the design of processes using tools that optimize energy consumption and reduce emissions.

6. SUBJECT PROGRAM

CONTENTS	
1	Part 1. Introduction. Sources of energy. Power generation: environmental restrictions, management of carbon dioxide emissions. Basic elements for the management of energy. Sankey diagram. Sustainability in the use of energy.
2	Part 2. The energy balance in the processes of transformation of raw materials into products. Elements of energy optimization: energy savings and energy optimization.
3	Part 3. Optimization: Development of case studies to address the minimization of energy consumption with environmental constraints.
4	Part 4. Process intensification: new equipment and strategies to enhance energy efficiency. Case study: reactive distillation.
5	Part 5. Integration processes. Heat exchange networks. Case studies on the integration of renewable energy in processes.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Test based on the fundamental concepts. 5.0 grade (in the scale 0-10) is required to pass the exam	Written exam	No	Yes	30,00
Students must submit a portfolio with the homeworks solved individually.	Work	No	Yes	70,00
TOTAL				100,00

Observations

Students must pass an exam and submit a portfolio with the homework solved individually. The possibility of recovery is considered in a final exam.

In the case of a health alert that makes it impossible to conduct the evaluation in person, the same type and distribution of tests will be maintained with the support of telematic means.

Observations for part-time students

For part-time students is possible to adapt the course evaluation to the part-time regime, preserving the results for at least two consecutive academic years.

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
J.W. Tester, E.M. Drake, M.J. Driscoll, M.W. Golay, W.A. Peters. Sustainable Energy: Choosing among options, 2 ed., The MIT Press, 2012.
F. Zhu, Energy and process optimization for the process industries, AIChE-Wiley, Hoboken (NJ), 2014.
D. Reay, C.Ramshaw and A. Harvey, Process Intensification, 2nd edition. Elsevier, Amsterdam, 2013.
J.J. Klemes, P.S. Varbanov, S.R.W. Alwi, Z.A. Manan, Process integration and intensification: saving energy, water and resources. De Gruyter, Berlin, 2014.
A. Stankiewicz, J.A. Moulijn (eds), Re-engineering the Chemical Process Plant, Marcel Dekker, Inc, 2004
A. Stankiewicz, T.Van Gerven, G. Stefanidis, The fundamentals of process intensification, Wiley-VCH, Weinheim, 2019