SUBJECT TEACHING GUIDE

G783 - Design of Chemical Processes

Degree in Chemical Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Chemical Engineering			Type and Year	Compulsory. Year 3
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Process Design, Management and Operation.Simulation, Dynamics, Control and Instrumentation of Chemical Processes. Analysis, Design and Optimisation of Processes and Products Module: Compusory Training Industrial Chemistry				
Course unit title and code	G783 - Design of Chemical Processes				
Number of ECTS credits allocated	6	Term		Semester based (1)	
Web	https://ocw.unican.es/course/view.php?id=235				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. DE QUIMICA E INGENIERIA DE PROCESOS Y RECURSOS.
Name of lecturer	JAVIER RUFINO VIGURI FUENTE
E-mail	javier.viguri@unican.es
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 3. DESPACHO PROFESORES (S3013)
Other lecturers	EVA CIFRIAN BEMPOSTA

3.1 LEARNING OUTCOMES
- Apply the chemical engineering background to the Conceptual design of chemical processes, addressing open-ended, unstructured problems with a high degree of abstraction, and understanding the importance of decision-making with limited information.
- Perform activities of preliminary design of process units, using engineering tools as short-cut and modern design approaches for the synthesis, analysis, evaluation and comparison of different technological alternatives using multiple criteria . Learn to deal with simplified analysis models.
- Being able to analyze, evaluate and compare preliminary process flow diagrams in terms of different evaluation criteria . Learn to make “educated guesses".
- Work effectively in groups and communicate through reports, interviews and oral presentations.

4. OBJECTIVES
The main objective is to introduce students to methods and background needed for conceptual design of continuously operating chemical plants. Particular attention is paid to the use of modern design approaches that are used in industry and to problems of current interest. Each student team is assigned to synthesize, design and evaluate an industrial project and prepare three consecutive design report and three oral presentations. The particular objectives for the students are to be able to:
• Know systematic methods of conceptual chemical processes design.
• Know the criteria and tools for sustainable products and processes design.
• Perform a systematic and effective calculations involved in the process analysis.
• Size and estimate costs of process equipment. Perform economic evaluations of conceptual designs. Apply empirical shortcut equations for sizing and economic evaluation.
• Establish the economic viability of a new project or revamping project.
• Apply systematic synthesis methods for distillation sequences and for heat exchanger networks.
• Know preliminary design tactics, scheduling and planning of batch processes. • Communicate effectively through three consecutive written reports and three oral presentation of a conceptual industrial project in group.

6. COURSE ORGANIZATION	
CONTENTS	
1	1. INTRODUCTION TO CHEMICAL PROCESS SYSTEM DESIGN
2	2. PROCESS SYNTHESIS 2.1. Methodology of conceptual design 2.2. Overview of Process Synthesis 2.2. Introduction to Sustainable Design
3	3. PROCESSES ANALYSIS BY MASS AND ENERGY LINEAR BALANCES: MODELS DEVELOP AND APPLICATION
4	4. EVALUATION of PRELIMINARY DESIGNS 4.1. Equipment sizing and costing 4.2. Economic evaluation
5	5. BASIC CONCEPTS IN PROCESS SYNTHESIS 5.1. Synthesis of distillation sequences 5.2. Heat Exchange Network Synthesis (HENS)
6	6. DESIGN AND SCHEDULING OF BATCH PROCESSES
7	7. CONCEPTUAL DESIGN METHODOLOGY APPLY TO A PROCESS DESIGN CASE STUDY

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Individual Exam. Written Exam.	Written exam	Yes	Yes	30,00
Practical Team Work. Written Memo 1, 2 and 3. Oral presentation	Work	No	Yes	55,00
Specific tests, short questions and problems related to the course and Memo subjects	Others	No	No	15,00
TOTAL				100,00

Observations

The minimum mark required in the exam will be 4 out of 10 and the minimum average mark required in the Memos Reports and Oral Presentation will be 5 out of 10. In order to consider the mark in the Memos and Presentations, an attendance of at least 90% of the practical classes and to deliver the works in the specified dates and signed by all members of the group. Group members who do not sign the report will obtain a grade of zero. Fail reports (<5 out 10) will be recoverable after its formative evaluation and delivery of new reports on the dates indicated by the teachers.

Observations for part-time students

Part-time students may choose between the continuous assessment or assessment in ordinary and extraordinary examination calls together the delivery if the Memos.

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
Biegler, L., Grossmann, I., Westerberg, A., Systematic methods of chemical process design. Prentice Hall, 1997
Seider, W., Lewin, D., Seader, J., Widadgo, S., Gani, R., Ng, K.M. Product and Process Design Principles. 4th Ed. John Wiley & Sons. 2017.
Douglas J., Conceptual Design of Chemical Processes, McGraw-Hill. 1988.
Sinnot, R., Towler, G., Chemical Engineering Design. 6th Ed. Coulson & Richardson´s Chemical Engineering Series. Butterworth-Heinemann. 2020. (También versión en castellano)
Martín, M., Industrial Chemical Process Analysis and Design. Elsevier. 2016
Chemical Process Design / Diseño de Procesos Químicos (2017). Open Course Ware. https://ocw.unican.es/course/view.php?id=235